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Contact Hours: **4**

Bioterrorism and Weapons of Mass Destruction
Emergency Preparedness for Nevada Nurses

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LEARNING OUTCOME & OBJECTIVES: Upon completion of this course, you will have increased your knowledge of the medical consequences of acts of terrorism involving the use of weapons of mass destruction and be better prepared to protect and care for yourself and your patients during emergencies relating to such an event. Specific learning objectives include:

- Define the terms "terrorism," "terrorist attack," "weapons of mass destruction (WMDs)," and "syndromic surveillance."
- Distinguish between a terrorist attack, criminal act, and mass casualty incident.
- Describe types of terrorists and terrorist attacks.
- Identify appropriate personal protective equipment (PPE) to be used when treating patients potentially or actually exposed to nuclear, biological, and chemical agents.
- Review signs and symptoms of exposure to and emergency treatment for patients exposed to biological, nuclear, and chemical agents.
- Explain the Health Alert Network (HAN), including its purpose and the features unique to the Nevada HAN.

INTRODUCTION

Violence and warfare as a means for one nation, state, or group to achieve control over another are almost as old as humanity. Records of wars survive in legends and oral traditions and in some of humanity's earliest efforts at language and images.

Until the beginning of the twentieth century, advances in weaponry focused on improving existing or "conventional" technologies. It was only after chemical weapons were introduced in the trenches of World War I that widespread attention was directed to what would be termed

"unconventional weapons." Even so, the use of such weapons was, at least in the mind of the American public, restricted to a remote battlefield location.

This worldview changed for some nations before it did in the United States. However, the bombing of the Murrah Federal Building in Oklahoma City in 1995 and the events of September 11, 2001, forced Americans to confront the reality that both the nation and individual citizens are potential targets of terrorists. More recent attacks (discussed below) demonstrate that the threat is continuing and continual.

To obsess over the fact that no one is absolutely safe and no place is off limits as a target could be paralyzing. However, for a healthcare provider or healthcare facility to deny the threat and do nothing to prepare would be equally counterproductive.

TERMS AND DEFINITIONS

What Is Terrorism?

Contemporary definitions of terrorism from U.S. sources include:

- "The unlawful use of violence or threat of violence, often motivated by religious, political, or other ideological beliefs, to instill fear and coerce governments or societies in pursuit of goals that are usually political" (DOD, 2018).
- "The unlawful use of force and violence against persons or property to intimidate or coerce a government, the civilian population, or any segment thereof, in furtherance of political or social objectives" (FBI, n.d.).

Recurring elements within these definitions include:

- The use of force and/or violence
- The intent to coerce some sort of action
- The decision to act outside the law

By their nature, terrorist acts are crimes, as the above definitions indicate, but a crucial difference lies in the motivation of the perpetrators. Unlike purely criminal acts, which are usually motivated by greed, passion, or vengeance, terrorist attacks generally reflect "motivations that are chiefly political, ideological, or religious; often, some element of symbolism in the choice of target, together with the desire to elicit fear in a larger audience beyond the immediate victims of an attack" (FEMA, 2014).

"MASS" VS. "MULTIPLE" CASUALTY INCIDENTS

A **mass casualty incident** (MCI or MASCAL) is a situation that "generates more patients than available resources can manage using routine procedures" (Green, 2006). The key factor is the relationship between the number of casualties generated and the capabilities of the receiving facility or facilities. Examples of MCIs include:

- The 2017 shooting at the Route 91 concert in Las Vegas, which left 58 victims dead and 851 injured. It is notable that of the injured, 422 sustained gunshot wounds and the rest were injured while trying to find safety.
- Multiple vehicle accidents, such as the January 2017 50-car pileup outside Fresno, California, caused by thick ground fog (tule fog), in which 12 people sustained minor to moderate injuries and were transported to multiple nearby hospitals.

A second, less-frequently used term is *multiple casualty incident.* Although superficially similar to a mass casualty incident, this term carries a different meaning for first responders and first receivers of trauma victims. Unlike a mass casualty incident, a **multiple casualty incident**:

- Can be managed with heightened response (including mutual aid, if necessary) by a single EMS agency or system
- Typically will not overwhelm the hospital capabilities of a jurisdiction and/or region but may exceed the capabilities for one or more hospitals within a locality
- Usually produces a short, intense peak demand for health and medical services, unlike the sustained demand typical of a mass casualty incident

Terrorists usually select targets that will also produce large numbers of casualties, so it is safe to assume that most terrorist attacks will also be either multiple or mass casualty incidents.

Types of Terrorists and Terrorist Attacks

In seeking to understand terrorism, there are various characteristics of the actors (terrorists), their targets, and the nature of their attacks (DOD, 2018). (Note: The following examples are based on nonclassified information available to the public at the time this course was written.)

CHARACTERISTICS OF TERRORISTS

Several factors can influence the type and magnitude of a terrorist attack, such as:

- The number and organization of the actual operators
- The degree of local and remote support available to them

Number of Operators

The September 11 multipronged attack on the World Trade Center, Pentagon, and Capitol is an example of effectively organizing, planning, and executing a terrorist attack. The multiple attackers were provided with adequate external financing to devote time and effort in order to plan their actions and to acquire the necessary skills to carry out their plans. This fits the description of a **highly organized group** with strong financial and political support.

A U.S. citizen of Pakistani descent and his wife, a Pakistani national, opened fire on a holiday party taking place at the Inland Regional Center in San Bernardino, California, killing 14 people. Investigators believe the couple was self-radicalized. They planned their attack in great detail, managing to hide their actions from their extended family. They appear to be a **local cell**, with their financial and logistical support limited to themselves and their immediate circle. While they were influenced by actions occurring in other parts of the world, they had no tangible assets beyond their own.

A classic example of a **lone operator** is the American-born man who pledged allegiance to ISIS and killed 49 people and wounded many others in a shooting spree at Pulse, a gay nightclub in Orlando, Florida. At the time, this was the second-deadliest mass shooting in recent U.S. history and the nation's worst terror attack since 9/11.

Origin of Operators

Referring to terrorism as *domestic* or *international* differentiates between both the location of the terrorist act and the place where the operators planned, trained, or obtained materials related to the attack.

- The firearm attack that killed 14 people at the Inland Regional Center in San Bernardino, California, is considered **domestic** terrorism because the activities occurred in the United States.

- The events of September 11 can be considered **international** terrorism because, although the targets were in the United States, the perpetrators were foreign nationals who planned, trained, and were supported from outside the United States.

CHARACTERISTICS OF TARGETS

The relative "hardness" of a target refers to its level of protection (physical structure, security personnel and technology, and/or access controls).

- **Hard target:** One that is heavily protected and would be difficult to penetrate by either brute force or infiltration. For example, in the aftermath of the September 11 attacks, both the physical structure and access criteria for commercial airliner cockpits have been significantly hardened.

- **Soft target:** One with relatively few or no layers of protection. By their very mission, healthcare facilities need to be readily accessible to both patients and caregivers.

NATURE OF AN ATTACK

An act of terrorism may be either covert or overt. The timing and/or sequencing of an attack are also factors that can impact numbers and types of casualties as well as the number and mix of available first responders.

Presence or Absence of Advance Notice

A **covert attack** takes its advantage from the element of surprise:

- Victims may arrive in multiple healthcare facilities before those facilities are aware there has been an attack and can implement their response plans.
- Victims of such an attack may contaminate the facility or caregivers, thus limiting the ability of the system to care for them or later-arriving victims.

An **overt attack**, because it is predicted in advance or immediately claimed by the responsible group, relies heavily on panic as an impact multiplier.

- Individuals in both the identified target area and well beyond may seek information and assistance from public and private resources.
- The sheer number of victims to be triaged may precipitate an MCI that overwhelms even systems that have a robust emergency response plan in effect.

In either scenario, because many terrorists' choices of agents have subtle and subjective symptoms, the system may be flooded with both actual victims and people who were not exposed but believe they have been.

Timing or Sequencing

The simplest sequence of a terrorist act is the **stand-alone primary attack**. The terrorists plan and carry out their act without any apparent rehearsal, possibly claim responsibility, and then either disappear or are engaged by authorities.

A **practice attack** (dry run or rehearsal) gives the terrorist or terrorists opportunities to identify and correct flaws in their plan. The drill may be limited to one or more elements of the actual attack or may be a full-on dress rehearsal.

Given sequential consideration, the idea of a **secondary attack followed by the primary attack** may appear inherently contradictory. But in actual practice, it is especially malicious. The chronologically first but conceptually secondary attack triggers an interagency response (law enforcement, fire protection, and emergency medical response), which draws first responders and onlookers to the area, thus setting the scene

for the attack that is the primary goal of the terrorists. A sequenced attack has several implications:

- It is a casualty multiplier, increasing the number of dead and injured.
- It turns first responders into casualties, simultaneously increasing the number of victims and removing first response assets (both personnel and material) from service.
- It raises the negative energy of the scene and may serve as a conscious or subconscious distractor, as both victims and responders wonder if there might be one or more additional attacks in the offing.

What Are Weapons of Mass Destruction (WMDs)?

DEFINITION

According to the DOD (2018), WMDs are:

> Chemical, biological, radiological, or nuclear weapons capable of a high order of destruction or causing mass casualties, and excluding the means of transporting or propelling the weapon where such means is a separable and divisible part from the weapon.

TYPES

Depending on the age of the reference consulted, the following acronyms may be used in describing the types of WMDs:

ACRONYMS FOR WMD TYPES	
Acronym	**Refers To**
CBRNE (most recent)	**C**hemical **B**iological **R**adiological **N**uclear High-yield **E**xplosives
B-NICE (superseded)	**B**iological **N**uclear/RDD* **I**ncendiary **C**hemical **E**xplosive
NBC (of historical interest)	**N**uclear **B**iological **C**hemical
*RDD = Radiological Dispersal Devices	
Sources: CERT, 2015: CERT, 2003; DOD, 2001.	

Two key take-away points from this evolving technology and terminology:

- Terrorists are limited only by their creativity and ability to construct and place devices.
- Advances in security measures only inspire terrorists to develop ways to circumvent them.

This course will focus on specific implications of the triad of nuclear/radiological, biological, and chemical—or "NBC" weapons. It will not cover caring for victims of solely incendiary and/or explosive weapons. The general principles of trauma care apply to patients suffering from burn or blast injuries no matter the source.

However, if a "combined" weapon (one incorporating both an NBC component as well as an incendiary or explosive device) is known or suspected to have been used, caregivers should consider the need for personal protective equipment and the requirement to decontaminate the victim prior to or concurrent with treatment.

VICTIMS, SURVIVORS, OR PATIENTS?

The terms used by healthcare professionals can have a significant impact on both the person needing care and on care providers. Thus, consideration must be given to how to refer to those who are physically, mentally, spiritually, or emotionally impacted by a terrorist attack. For instance, should injured individuals be considered victims, patients, or survivors?

In the immediate aftermath of an incident, there is no stigma in describing an injured person as a *victim*; once (s)he begins receiving care, most would accept the use of *patient. Survivor* is a more internally derived descriptor; only the affected individual can truly define himself or herself as having made it out the other end of the experience.

While there are no hard-and-fast guidelines on choosing the "correct" term, the overriding considerations are:

- How the person receiving care and support appears to react to the term used to describe him or her
- The need to choose words that seem to resonate positively with the individual receiving care

Source: Peternelj-Taylor, 2015.

PERSONAL PROTECTIVE EQUIPMENT (PPE)

Personal protective equipment includes the protective clothing and equipment provided to shield or isolate a person from the chemical, physical, and thermal hazards that can be encountered at a hazardous materials incident (DOD, 2018). (This course does not address the issue of thermal hazards.)

PPE and Exposure Risks

Just as with Standard Precautions and transmission-based precautions, the components of appropriate PPE are determined by the nature of the anticipated exposure. This includes:

- The nature of the known or suspected hazardous agent (biological, radiological, or chemical)
- The method(s) of dispersal and exposure (inhalation, skin absorption, ingestion, eye or skin contact)
- The circumstances under which a care provider is exposed

The last is exceptionally important: the closer in time and place the victim is to the exposure incident, the greater the risk to the care provider. This is the rationale for the distinctions between *first responder* and *first receiver* (see box below).

The primary determining factor in selecting appropriate PPE is the nature of the known or anticipated risk, not the job title of the caregiver, the nature of care being given, or the location where the care is given.

FIRST RESPONDERS VS. FIRST RECEIVERS

First responders are personnel who have responsibility to initially respond to emergencies. Some examples are firefighters, HAZMAT team members, law enforcement officers, lifeguards, forestry personnel, ambulance attendants, and other public service personnel. In the case of hazardous materials incidents, these personnel typically respond at the site where the incident occurred.

First receivers are personnel at a hospital or other care site engaged in decontamination and treatment of victims who have been contaminated by a hazardous substance(s) during an emergency incident. The incident occurs at a site other than the receiving facility, unless the care facility was the intended target. These individuals are a subset of first responders.

OSHA/EPA LEVELS OF PPE

Level	To Be Selected When:
A	The greatest level of skin, respiratory, and eye protection is required
B	The highest level of respiratory protection is necessary but a lesser level of skin protection is needed
C	The concentration(s) and type(s) of airborne substance(s) are known and the criteria for using air purifying respirators are met
D	Minimal protection is required for nuisance contamination only

Sources: OSHA, 1994; EPA, 2017a.

Level A PPE

Protection provided:

- Highest level of skin, eye, respiratory protection

Elements:

- Positive pressure, full face-piece, self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA
- Totally encapsulated chemical- and vapor-protective suit
- Inner and outer chemical-resistant gloves
- Disposable protective suit, gloves, and boots

Level A–equivalent totally encapsulating chemical- and vapor-protective suit. (Source: U.S. DHHS.)

Indications:

- Identified or suspected hazards requiring maximal skin, eye, and respiratory protection
- Working in confined areas where hazards have not been fully characterized

Who should wear:

- First responders
- Those facing identified or potential risk of biological, liquid, or vapor chemical hazard exposure exists

Level B PPE

Protection provided:

- Highest level of respiratory protection; lower level of skin protection

Elements:

- Positive pressure, full face-piece self-contained breathing apparatus (SCBA) or positive pressure supplied air respirator with escape SCBA
- Totally encapsulated chemical- and vapor-protective suit
- Inner and outer chemical-resistant gloves
- Disposable protective suit, gloves, and boots

Level B–equivalent non-gas-tight encapsulating suit.
(Source: U.S. DHHS.)

Indications:

- Identified or suspected hazards requiring maximal respiratory protection
- Working in atmospheres containing <19.5% oxygen
- Lower-level skin hazard may be present

Who should wear:

- First responders

- Those entering the most heavily contaminated radiation zones to rescue victims or protect valuable property necessary for public welfare

Level C PPE

Protection provided:

- Lower level of respiratory and skin protection; adequate for radiation event response where other hazards have been determined not to be present

Elements:

- Full-face air purifying respirator
- Inner and outer chemical-resistant gloves
- Hard hat
- Escape mask
- Disposable chemical-resistant outer boots

Level C–equivalent PPE. (Source: U.S. DHHS.)

Indications:

- Hazards have been identified
- Hazards will not be absorbed by or adversely affect exposed skin

- All criteria for using an air-purifying respirator are met (i.e., concentrations of all airborne contaminants are known, appropriate filters are available, oxygen levels are sufficient)

Who should wear:

- First responders and first receivers
- Those caring for patients/victims likely to be contaminated with radiological material

Level D PPE

Protection provided:

- Lowest level of respiratory and skin protection

Elements:

- Gloves
- Coveralls
- Safety glasses
- Face shield
- Chemical-resistant, steel-toe boots or shoes

Level D–equivalent PPE. (Source: U.S. DHHS.)

Indications:

- Atmosphere contains no known hazards
- No or very low potential for unexpected respiratory or skin contact with environmental hazards

Who should wear:

- First receivers
- Those working in post-decontamination areas, as Standard Precautions PPE (per protocol) for infection-control purposes

(U.S. DHHS, 2018)

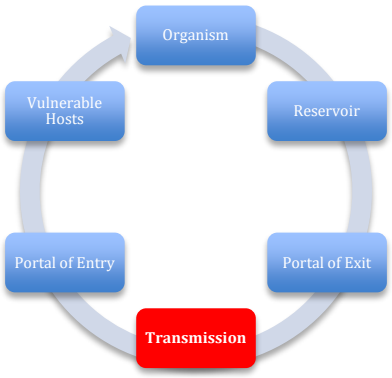
BIOLOGICAL TERRORISM PREPAREDNESS AND RESPONSE

A biological agent is a microorganism (or a toxin derived from it) that causes disease in persons, plants, or animals or causes the deterioration of material (DOD, 2018). It has been weaponized, and because of the changes it has undergone, it will affect a broader segment of the human or animal population or crops than the naturally occurring form of the pathogen.

Dispersal of Biological Agents

While the standard chain of infection applies to diseases caused by exposure to biological weapons, the obvious difference is the **mode of transmission** link.

- Naturally occurring disease is almost always spread unintentionally. In many cases, it occurs as part of carrying out normal daily activities, with a contaminated hand or uncovered sneeze passing on the infectious agent.
- Intentional spread indicates biological terrorism.



Chain of infection. In biological terrorism, the mode of transmission is intentional. (Source: Wild Iris Medical Education, Inc.)

Preparation to deal with bioterrorism has much in common with the epidemiology of emerging infectious diseases. As they do with naturally occurring diseases, healthcare providers and public health agencies must be prepared to deal with pathogens not normally presenting in this country or varying in their presentation and/or severity.

In the case of an **overt** attack, healthcare facilities in the immediate area will be inundated with victims, possibly without regard to the relationship between the stated time and place of release and the known incubation period. Fear may drive individuals who were nowhere near the event site into the healthcare system.

If the attack is **covert,** the arrival of victims at one or more perhaps widely spread facilities may be the first indication that an act of terrorism has occurred. Because most pathogens have an incubation period before the infected person begins to show symptoms, the attack may remain silent for some time. Additionally, infected individuals may further spread the agent just by following their daily routine.

Biological agents may be dispersed by several means, but only aerosol sprays are reasonably practical. The use of small fixed-wing or rotary aircraft could be an effective way to accomplish dissemination of the agent. Contaminating public water supplies is not practical; it requires a large amount of agent to be introduced into the water after it passes through the water treatment facility.

Syndromic Surveillance for Bioterrorism

The CDC defines *syndromic surveillance* as the study of real-time health-related data that precede diagnosis and signal a sufficient probability that cause an outbreak of a disease which warrants further public health response. These data streams have also been used as input to statistical algorithms designed to detect bioterrorist attacks.

Healthcare providers—including emergency department staff and acute care clinic physicians, nurses, and assistive personnel and infection prevention specialists—play a key role in initiating the response to an act of bioterrorism. Their knowledge of what is usual among their patient population will provide the starting point for syndromic surveillance, relying as much on objective knowledge of community trends as on the instinct most professionals develop about what is “normal” for their setting. Clinical features that may be noted include:

- Increases in calls or visits to emergency departments, urgent care facilities, clinics, and physicians’ offices
- Patients presenting with signs and symptoms of agents potentially used in biological terrorism
- Increases in the use of over-the-counter drugs or complementary medicines used to treat potential weapon-related signs and symptoms

The most **common features of an outbreak** caused by bioterrorism agents include:

- A rapid increase (hours to days) in the number of previously healthy persons with similar symptoms seeking medical treatment
- A cluster of previously healthy persons with similar symptoms who live, work, or recreate in a common geographical area
- An unusual clinical presentation
- An increase in reports of dead animals
- A lower incidence rate in individuals who are situationally protected (e.g., confined to home with no exposure to large crowds)
- An increase in number of patients who expire within 72 hours after admission to the hospital

All the above factors reflect changes from community patterns. Thus, an astute observer with a finger on the community's general "health pulse" can make a significant difference in how soon a response to the threat begins.

An exception to the community comparison is any person with a history of recent (past two to four weeks) travel to a foreign country who presents with symptoms of high fever, rigors, delirium, rash not characteristic of measles or chickenpox, extreme myalgias, prostration, shock, diffuse hemorrhagic lesions or petechiae, and/or extreme dehydration due to vomiting or diarrhea with or without blood loss. (Note the common thread between this factor and the 2015 spread of Ebola from western Africa to Europe and the Americas and the 2016 Zika outbreak in the Americas.)

The relationship to symptoms presentation and travel underscores the need to include queries about travel early in the intake/triage process. This aids in distinguishing between a potential victim of a biological weapon and a person who has been exposed to a naturally transmitted disease to which they have no community-acquired or vaccination-provided immunity.

While equipment for **detecting and identifying** biological agents does exist, there are significant drawbacks to the systems currently available. Today's technology is:

- Geared toward detecting agents in the environment so that first responders can take appropriate precautions
- Not intended to be an aid to diagnosis
- Complex to use and requires extensive initial and refresher training to insure the delivery of accurate information
- Costly to purchase and maintain

Singly, any of these considerations keep widespread availability of this technology from being a practical community option. Taken in combination, they form a near-insurmountable barrier.

CASE

Several bank employees were processing recent deposits into the bank's ATMs. One of them opened an envelope containing currency and a note stating the bills had been contaminated with anthrax. The bank manager implemented the bank's response plan and notified public safety agencies. The workers were brought to the nearby hospital, and the hospital's facility disaster plan was activated.

The bank and parking lot and sidewalks were secured. Since the note stated that the attack was directed specifically at that branch and the syndromic surveillance data supported that conclusion, public health and law enforcement officials felt that no widespread exposure had occurred.

As part of the healthcare facility disaster plan, the information officer conducted press conferences, stressing the reasons why there was no need for concern on the part of anyone not already identified as having been exposed.

The community emergency operations center notified all healthcare facilities in its catchment area.

The social media liaison ensured that accurate information was immediately posted to the facility's websites and social media sites.

All departments in the facility were briefed, and the in-place alert system was used to inform off-duty personnel of the extent of the incident.

To no one's surprise, worried citizens showed up in large numbers. The infection preventionist, assisted by employee health and security personnel, set up a series of checkpoints to direct the "walking worried" to areas where they could express their concerns and receive education and reassurance. Checkpoint personnel also sorted out friends and families of the exposed so they could receive support and information before they were reunited with the victims.

Bioweapon Classification Categories

The U.S. public health system and primary healthcare providers must be prepared to address various biological agents, including pathogens that are rarely seen in the United States. Classification is based on ease of dissemination, morbidity and mortality, potential for panic and social disruption, and requirements for public health preparedness.

CATEGORY A

These high-priority agents include organisms that pose a risk to national security because they:

- Can be easily disseminated or transmitted from person to person
- Result in high mortality rates and have the potential for major public health impact
- Might cause public panic and social disruption
- Require special action for public health preparedness

CATEGORY A AGENTS/DISEASES

- Anthrax (*Bacillus anthracis*)
- Botulism (*Clostridium botulinum* toxin)
- Plague (*Yersinia pestis*)
- Smallpox (variola major)
- Tularemia (*Francisella tularensis*)
- Viral hemorrhagic fevers, including filoviruses (Ebola, Marburg), arenaviruses (Lassa, Machupo)
  (CDC, 2017c)

CATEGORY B

Second highest priority agents include those that:

- Are moderately easy to disseminate
- Result in moderate morbidity rates and low mortality rates
- Require specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance

CATEGORY B AGENTS/DISEASES

- Brucellosis (*Brucella* species)
- Epsilon toxin of *Clostridium perfringens*
- Food safety threats (*Salmonella* species, *Escherichia coli* O157:H7, *Shigella*)

- Glanders (*Burkholderia mallei*)
- Melioidosis (*Burkholderia pseudomallei*)
- Psittacosis (*Chlamydia psittaci*)
- Q fever (*Coxiella burnetii*)
- Ricin toxin from *Ricinus communis* (castor beans)
- Staphylococcal enterotoxin B
- Typhus fever (*Rickettsia prowazekii*)
- Viral encephalitis (alphaviruses, such as eastern equine encephalitis, Venezuelan equine encephalitis, and western equine encephalitis)
- Water safety threats (*Vibrio cholerae, Cryptosporidium parvum*)
(CDC, 2017c)

CATEGORY C

Third highest priority agents include emerging pathogens that could be engineered for mass dissemination in the future because of:

- Availability
- Ease of production and dissemination
- Potential for high morbidity and mortality rates and major health impact

CATEGORY C AGENTS

- Emerging infectious diseases such as Nipah virus and hantavirus
(CDC, 2017c)

Category A Diseases with Potential for Use as Bioweapons

ANTHRAX

Bacillus anthracis is a spore-forming organism, with the spores being the infectious element. In its natural state, it is present in the soil, where it may be ingested by grazing animals. It can be transmitted to humans by handling or ingesting contaminated animals, animal products, or soil. Unless exposure is due to an intentional release, anthrax infections are very rare.

INHALATION ANTHRAX	
Presentation	• **Initial:** Flu-like symptoms such as sore throat, mild fever, fatigue and muscle aches, which may last a few hours or days; mild chest discomfort; shortness of breath; nausea; coughing up blood; painful swallowing • **Delayed:** High fever, trouble breathing, shock, meningitis
Treatment	60 days of appropriate antibiotic, plus supportive intensive care
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions
Notes	• Hand hygiene must be a vigorous wash for 30 to 60 seconds with soap and water or 2% chlorhexidine gluconate after spore contact (alcohol hand rubs are inactive against spores) • Not contagious person-to-person
Sources: Mayo Clinic, 2017; OSHA, n.d.-a	

CUTANEOUS ANTHRAX	
Presentation	• Within 2 weeks of exposure • Local edema in area of contact, progressing to itching macule or papule, then ulceration, then eschar formation • May include lymphangitis and lymphadenopathy
Treatment	60 days of appropriate antibiotic and wound care
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions; add Contact Precautions if uncontained copious drainage is present
Notes	Hand hygiene must be a vigorous wash for 30 to 60 seconds with soap and water or 2% chlorhexidine gluconate after spore contact (alcohol hand rubs are inactive against spores)
Source: Mayo Clinic, 2017.	

BOTULISM

Clostridium botulinum is also a soil-inhabiting, spore-forming organism. The neurotoxin it forms is extremely potent; <1 microgram is fatal for adults. It causes difficulty breathing, muscle paralysis, and if untreated, death can occur. Botulism can be contracted by ingesting contaminated canned, smoked, or vacuum-packed foods, but also by inhaling spores.

There are seven distinct forms of botulinum toxin, types A to G. Types A, B, E, and rarely F cause human botulism. Types C, D, and E cause illness in other mammals, birds, and fish.

FOOD-BORNE BOTULISM	
Presentation	• **Adults:** Drooping eyelids; weakened jaw clench; difficulty swallowing, speaking, and seeing; symmetrical descending proximal-to-distal weakness and respiratory dysfunction • **Infants and children:** Loss of head control, limb weakness, respiratory distress, constipation, lethargy, and loss of gag reflex
Treatment	• Antitoxin: Does not reverse paralysis but arrests its progression; recovery follows the regeneration of new neuromuscular connections. • Supportive care, per symptoms; ventilator support may be required for weeks to months. • Recovery takes weeks to months; those who survive may have fatigue and shortness of breath for years.
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions
Notes	There is no current FDA-approved human immunization against botulism; extensive research is in progress.
Sources: CDC, 2017b; NCBI, 2017; WHO, 2018.	

INHALATION BOTULISM	
Presentation	Same as for food-borne (see above), but lacking GI symptoms
Treatment	• Antitoxin (available from CDC; may reduce severity of symptoms) • Supportive care, including mechanical ventilation if needed
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions
Source: CDC, 2017b; WHO, 2018.	

PLAGUE

Yersinia pestis is a bacterium that causes acute, potentially fatal infections in both humans and animals. It is naturally occurring in environments in which rats and their fleas exist. Plague has occurred in rural and semi-rural areas of the western United States, primarily in semi-arid upland forests and grasslands. In addition, wild carnivores can become infected by consuming infected prey.

There are five principal forms of plague in humans, with bubonic, pneumonic, and septicemic being the most common. Plague meningitis and pharyngeal plague are the others. Ocular plague has been reported in free-ranging mule deer.

Plague is rarely naturally transmitted by inhalation, but that is the most likely means if the organism were to be released intentionally. If released as an aerosol, an outbreak of pneumonic plague is the anticipated result.

BUBONIC PLAGUE	
Presentation	• **First several days:** Nonspecific, flu-like symptoms • **2 to 6 days after exposure:** Buboes (grossly enlarged, extremely tender lymph nodes with drainage at the inoculation site) and fever • If **untreated**, can progress to septicemia or secondary pneumonic plague or plague meningitis
Treatment	• Antibiotics (streptomycin, doxycycline, gentamycin, ciproflaxin) • Supportive measures: Oxygen, IV fluids
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions
Notes	Without treatment, about 50% fatality
Source: WebMD, 2018.	

PNEUMONIC PLAGUE	
Presentation	• **1 to 6 days:** Acute onset of fever and chills, malaise, myalgias, and progressive lethargy • If **untreated**, can progress to adult/acute respiratory disease syndrome and refractive pulmonary edema, shock, hypotension, and multiple organ system failure or plague meningitis
Treatment	• Antibiotics (streptomycin, doxycycline, gentamycin, ciproflaxin) • Supportive measures: Oxygen, IV fluids
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions plus Droplet Precautions until patients have received a minimum of 48 hours of appropriate antibiotics and until pneumonia has been ruled out or until sputum culture have shown negative findings; then Standard Precautions alone
Notes	Without treatment, about 50% fatality
Source: Minnaganti, 2017.	

SEPTICEMIC PLAGUE	
Presentation	• Usually secondary to pneumonic or bubonic plague; may be primary presentation • Acute onset of fever and chills, prostration, abdominal pain, nausea, and vomiting • May progress to include purpura, disseminated intravascular coagulopathy, hypotension, and shock
Treatment	• Antibiotics (streptomycin, doxycycline, gentamycin, ciproflaxin) • Supportive measures: Oxygen, IV fluids
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions
Source: Minnaganti, 2017.	

SMALLPOX

The variola virus causes smallpox in two forms. Variola major is the most common and most severe. It has an historical fatality rate of ~30%. Variola minor is less common and less severe, with an historical fatality rate of ≤1%.

Transmission begins with virus particles being sloughed from the oropharyngeal lesions of an infected person. Inhalation of airborne droplets of this saliva introduces the disease to a new host. It can also be spread by direct contact with droplets or contaminated items such as clothing, bedding, or tissues.

CDC's Strategic National Stockpile is the nation's largest supply of potentially life-saving pharmaceuticals and medical supplies for use in a public health emergency severe enough to cause local supplies to run out (CDC, 2018a).

VARIOLA MAJOR	
Presentation	• **Incubation period:** 7 to 19 days (although the average length is 10 to 14 days); patient is not contagious and usually has no symptoms and may feel fine • **Initial symptomatic period:** 2 to 4 days; patient may or may not be contagious; symptoms include high fever, head and body aches; possible vomiting; usually too sick to carry on normal activities • **Early rash:** 4 days; small red spots on the tongue and in the mouth; changing into sores that break open in and spread large amounts of the virus into the mouth and throat. The person continues to have a fever until the rash

	spreads over the body (usually within 24 hours). By the fourth day, skin sores fill with a thick, opaque fluid and often have a dent in the center; once the skin sores fill with fluid, the fever may rise again and remain high until scabs form over the bumps. At this time, the person is **most contagious**. • **Pustular rash/scabs:** 10 days; contagious. Sores become pustules (sharply raised, usually round and firm to the touch, like peas under the skin). After about 5 days, pustules begin to form a crust and then scab. By the end of the second week after the rash appears, most of the sores have scabbed over. • **Scabs fall off:** 6 days, contagious. Three weeks after the rash appears, most scabs will have fallen off. • **No scabs:** Four weeks after the rash appears, all scabs should have fallen off. Once all scabs have fallen off, the person is **no longer contagious**.
Treatment	• No specific treatment • Isolation • Supportive treatment, including fluid replacement and antibiotics for secondary skin infections
PPE	• **First responders:** Level A, B, or C, depending on circumstances of agent release • **First receivers:** Standard Precautions
Notes	• The most important method for preventing transmission of smallpox is vaccination. All staff who provide care for smallpox patients must be vaccinated against smallpox. In a smallpox emergency, only staff with confirmed vaccination status should provide direct care to patients with suspected or confirmed smallpox.
Sources: CDC, 2016a.	

NUCLEAR/RADIOLOGICAL TERRORISM PREPAREDNESS AND RESPONSE

Nuclear or radiological weapons are the newest member of the WMD "family." As an offshoot of the 20th-century nuclear age, they are extremely technology dependent. Creating a nuclear WMD requires a high degree of scientific knowledge (or the ability to interpret and apply information available on the Internet) as well as access to specific materials and facilities.

The use of radiation as a terrorist weapon may be either overt or covert.

An overt attack could be carried out by the intentional deployment of a nuclear weapon or the use of an RDD or "dirty bomb." The latter involves the dispersal of nuclear material by using conventional explosives.

Placing radioactive material in a location where it would expose unsuspecting victims or contaminate common-use objects is how a terrorist group might conduct a covert attack. Examples include concealing the material in a high-traffic location or contaminating food or water sources. A covert attack is a "low-tech" way to conduct radiation terrorism. Logistical requirements might be as simple as a trowel to bury material in planters at a busy public transportation plaza or a take-out cup to carry the contaminant around a crowded market.

NUCLEAR WEAPONS VS. RADIOLOGICAL DISPERSIVE DEVICES

Nuclear weapons and radiological dispersive devices (RDD) have several similarities:

- They both have the ability to create damage (due to the explosive power of the weapon) and to contaminate persons and inanimate objects (due to the inclusion of radioactive material).
- Both rely on the public fear of anything associated with nuclear use or radiation.
- Caring for victims triggers the need for vast amounts of personnel and material resources to decontaminate casualties and clean up contaminated debris.

They differ in the type of nuclear material and required technology:

- A true nuclear weapon requires the logistical and financial support to acquire the materials and the skill to create and deliver the weapon, in particular, access to weapons-grade plutonium or uranium-238. These complex factors may put this type of attack beyond the range of all but well-organized, -supported, and -financed groups.
- An RDD also requires access to nuclear material but can employ more readily available commercial-grade material. It also relies on far less sophisticated conventional explosive technology to disperse it. This makes it a potential weapon for a wider range of terrorist groups.

What Is Ionizing Radiation?

Ionizing radiation has so much energy that it can knock electrons out of atoms, a process known as *ionization*. Ionizing radiation can affect the atoms in living things, so it poses a health risk by damaging tissue and DNA in genes. Sources of ionizing radiation include X-ray machines, cosmic particles from outer space, and radioactive elements. Radioactive elements emit ionizing radiation as their atoms undergo radioactive decay (EPA, 2017b). This can be a positive attribute when it is used as a method of medical treatment or negative when it is harnessed into a weapon.

The nuclear materials used in diagnostic or interventional medical care are forms of ionizing radiation.

UNITS OF MEASURE

How radiation is expressed is determined by the relationship of its amount to another factor. There are two measurement systems in use, the conventional system and the Système International d'Unités (SI). The conventional system is generally used in the United States. The terminology used to describe radiation is context-dependent.

UNITS OF RADIATION MEASUREMENT	
What Is Being Measured	**Measurement System**
Emitted radiation (amount of radiation given off by a material	Conventional: Curie (Ci) SI: Becquerel (Bq) Conversion: 1 Ci = 3.731010 Bq
Radiation dose (amount of energy deposited per unit weight of human tissue)	Conventional: Rad SI: Gray (Gy) Conversion: 1 rad = 0.01 Gy
Biologic risk (risk that a person will suffer health effects from exposure)	Conventional: Rem SI: Sievert (Sv) Conversion: 1 rem = 0.01 Sv
Source: CDC, 2014a.	

MEASURING DEVICES

Because radiation cannot be detected by human senses, a device must be used to confirm or exclude its presence. In the case of a radiation terrorism incident, two general types of devices will be used, one to survey victims or healthcare workers and the other to monitor healthcare workers' cumulative exposure.

Radiation Survey Meters

Colloquially known as *Geiger counters,* radiation survey meters identify the presence of radiation in the physical environment or on the surface of or within victims. They are used during triage and decontamination of victims.

Radiation survey meter (GM meter). (Source: Steve Sugarman, REAC/TS.)

Personal Dosimeters

The second type of measuring device is a personal dosimeter, and it is part of the PPE for persons facing exposure to radiation as part of their duties. Personal dosimeters are just that: they are intended to monitor the exposure of one individual. They should not be shared, as that would provide incorrect information on any and all persons involved in the sharing.

There are two types of personal dosimeters: those used during routine healthcare provision and those required during a radiation emergency such as the aftermath of a terrorist attack.

Dosimeters designed to be used in situations where radiation or radioactive materials are used as part of diagnosis or treatment include film badges, thermoluminescent dosimeters (TLDs), and optically stimulated luminescence (OSL) dosimeters. These dosimeters are not self-reading and do not provide real-time information. However, given the relatively low levels of radiation exposure experienced in usual circumstances, the monthly or quarterly reporting interval of film badge–type monitoring provides adequate exposure information to both the wearer and those responsible for facility radiation safety.

However, in the event of a terrorist attack using radiation, care providers will have much greater than usual potential exposure over a significantly shorter period of time and will require real-time information on their exposure so they can remove themselves to a safe area before they exceed recommended levels. The newest personal dosimeters provide sophisticated **real-time information** on exposure. Many come with alarms that indicate the wearer is approaching maximum allowable exposure and have the ability to automatically download information to a computer.

Dosimeters: film badge (left), ring badge (center), and real-time (right).
(Sources: OSHA and U.S. DHS.)

Effects of Radiation

Radiation injury to the body happens in one or more ways, depending on the situation that caused the exposure.

TYPES OF RADIATION EXPOSURE

It is critical to note that **exposure to radiation does not make a person radioactive**:

- A patient undergoing diagnostic or external therapeutic radiation is exposed but not radioactive. This radiation can be absorbed by the body or pass through the body. The person exposed is not radioactive and may be managed like any other patient.

- Victims of a radiation terrorist attack are in the same category as patients undergoing invasive radiation therapy. Once the radioactive material is removed from patients' bodies, they do not pose a risk to care providers.

Radioactive contamination occurs when radioactive material is deposited on or in an object or a person. Radioactive materials released into the environment can cause air, water, surfaces, soil, plants, buildings, people, or animals to become contaminated. A person exposed to radiation is not necessarily contaminated. For a person to be contaminated, radioactive material must be on or inside the body.

Radioactive contamination can be external, internal, or both. When radioactive materials—in the form of dust, powder, or liquid—come into contact with a person's skin, hair, or clothing, he or she is considered **externally contaminated.** External contamination can be removed by shedding contaminated clothing and/or completely washing off the source of radioactivity.

If radioactive materials get inside the body through the lungs, gut, skin, or wounds, the contaminant can become deposited **internally**. Incorporation is the process of the uptake of radioactive materials by body cells, tissues, and target organs such as bone, liver, thyroid, or kidney. Incorporation cannot occur unless contamination has occurred (ORISE, 2002). Internal contamination continues until the radioactive material decays, is flushed from the body by natural processes, or is removed by medical countermeasures.

RADIATION ILLNESS

Once a person has been exposed to radiation beyond a therapeutic dose, **radiation-induced illness** may occur. Two major categories have been identified: acute radiation syndrome and cutaneous radiation syndrome (CDC, 2014b, c, d).

Acute Radiation Syndrome

Acute radiation syndrome (ARS) is caused by total or near-total body irradiation by a high dose (>0.7 Gy or >70 rads) of external, penetrating radiation over a very short period of time (minutes). Onset and severity of symptoms are related to the severity of exposure. Victims in close proximity to the detonation of either a nuclear device or an RDD would receive the intense exposure that causes ARS (CDC, 2018b). There are four stages of ARS (see below).

FOUR STAGES OF ARS

Stage	Characteristics
1. Prodromal (early)	• Patient experiences nausea, vomiting, anorexia, and possibly diarrhea. • Duration of symptoms can vary. • Can occur within minutes to days following exposure.
2. Latent	• Patient looks and feels generally healthy. • Can last for a few hours to a few weeks.
3. Manifest illness	• Patient begins to experience symptoms specific to the part(s) of the body affected. • Symptoms depend on the specific syndrome (bone marrow or hematopoietic, gastrointestinal, or cardiovascular). • Can last from hours to several months.
4. Recovery	• Lasts from several weeks to two years. • Most patients who do not recover will die within several months of exposure.

Source: CDC, 2018b.

Cutaneous Radiation Syndrome (CRS)

As the name implies, CRS presents as skin damage manifesting within hours, days, or weeks after exposure. It is caused by acute exposures to beta radiation or X-rays or contamination of the patient's skin or clothes. Acute radiation syndrome will usually be accompanied by some skin damage; however, CRS can occur without the other symptoms of ARS. The patient experiences transient itching, tingling, erythema, or edema within hours or days. This is usually followed by a latent period. Lesions may not be seen for weeks to months postexposure but then can be debilitating or even life threatening (CDC, 2018b).

Syndromic Surveillance for Nuclear/Radiological Terrorism

If even one patient presents with symptoms suggestive of nontherapeutic radiation exposure, aggressive investigation is warranted to discover the circumstances of the exposure. Determination of the cause (accidental exposure, such as a workplace incident, or intentional exposure caused by terrorists) will determine what actions beyond caring for the victim(s) are indicated.

Once the index of suspicion is raised, data is needed to rule in or out commonalities. The questions for syndromic surveillance in the case of possible radiation terrorism home in on the victim's circumstances immediately prior to the incident more than symptoms. The clinician poses these questions in a sensitive manner:

- Where were you before you started experiencing …?
- What were you doing/eating/touching …?
- When did this happen?
- Were you alone or in a group?

As soon as the possibility of a terrorist act or radiation incident is even implied, the victim's focus will likely shift inward. All but the most altruistic individuals will initially be more concerned with their own well-being and that of their immediate circle than "the greater good." The clinician should help the patient remain calm and focused by providing fact-based reassurance while eliciting information that might provide clues to the scope of the incident.

In the case of a known or suspected **covert** radiation terrorist attack, syndromic surveillance focuses on case-finding and data collection. A covert release may lead to a staggered (over time and to multiple facilities) patient presentation. The prompt collection and interpretation of data in a coordinated manner can decrease the time it takes authorities to locate and neutralize the radiation source(s). This will end the production of new victims. A secondary gain is the reinforcement of public confidence in the ability of the system to protect its people.

The primary function of syndromic surveillance in the case of an **overt** attack is as much triaging data as it is collecting it. Sorting out those most likely to have been affected from those frightened about the possibility will give a truer picture of the event as a whole.

Treating Victims of Nuclear/Radiation Terrorism

The **overriding principle in treating victims** of radiation terrorism is simple: addressing contamination issues should not delay treatment of life-threatening injuries.

Some victims of a terrorist attack involving radiation, especially if an RDD was used, will have immediate, life-threatening injuries. Thus, the initial care team should include staff with expertise in radiation safety as well as trauma-related injuries.

- The facility disaster plan should contain information on how to contact individuals with this type of experience. For facility staff, an up-to-date alert roster should be readily available.

- If this expertise is not available in-house, a consultative relationship with a larger institution may be the answer, and that should be included in the disaster plan.

- In the absence of either of these options, or to augment them, the Radiation Emergency Assistance Center is available 24/7/365 *(see "Resources" at the end of the course)*. This agency's function includes deploying to and providing emergency medical consultation for incidents involving radiation anywhere in the world.

RISK TO PREGNANT HEALTHCARE PROVIDERS

The use of science-based policies and procedures will protect caregivers. It is highly unlikely that the levels of radioactivity associated with a contaminated patient would pose a significant health risk to care providers if they follow protocols. However, due to fetal sensitivity to radiation, pregnant staff should be assigned to duties that will not put them in contact with exposed patients or contaminated materials.

OSHA has made a clear distinction between the site where a hazardous substance was released and hospital-based decontamination facilities. This distinction is important because it helps define the maximum amount of contaminant to which facility healthcare workers might be exposed (i.e., the quantity of material on living victims and their possessions when they arrive at the hospital).

The OSHA best practices document notes that during victim decontamination procedures, the hazard to healthcare workers is strictly from secondary exposure and is dependent on the type and strength of the contaminant and how long the worker is exposed to it. Thus, the possible exposure of first receivers is limited to the amount of substance arriving at the hospital as a contaminant on victims and their clothing or personal effects (OSHA, 2008).

TRIAGE AREA

Two functions will occur in the triage area:

1. Actual or potential victims, who will be routed to an appropriate area to receive services, will be distinguished from those people seeking information or reassurance.

2. Those requiring decontamination and treatment will begin that process. This may include any healthcare providers who were exposed prior to learning of the radiation risk among patients.

The triage area should consist of contaminated and clean zones separated by a buffer zone. It should be located in an area where environmental and geographic factors will not lead to contamination of the facility as a whole. The decontamination area may be a permanent,

purpose-built decontamination chamber or area, or it may be a temporary structure assembled as needed from prepositioned supplies. In simple terms, think of keeping contamination "downhill and downwind" from the facility. Consult the facility disaster plan for information on location and detailed setup.

PERSONAL PROTECTIVE EQUIPMENT

Those healthcare workers assigned to work in the triage area must don appropriate PPE and use Standard Precautions. These actions are based on the same guidelines as used for infection prevention and control. The cornerstone of personal protection, no matter the nature of the hazard, is the correct, consistent use of PPE.

- PPE for first responders: Level B
- PPE for first receivers: Level C

The following considerations apply to the correct use of Level C PPE in this instance:

- The first pair of gloves is worn under the gown cuff and secured with tape; the second pair is worn over the cuff for ease of changing as needed.
- Open cuffs, hems, and any other potential gaps are sealed with appropriate tape. A fold-over or "courtesy" tab facilitates the removal of tape while wearing gloves.
- A personally assigned dosimeter is worn on the outside of the primary PPE garment. The dosimeter is placed in a position where it will not be dislodged during normal activity. A second dosimeter may be worn under the gown if facility policy dictates.

Lead aprons are not necessary. Their use can give a false sense of security and result in disregard of evidence-based actions (U.S. DHHS, 2014a).

INITIAL SURVEY FOR DECONTAMINATION

Decontamination is a systematic process of evaluation, action, and reevaluation where objective findings determine the next step. It begins with an initial survey of the victim with a radiation meter. This is carried out only by trained personnel using consistent technique to obtain valid, comparable results. The surveyor observes for both surface and embedded material. On-site radiation professionals are included on the response team to perform or supervise this function.

Any visible radioactive material is handled with forceps and stored in lead or lead-lined containers. The container is labeled with the details of the survey, including date, time, surveyor, meter used, and findings (CDC, 2014b).

PERFORMING A SURVEY FOR RADIATION CONTAMINATION

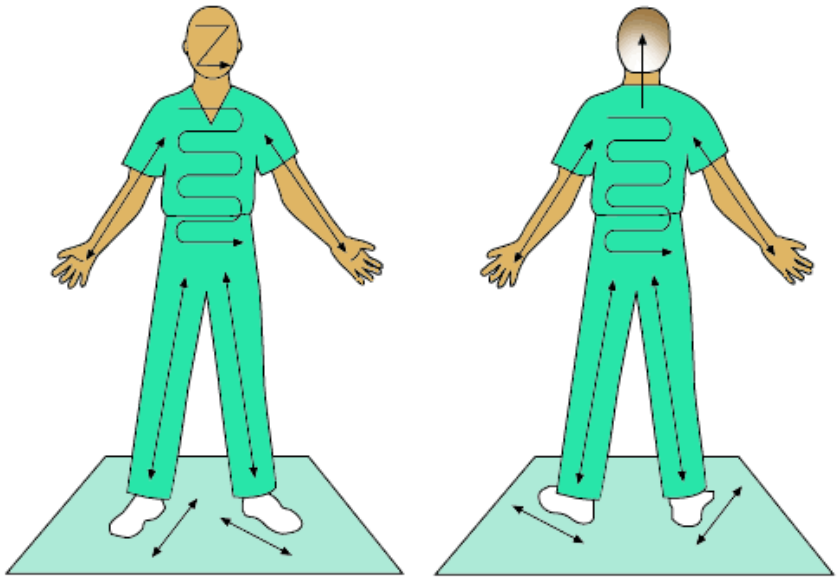
In the event of suspected radiation contamination, healthcare personnel will use a radiation survey monitor to survey patients. Completing a full survey of a single victim is time-consuming.

Prior to beginning the survey:

- Inspect the equipment.
- Perform a battery check.
- Conduct a source/operational check.
- Conduct a background reading.

When performing the survey:

- Start at the head on the front side of the victim.
- Continue systematically over the body, including the feet and soles.
- Repeat on the back side of the victim.



(Source: Radiation Emergency Assistance Center/Training Site)

Source: U.S. DHHS, 2017a.

REMOVING CLOTHING

Once the initial survey is complete, a victim's clothing is removed as follows:

- Cut and roll the clothing so that the outer surfaces are confined and contained within the rolls and any radioactive debris is also incorporated.
- Roll away from the face and any open wounds.
- Roll gently to avoid dispersing any radioactive debris.
- Double-bag and label the clothing; preserve and store as possible evidence, following instructions in the facility disaster plan.

SECONDARY SURVEY AND CLEANING

Once the victim's clothing has been removed, a secondary survey is performed in the same manner as discussed above. Then the victim is decontaminated as follows:

- Allow the victim to assist or participate to the extent possible. Even the small measure of autonomy this provides may allow the victim to feel a degree of control over what has happened.
- Rinse any wounds with tepid saline or water.
- If facial contamination is known or suspected, flush the eyes, ears, and nose and rinse the mouth.
- Clean intact skin gently with soap and water, starting outside the contaminated area and working inward. Do not scrub or rub the skin.
- Dry the skin gently and cover the victim's exposed skin once an area has been decontaminated. This serves the dual purpose of preventing unnecessary exposure and preventing loss of body heat.
- Cover any wounds with waterproof dressings.
- Transport or assist the victim to the buffer zone, where someone assigned to the buffer zone will assume responsibility for the victim.

Additional surveys and repeated decontamination may be required until surveys indicate that the radiation level is no more than twice the background radiation level or unchanged from the immediate previous reading.

Once the victim has been decontaminated, Standard Precautions and routine assessment and care pathways are indicated (CDC, 2005).

Disposal of wastewater and decontamination materials is dictated by facility policies.

When leaving the contaminated area, assigned personnel should remove and properly dispose of contaminated outer garments, shower if indicated in the facility disaster plan, and receive a body survey with a radiation meter.

ADDRESSING INTERNAL CONTAMINATION

Internal contamination is considered if high survey readings persist following decontamination. Nose or mouth contamination may indicate inhalation or ingestion.

Assessment may include analysis of urine, blood, and fecal samples or whole-body counts. Internal contamination generally does not cause early symptoms.

Radiation experts may be consulted regarding an individualized treatment plan. The following may be treatment options: early administration of radionuclide-specific decorporation agents such as Prussian blue, DTPA, or bicarbonate and/or gastric lavage, and/or antacids and/or cathartics to assist in clearing ingested contaminants.

Source: U.S. DHHS, 2014b.

CASE

A "dirty bomb" explodes in a crowded casino. Per local emergency response plans, all hospitals in the area are notified to expect the arrival of multiple casualties with both radiation exposure and traumatic injuries. ED staff and others involved in each facility's emergency response team don appropriate PPE prior to the arrival of the first victims.

Per protocols, treatment is begun immediately for physiologically unstable patients prior to performing the initial survey or beginning initial decontamination. For those without life-threatening injuries, initial radiation surveys are performed. Care providers then remove contaminated clothing from the individuals and place each victim's clothing and belongings in individual property bags that are then properly labeled. Once all clothing is removed and secured, the secondary survey is performed.

In victims who have been injured by shrapnel from the blast, ED staff remove the shrapnel to protect against possible internal contamination. They clean the wounds, carefully catching any water run-off. They also wash the patients' bodies with soap and water to remove any external contamination. They then complete a second scan to determine the degree to which the decontamination process was successful.

ARS AND CRS TREATMENT REGIMENS

ARS includes an interdisciplinary combination of symptom-directed interventions and ongoing assessment, as both obvious and subtle presentations are part of an evolving process.

The goals are to assess and document the patient's ongoing status and the progression of signs and symptoms, provide life-saving and comfort-oriented care, and establish a foundation for future treatment.

Initial treatment includes, but is not limited to, the following interventions:

- Treating vomiting immediately
- Performing serial complete blood counts (CBCs) (emphasizing the lymphocyte count) every 2 to 3 hours for the first 8 to 12 hours after exposure (and every 4 to 6 hours for the following 2 to 3 days)
- Precisely recording all clinical symptoms, particularly nausea, vomiting, diarrhea, and itching, reddening, or blistering of the skin, including time of onset
- Taking color photographs of suspected radiation skin damage for inclusion in the patient's record (or if this is not possible, dated and timed objective descriptions that capture the extent of the injuries at the time of assessment are critical; using a series of purpose-made human silhouettes or improvised sketches can capture the progression of cutaneous injury)
- Considering tissue and blood typing as well as initiating viral prophylaxis
- Promptly consulting with experts in radiation, hematology, and radiotherapy and radiation accident management about dosimetry, prognosis, and treatment options
- After consultation, beginning the following treatment (as indicated):
    - Supportive care in a clean environment (burn unit or similar area)
    - Prevention and treatment of infections
    - Stimulation of hematopoiesis by use of growth factors, system cell transfusions, or platelet transfusions (if platelet count too low)
    - Psychological support
    - Observation of existing or new onset erythema, hair loss, skin injury, mucositis, parotitis, weight loss, or fever

With CRS, delayed occurrence of lesions is a differentiating factor from thermal burns. An important part of treatment is to document time of occurrence of lesions and progressive changes in appearance. Treatment of localized injuries is symptomatic, focusing on pain relief and prevention of infection (CDC, 2014b, c, d).

Psychosocial Aspects of Radiation Terrorism

Terrorists count on the general public's fear of anything to do with radiation as a force multiplier. The number of actual victims seeking care will be directly related to the population size and density at the attack site. In urban areas, this could be hundreds to thousands. Most will self-refer to the nearest hospital. While many may need decontamination, others may seek radiologic screening even though not contaminated. Many may simply be seeking reassurance.

Psychogenic symptoms, such as nausea or vomiting, may manifest. Mental health professionals should always be members of the response team and available in any first-receiver facility to provide such support.

Radiation exposure **fact sheets**, both hardcopy and online, should be made available to patients and families. As with all care, information must be in-language to meet a number of regulatory and voluntary accreditation standards and, more importantly, the needs of patients and their loved ones. Having preprepared translated sheets available in the predominant languages spoken in the area and/or a plan in place to use interpreters for direct communication should be considered as part of facility planning.

When **interpreters** are required to obtain or convey information, the decision to use previously identified facility staff or professionally trained over-the-phone providers of interpretation services is a complex one. Factors to consider include:

- The existence of a contract with an interpretation provider, either as subscription service or on an as-needed basis
- The big-picture demand (at numerous impacted sites) for the services of these interpreters, especially in a situation involving large numbers who are non-English speakers and/or large numbers of casualties
- The skill and availability of in-house interpreters and/or bi- or multilingual staff members
- The most efficient and effective primary use of these staff members (as care providers or as interpreters)

The use of uninjured or minimally injured family members or significant others should be a last resort. Most likely, they will be too overwhelmed by the situation to be effective communicators.

Patients who are pregnant and their families/significant others will require special counseling.

Separate areas may be needed for radiation screening and counseling for patients with minimal risk of exposure or injury.

Reporting Procedure Following a Radiation Terrorism Incident

The Radiation Emergency Assistance Center should be contacted to record the incident in the Radiation Accident Registry System. The facility disaster plan will indicate who has the authority and responsibility to perform this notification.

CHEMICAL TERRORISM PREPAREDNESS AND RESPONSE

The first documented use of chemical weapons in declared warfare in the modern period was during World War I. Contemporary news media continue to state or imply that various governments or nongovernment operators use chemical agents to this date.

Chemical agents are attractive to terrorists because they or their precursors are readily available. A glance under most households' kitchen sinks or in their garages will reveal any number of potential chemical weapons or the ingredients to build them. Releases of these may be overt or covert, used against hard or soft targets, and employed by terrorists with varying levels of organization and/or outside support.

The threatened or actual use of chemical agents carries the same associated triage and psychological issues as with biological or radiological agents.

Dispersal of Chemical Agents

Chemical agents may be delivered by a variety of methods, limited only by the technology available to the terrorists:

- Spraying an aerosolized agent
- Exploding a dispersal device
- Contaminating food, water, or some other necessity or commonly used item

Immediate recognition of a covert chemical agent attack may be complicated by several factors:

- Depending on the chemical agent, symptoms of exposure might be similar to those of common diseases.
- Immediate symptoms of certain chemical exposures might be nonexistent or mild despite the risk for long-term effects.
- Exposure to contaminated food, water, or consumer products might result in reports of illness over a long period and in various locations.
- Persons exposed to two or more agents might have a mixed clinical presentation.

Classification of Chemical Agents

BY DURATION OF EFFECT

Unlike biological agents, which do not remain active in the environment for relatively long periods after delivery, chemical agents may or may not continue to be a threat after deployment. In terms of duration of potential effect and hazard target, chemical agents may be:

- **Persistent agents**, which remain active for up to a month on surfaces and are most dangerous to the skin
- **Nonpersistent agents**, which dissipate within a few hours and are most dangerous to the lungs

BY CDC CASE CLASSIFICATION

- **Suspected**: A case in which a potentially exposed person is being evaluated by health-care workers or public health officials for poisoning by a particular chemical agent, but no specific credible threat exists
- **Probable**: A clinically compatible case in which a high index of suspicion (credible threat or patient history regarding location and time) exists for vesicant exposure, or an epidemiologic link exists between this case and a laboratory-confirmed case
- **Confirmed**: A clinically compatible case in which laboratory tests on biologic samples have confirmed exposure

The case can be also be confirmed if laboratory testing was not performed because either a predominant amount of clinical and nonspecific laboratory evidence of a particular chemical was present or the etiology of the agent is known with 100% certainty (Belson et al., 2005).

Types of Chemical Agents

There are five major types of chemical agents:

- Blister
- Choking
- Blood
- Nerve
- Incapacitation/riot control

BLISTER AGENTS

Blister, or vesicant, agents are highly reactive chemicals that combine with proteins, DNA, and other cellular components to result in cellular changes immediately after exposure. Depending on the agent, signs and symptoms may manifest anywhere from 2 to 24 hours after exposure. Likely routes of exposure are inhalation, dermal contact, and ocular contact; ingestion is also possible.

Factors that contribute to the time of onset and the severity of illness include the:

- Amount and route of exposure to the vesicant
- Type of vesicant
- Baseline health condition of the exposed person

BLISTER AGENTS	
Examples	Distilled mustard (HD), mustard gas (H), Lewisite, mustard/Lewisite, mustard/T, nitrogen mustard, phosgene oxide, sesqui mustard, and sulfur mustard
Presentation	**Respiratory signs and symptoms:** • Chest tightness • Clear rhinorrhea • Cough • Dyspnea (shortness of breath) • Hemoptysis • Nasal irritation/pain • Sore throat • Tachypnea
	Dermal signs and symptoms: • Blisters (within 1 hour with phosgene oxime, delayed for 2 to 12 hours with Lewisite, delayed for 2 to 24 hours with mustards) • Erythema (immediate with lewisite and phosgene oxime, may be delayed for 2 to 24 hours with mustards) • Immediate blanching (phosgene oxime) • Itching • Necrosis and eschar (over a period of 7 to 10 days)
	Ocular signs and symptoms: • Blindness • Blurred vision • Corneal ulceration • Conjunctivitis • Eyelid edema • Eye pain/burning • Lacrimation • Photophobia
	Cardiovascular signs: • Atrioventricular block and cardiac arrest (with high-dose exposure) • Hypotension (with high-dose exposure to lewisite) • Gastrointestinal signs and symptoms (prominent if ingestion is a route of exposure) • Abdominal pain

	• Diarrhea (sometimes bloody) • Hematemesis • Nausea and vomiting
	Central nervous system signs and symptoms (with exposure to high doses): • Ataxia • Coma • Convulsions • Tremors

	Hematological signs and symptoms:
	• Anemia
	• Bleeding/hemorrhage
	  ○ Bone marrow suppression
	  ○ Increased susceptibility to infection
	  ○ Leukocytopenia
	  ○ Thrombocytopenia

Treatment	**First responder care:** • On-site decontamination (if done within 1–2 minutes of exposure, can minimize further tissue damage) • On-site ALS care prior to transport
	First receiver care: • No antidote for mustard agents • British anti-Lewisite for Lewisite (alone or in combination) for systemic symptoms • Intensive care for symptom-related support
PPE	• **First responders** (regardless of location: release site or triage/treatment area; until decontamination has been completed): Level A PPE • **First receivers** once decontamination has been completed: Level C PPE
Notes	Smell of garlic, mustard, or onion on body; oily droplets on skin
Sources: CDC, 2018c; Dire, 2018.	

CHOKING AGENTS

Choking/lung/pulmonary agents are chemicals that cause severe irritation or swelling of the respiratory tract (lining of the nose, throat, and lungs). Chemicals such as ammonia, chlorine, and phosgene cause eye, nose, and throat irritation, cough, wheezes, and dyspnea, also known as *irritant gas syndrome*.

Choking agents are delivered as gases; inhalation triggers the immune system. Fluids build up in the respiratory system, especially the lungs. Effects may be felt at once or delayed up to three hours (U.S. DHHS, 2017b).

CHOKING AGENTS (EXCEPT RICIN)	
Examples	Phosgene, chlorine, diphosgene, chloropicrin, oxides of nitrogen, sulfur dioxide
Presentation	**Immediate signs and symptoms of exposure:** • Coughing • Burning sensation in the throat and eyes • Watery eyes • Blurred vision • Difficulty breathing or shortness of breath • Nausea and vomiting • Lesions similar to those from frostbite or burns (resulting from skin contact) • Fluid in the lungs (pulmonary edema) within 2 to 6 hours following exposure to high concentrations of phosgene
	Delayed effects (may not be apparent for up to 48 hours after exposure): • Difficulty breathing • Coughing up white to pink-tinged fluid (a sign of pulmonary edema) • Low blood pressure • Heart failure
Treatment	**First responder care:** • On-site decontamination (if done within 1–2 minutes of exposure, can minimize further tissue damage) • On-site ALS care prior to transport
	First receiver care: • No antidotes for choking agents • Monitoring for first 48 hours for delayed effects • Intensive care for symptom-related support
PPE	• **First responders** (regardless of location: release site or triage/treatment area; until decontamination has been completed): Level A PPE • **First Receivers** once decontamination has been completed: Level C PPE
Sources: CDC, 2018d, e, f.	

CHOKING AGENTS (RICIN)	
Presentation	• Clusters of acute lung or GI injury (depending on exposure); circulatory collapse; shock; tracheobronchitis, pulmonary edema, necrotizing pneumonia if inhaled • Inhalation: chest tightness, coughing, weakness, nausea, fever • Systemic effects depend on route of exposure and dose. • Dermal and ocular exposure by ricin in powder or mist form can cause erythema and pain of the skin and eyes.
	Ingestion exposure (signs and symptoms of poisoning from oral exposure to purified ricin presumed similar to reports of illness after castor bean mastication and ingestion): • Hallucinations • Hematuria • Hypotension • Hypovolemic shock and multiple system organ failure, leading to death • Influenza-like symptoms (fever, myalgia, and arthralgia) • Profuse diarrhea (bloody or nonbloody) • Profuse vomiting • Seizures • Severe dehydration • Weakness
	Inhalational exposure (data on inhalational exposure to ricin in humans limited): • Cough, respiratory distress, bronchoconstriction • Cyanosis • Excessive diaphoresis • Hypotension, respiratory failure, and multisystem organ failure, leading to death • Influenza-like symptoms (fever, myalgia, and arthralgia) • Nausea • Pulmonary edema • Weakness
Treatment	**First responder care:** • On-site decontamination • On-site ALS care prior to transport

	First receiver care: • No antidotes for choking agents. • Intensive care for symptom-related support
PPE	• **First responders** (regardless of location: release site or triage/treatment area; until decontamination has been completed): Level A PPE • **First receivers** once decontamination has been completed: Level C PPE
Source: CDC, 2018f.	

BLOOD AGENTS

Blood agents are also intended for inhalation. They block the enzyme necessary for aerobic metabolism, depriving the red blood cells of oxygen and causing asphyxiation. Onset of symptoms is immediate—seconds to minutes.

BLOOD AGENTS	
Examples	Hydrogen cyanide, cyanogen chloride
Presentation	People exposed to a **small amount** of cyanide by breathing it, absorbing it through their skin, or eating foods that contain it may have some or all of the following signs and symptoms within minutes: • Dizziness • Headache • Nausea and vomiting • Rapid breathing • Rapid heart rate • Restlessness • Weakness
	Exposure to a **large amount** of cyanide by any route may cause these other health effects as well: • Convulsions • Loss of consciousness • Low blood pressure • Lung injury • Respiratory failure leading to death • Slow heart rate
Treatment	**First responder care:** Onsite decontamination and simultaneous 100% O_2 and antidote treatment (consult Agency for Toxic Substances and Disease Registry for specific dosing regimens) (*see "References" at the end of this course*)

PPE	• **First responders** (regardless of location: release site or triage/treatment area; until decontamination has been completed): Level A PPE • **First receivers** once decontamination has been completed: Level C PPE
Notes	Bitter almond odor indicates cyanide
Source: ATSDR, 2014a.	

NERVE AGENTS

Nerve agents affect the transmission of nerve impulses, causing death by shutting down the respiratory centers in the brain and paralyzing the respiratory muscles. Care is based on the patient's condition at time of initial evaluation.

TRIAGE FOR NERVE AGENT CASUALTIES		
Category	**Effects**	**Clinical Signs**
Immediate	Unconscious, talking but not walking, or moderate to severe effects in two or more systems (e.g., respiratory, GI, muscular, CNS)	Seizing or postictal, severe respiratory distress or apneic, recent cardiac arrest
Delayed	Recovering from agent exposure or antidote	Diminished secretions, improving respiration
Minimal	Walking and talking	Miosis, rhinorrhea, mild to moderate dyspnea
Expectant	Unconscious	Cardiac/respiratory arrest of long duration
Source: ATSDR, 2014b.		

NERVE AGENTS	
Examples	Sarin, tabun, soman, organic pesticides
Presentation	**Central nervous system signs and symptoms:** • Miosis (unilateral or bilateral) • Headache • Restlessness • Convulsions • Loss of consciousness • Coma
	Respiratory signs and symptoms: • Rhinorrhea (perfuse watery runny nose) • Bronchorrhea (excessive bronchial secretions) • Wheezing

	• Dyspnea (shortness of breath) • Chest tightness • Hyperpnea (increased respiratory rate/depth) – early (increased respiratory rate/depth) • Bradypnea (decreased respiratory rate) – late (decreased respiratory rate)
	Cardiovascular signs resulting from blood loss: • Tachycardia (increased heart rate) – early (increased heart rate) • Hypertension (high blood pressure) – early (high blood pressure) • Bradycardia (decreased heart rate) – late (decreased heart rate) • Hypotension (low blood pressure) – late (low blood pressure) • Arrhythmias/dysrhythmias (prolonged QT on EKG, ventricular tachycardia)
	Gastrointestinal signs and symptoms: • Abdominal pain • Nausea and vomiting • Diarrhea • Urinary incontinence, frequency • Musculoskeletal signs and symptoms • Weakness (may progress to paralysis) • Fasciculations (local or generalized) • Skin and mucous membrane signs and symptoms • Profuse sweating (local or generalized) • Lacrimation (tear formation)
	Conjunctival injection
Treatment	**First responder care:** • Onsite decontamination and antidote administration • Antidotes: Atropine and pralidoxime chloride (2-PAM Cl); atropine administered every 5 to 10 minutes until secretions begin to dry up; 2-PAM Cl administered within minutes to a few hours (depending on the agent) following exposure to be effective, generally no benefit in giving more than three injections of 2-PAM Cl. • Military Mark I kit containing autoinjectors provides the best way to administer the antidotes to healthy adults; one autoinjector delivers 2 mg atropine and the other delivers 600 mg 2-PAM Cl. • If Mark I kit is unavailable or the patient is not an otherwise healthy adult, consult Agency for Toxic Substances and Disease Registry for specific dosing regimens *(see "References" at the end of this course)*.

PPE	• **First responders** (regardless of location: release site or triage/treatment area; until decontamination has been completed): Level A PPE • **First receivers** once decontamination has been completed: Level C PPE
Source: ATSDR, 2014b.	

CASE

A woman walked into a casino showgirls' dressing room 30 minutes before the first show of the evening. In the controlled chaos, no one noticed her enter the room, pause by the door, or set the door lock. Her phone vibrated, signaling that her accomplice was going to throw the breaker for the lights in 10 seconds. The woman punctured the lid of a large food storage container and placed the container on the floor near the door. As the lights went out, she left the room, closing and locking the door behind her.

The 35 dancers in the dressing room panicked and in attempting to reach the door knocked over the container, dispersing sarin and causing the liquid to vaporize. The dancers began inhaling the agent. Several fell, and their skin was exposed to the remaining agent pooled on the floor in liquid form. All of the dancers began experiencing the symptoms of moderate exposure, with those nearest the door having a more immediate, intense reaction.

Their screams alerted other casino employees, who found a note on the locked door calling the dancers "Jezebels" and promising further "saran" attacks. Some employees called 911, while others broke down the door and began to assist their colleagues. Because all of the agent had not evaporated, some rescuers were also exposed and began to experience symptoms.

First responders arrived and identified the situation as a sarin gas exposure. Their assessment included the need to provide antidotes and possible ventilatory support for 40 or more victims. Shortfalls to providing this care were readily apparent.

- An on-site decontamination setup was needed to prevent any additional victims being generated.
- While atropine and diazepam were readily available in the first response vehicle and from their base station in adequate quantities to treat the number of victims, the necessary 2-PAM chloride was not.

The nearest hospital was notified, and it activated its disaster plan. However, it did not have adequate intensive care beds available to treat the number of victims anticipated to require ventilatory support.

The community emergency operations center was immediately contacted.

The preprepared decontamination supplies and equipment were dispatched, and the emergency call roster was activated to staff the decontamination area.

In accordance with the community plan, other hospitals were notified of the situation and alerted to the potential need to provide supportive care for a large influx of patients.

Previously identified sources for 2-PAM chloride were contacted, and emergent delivery was made to the release site and the facilities poised to receive victims.

INCAPACITATION/RIOT CONTROL AGENTS

Incapacitation and riot control agents are designed to be nonlethal but can cause injury or death because self-preservation behaviors may be overridden or inhibited. Large numbers of victims will easily overwhelm the healthcare system.

INCAPACITATION/RIOT CONTROL AGENTS	
Examples	• Incapacitation: BZ, LSD • Riot control: CS ("tear gas"), CN (Mace)
Presentation	• Incapacitation: Dizziness, dry mouth, sweating, tremors; tachycardia, hypertension; bizarre behavior • Riot control: Runny nose and eyes, shortness of breath, skin burns
Treatment	• Incapacitation: As indicated, if injured; protection from further injury Riot control: Flush eyes and/or skin; treat symptomatically
PPE	• **First responders** (regardless of location: release site or triage/treatment area; until decontamination has been completed): Level A PPE • **First receivers** once decontamination has been completed: Level C PPE
Source: CDC, 2018h; Riga, 2015.	

Decontamination of Victims of Chemical Agents

Removing the chemical agent from the victim's person and clothing serves two purposes:

- It ends the victim's exposure and limits injury to what has been received up to that time.
- It significantly reduces the risk of exposure to healthcare workers.

Ideally, clothing is removed and decontamination carried out before the victim is transported from the release site to the healthcare facility. Studies have shown that simply **removing contaminated clothing can reduce the quantity of contaminant associated with victims by an estimated 75% to 90%.**

Having victims shower with tepid water and a liquid soap with good surfactant properties is widely considered the most effective method for removing the remaining hazardous substance from victims' skin and hair. When the nature of the contaminant is known, decontamination procedures can be adjusted to best remove the specific hazard (OSHA, 2005).

If clothing has not been removed and decontamination done prior to arrival at the healthcare facility, clothing removal and decontamination should be done before the victims are moved into the facility.

SUGGESTIONS FOR A WORKPLACE "SURVIVAL KIT"

In the case of a terrorist attack, it is likely that healthcare professionals will be at work beyond their normal shifts due to increased patient load. If the nature of the attack calls for quarantine or lock down, employees may not be able to leave the facility, nor will replacements be allowed to report for work. Any emergency survival kit located in a vehicle may not be accessible, nor is it likely that anyone will be able to bring a "care package" from home, at least in the initial hours. Thus, it is important to keep a personalized "survival kit" in a secure location at the workplace. Suggested items include:

- Contact lens case and solutions and current prescription glasses
- Eye lubricant drops
- Batteries for hearing aid, if needed
- Several days' supply of any required or anticipated prescription and/or OTC medications
- Extra socks and underwear
- Personal care products (deodorant, shampoo, oral hygiene)
- Feminine hygiene or urinary care products, if needed
- Charger for cell phone
- Individual packets of water flavoring or electrolyte replacement products
- Ear plugs and an eye shade
- A small supply of nonperishable, ready-to-eat food items in case of individual needs or as personal "comfort food"

The following are some additional considerations for creating one's personal kit:

- Think "outside the box," that is, beyond what is needed for a normal shift.
- Ask, "What would keep me from being effective if I did not have it?"
- Regularly replace items with an expiration or "use by" date.

HEALTH ALERT NETWORK

CDC Health Alert Network

CDC's Health Alert Network (HAN) is its primary method of sharing cleared information about urgent public health incidents with public information officers; federal, state, territorial, tribal, and local public health practitioners; clinicians; and public health laboratories. CDC's HAN collaborates with federal, state, territorial, tribal, and city/county partners to develop protocols and stakeholder relationships that will ensure a robust interoperable platform for the rapid distribution of public health information (CDC, 2018i).

Individuals can sign up on the CDC website to receive HAN email updates or subscribe to HAN RSS feeds. *(See "Resources" at the end of this course.)*

HAN MESSAGE TYPES

The HAN Messaging System currently directly and indirectly transmits information to over 1 million recipients. Message types are categorized by the level of urgency of the information.

- **Health Alert**: Provides vital, time-sensitive information for a specific incident or situation; warrants immediate action or attention by health officials, laboratorians, clinicians, and members of the public; conveys the highest level of importance
- **Health Advisory**: Provides important information for a specific incident or situation; contains recommendations or actionable items to be performed by public health officials, laboratorians, and/or clinicians; may not require immediate action
- **Health Update**: Provides updated information regarding an incident or situation; unlikely to require immediate action
- **Info Service**: Provides general public health information; unlikely to require immediate action

(CDC, 2016b)

Nevada Health Alert Network

The Nevada Division of Public and Behavioral Health, Public Health Preparedness Program (PHP), administers the Nevada Health Alert Network (NVHAN). NVHAN is a viable, statewide, bed-tracking, availability, and alerting system in place throughout Nevada. NVHAN is a digital, high-speed notification system used to rapidly contact hospitals, healthcare facilities, and thousands of staff with extreme accuracy and in mere seconds.

NVHAN is composed of three systems:

- **HAvBED** (Hospital Available Beds for Emergencies and Disasters)
- **NXT Communicator**

- **Wireless Priority Service (WPS)** and **Government Emergency Telecommunications Service (GETS)**

State of Nevada employees, healthcare professionals, first responders/police/fire, or critical infrastructure agencies such as energy, water, communications, etc., can enroll for HAvBed or CommunicatorNXT (NV DPBH, 2018). *(See also "Resources" at the end of this course.)*

HAvBED

HAvBED is a vital component of the Nevada HAN for immediate transmission of critical health information during a catastrophic event in the state or the western United States, including California, Colorado, Idaho, Arizona, New Mexico, and Oregon. The system is intended for healthcare professionals, first responders, law enforcement, and critical infrastructure agencies such as energy, water, communications, etc.

HAvBED is an interactive system with worldwide access via the Internet. With access limited by password entry, the HAvBED system allows transmission of confidential information not intended for public dissemination during a public health emergency. A large library feature provides access to vital PHP documents, information, plans, and resources, including Nevada's Public Information and Communications Plan.

NXT COMMUNICATOR

NXT Communicator is a digital system designed to rapidly contact large groups of key individuals within the state during an emergent event. The system will contact via email, voice (via cell or home phone), text, or facsimile. It also allows senior leadership to access contact information from any Internet location via a secure network.

WPS/GETS

WPS/GETS is intended for use in an emergency or crisis situation when the wireless network (cell phone) and/or public telephone network become congested due to increased call volumes or damage to network facilities, hindering the ability of national security and emergency preparedness personnel to complete emergency calls. WPS/GETS enables selected leadership to gain priority access via a pre-assigned access code.

CONCLUSION

While the prospect of another terrorist act within the United States may be terrifying, one may occur. The result of any terrorist attack is possible civilian casualties, and this makes it a healthcare as well as a public safety concern.

Viewed from this perspective, both healthcare facilities and the personnel who staff them have a professional responsibility to prepare to care for the victims who will present to them. Acquiring and maintaining the information and skills needed to effectively respond to the casualties of such an action are necessary initial steps to be ready for those patients.

RESOURCES

Nevada

Nevada Health Alert Network (NVHAN)
http://dpbh.nv.gov/Programs/NVHAN/NVHAN_-_Home

NVHAN HAvBed/CommunicatorNXT sign-up form
http://dpbh.nv.gov/uploadedFiles/dpbh.nv.gov/content/Programs/NVHAN/dta/Forms/HAvBEDNXTContact%20InfoSheet%203%202015.pdf

Public Health Preparedness (Nevada DPBH)
http://dpbh.nv.gov/Programs/Preparedness

General

Community Emergency Response Team (CERT)
https://www.ready.gov/community-emergency-response-team

Health Alert Network (HAN)
https://emergency.cdc.gov/han

Information on specific types of emergencies (CDC)
http://emergency.cdc.gov/hazards-specific.asp

Radiation Emergency Assistance Center/Training Site (REAC/TS)
http://orise.orau.gov/reacts

Terrorism safety tips (American Red Cross)
http://www.redcross.org/get-help/how-to-prepare-for-emergencies/types-of-emergencies/terrorism

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TEST

[Take the test online at wildirismedicaleducation.com]

1. Which is **not** a recurring element among the listed definitions of terrorism?

a. Using force and/or violence

b. Intending to coerce some sort of action

c. Using weapons of mass destruction against civilians

d. Acting in violation of the law

2. In differentiating between a criminal act and a terrorist attack, FEMA states that a unique characteristic of a terrorist act is to:

a. Elicit fear only among the immediate victims.

b. Threaten the loss of property.

c. Target victims with symbolic significance.

d. Pose a threat of personal injury.

3. Which scenario would be considered a "mass casualty incident" for a rural community hospital emergency department (ED)?

a. Patient numbers and acuity in the ED are at the usual level. One nurse and one nursing assistant are stuck in traffic and will arrive about 20 minutes late for their shifts.

b. A football game incident between two high schools with an intense, long-standing rivalry severely injures one player from each team. Worried team members and parents crowd the ED waiting area.

c. Injured patients from a public transit bus accident require immediate care. The number of patients exceeds the ED capacity, and the next closest ED is over an hour away.

d. It is both a full and blood moon on Friday the 13th. All assigned ED staff are on duty, but they have a "really bad feeling about tonight."

4. Which is an example of a terrorist attack on a "soft" target?

a. Overpowering crew members in an airplane cockpit

b. Planting a bomb in a healthcare facility

c. Shooting at personnel on a U.S. military installation

d. Detonating explosives in the Pentagon

5. According to the Department of Defense definition, weapons of mass destruction are:

a. Only to be used in a case of last resort.

b. Those capable of causing a large number of casualties.

c. Never to be used against civilian populations.

d. Those capable of destroying all structures within several miles.

6. Which factor is the most important when choosing appropriate personal protective equipment?

a. The nature of the care to be provided

b. The location where care is to be given

c. The job position of the clinician

d. The nature of the known or anticipated risk

7. In situations requiring a high level of respiratory protection and a lower level of skin protection, the clinician selects which OSHA/EPA level of PPE?

a. Level A PPE

b. Level B PPE

c. Level C PPE

d. Level D PPE

8. Which feature describes a possible outbreak caused by the use of a bioterrorism weapon?

a. A rapid increase (hours to days) in the number of previously healthy persons with similar symptoms seeking medical treatment

b. A higher incidence rate in individuals who are protected (e.g., confined to home with no exposure to large crowds)

c. A higher number of patients with typical clinical presentations in the emergency department

d. A decrease in the number of patients who expire within 72 hours after admission to the hospital

9. A clinician who is caring for a patient with inhalation anthrax may have had contact with the spores. Hand hygiene for the clinician requires:

a. A vigorous wash for 30 to 60 seconds with soap and water or 2% chlorhexidine gluconate.

b. A vigorous wash for 10 to 15 seconds with soap and water or povidone-iodine.

c. A vigorous wash with any approved cleansing product, as long as adequate friction is applied.

d. A triple application of an alcohol hand rub.

10. The personal protective equipment for first receivers of a victim with either food-borne or inhalation botulism is:

a. Standard and Contact Precautions if uncontained copious secretions are present.

b. Contact Precautions only.

c. Droplet Precautions until patients have received 48 hours of appropriate antibiotics, then Standard Precautions.

d. Standard Precautions only.

11. If terrorists use *Yersinia pestis* as a weapon, untreated victims of the resulting bubonic plague:

a. Could go on to develop septicemia, secondary pneumonic plague, or plague meningitis.

b. Typically experience a mortality rate of 25% without treatment.

c. Will require Droplet Precautions until they have received 48 hours of appropriate antibiotics, then Standard Precautions will be adequate.

d. Typically die within 24 hours.

12. For first receivers caring for patients with variola major, or smallpox, personal protective equipment is based on:

a. Standard Precautions.

b. Standard Precautions plus Contact Precautions.

c. Droplet Precautions.

d. Combined use of Standard, Airborne, and Droplet Precautions.

13. During the manifest illness stage of acute radiation syndrome (ARS), the patient:

a. Experiences symptoms that are vague and nonspecific.

b. Looks and feels as well as before the exposure.

c. Experiences symptoms specific to the part(s) of the body affected.

d. May or may not experience symptoms.

14. When conducting syndromic surveillance for a terrorist attack using radiation, the healthcare provider's investigation focuses on the:

a. Previous occupational and/or therapeutic exposure of the victims to radiation.

b. Symptoms of the victims.

c. Whereabouts and actions of the victims immediately prior to feeling ill.

d. Radon levels of the victims' residences.

15. In caring for a victim of a terrorist attack that involves radiation, the overriding principle is to decontaminate the patient:

a. Before attending to any injuries.

b. After treating all injuries.

c. Before transferring the patient.

d. After treating any life-threatening injuries.

16. While working in the triage area for victims of a radiation terrorist attack, the healthcare worker's PPE includes:

a. A personal dosimeter worn on the outside of the primary PPE garment.

b. A full-body lead apron and a "film badge" dosimeter worn under the apron.

c. A full-body lead apron covering the front and back of the torso for a provider who is pregnant.

d. A facility-provided, correctly-sized lab coat with any openings secured with tape.

17. Which is a significant component unique to the treatment of cutaneous radiation syndrome (CRS)?

a. Documenting the time of occurrence of skin lesions and ongoing changes in their appearance

b. Treating localized injuries to prevent scarring

c. Determining what the patient was doing immediately prior to the attack

d. Developing an individualized treatment plan to deal with internal contamination

18. A patient who has been exposed to ricin is treated with:

a. 2-PAM chloride (600–1800 mg IM or 1 Gm IV over 20 to 30 minutes).

b. High-dose steroids to prevent pulmonary edema.

c. Amyl nitrate inhalation, 1 ampule every 5 minutes.

d. Appropriate supportive care based on the level of respiratory distress.

19. Atropine is the treatment of choice for which category of chemical agent?

a. Blood

b. Incapacitation/riot control

c. Nerve

d. Blister/vesicant

20. A number of people who attended a violent political protest were exposed to an agent in gas form. They presented to the emergency department with runny eyes and noses and skin burns. The agent was most likely:

a. An incapacitating agent.

b. A blood agent.

c. A riot control agent.

d. A blister agent/vesicant.

21. The quantity of contaminant associated with victims of a chemical weapon release can be reduced by an estimated 75% to 90% by having the victims:

a. Remove contaminated clothing as soon as possible.

b. Shower with tepid water and a liquid soap with good surfactant properties after removing their contaminated clothing.

c. Remove contaminated clothing after showering.

d. Shower with tepid water and a liquid soap with good surfactant properties while still dressed.

22. What is the recommended PPE for first responders providing decontamination and immediate care for victims of a chemical agent exposure?

a. Level A PPE

b. Level B PPE

c. Level C PPE

d. Normal work attire and PPE for Standard Precautions

23. The Health Alert Network system message that conveys the highest level of importance and warrants immediate action or attention is the:

a. Health Alert.

b. Health Update.

c. Health Advisory.

d. Info Service.

24. Participation in all or part of the Nevada Health Alert Network:

a. Is limited to senior state government officials.

b. Provides notice of state emergent events in mere seconds.

c. Is available for all citizens of the state.

d. Allows access to information on national catastrophic events.