Emergency Preparedness Nursing

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NEWPORT HOSPITAL
EMERGENCY PREPAREDNESS:
Hazmat/Decontamination Training

Patricia Grimes RN, CEN
OVERVIEW OF TOPICS

- REQUIREMENTS
- WHAT IS TERRORISM
- WHAT IS WMD
- WHAT IS CBRNE
- PERSONAL PROTECTIVE EQUIPMENT (PPE)
- HOSPITALS ROLE
- DECONTAMINATION OPERATIONS
- NIMS AND INCIDENT COMMAND
- DECON EQUIPMENT SET UP
HOSPITAL BASED REQUIREMENTS
• 29 CFR 1910.120

• Employees engaged in emergency response and exposed to hazardous substances presenting an inhalation hazard or potential inhalation hazard shall wear positive pressure self-contained breathing apparatus while engaged in emergency response, until such time that the individual in charge of the ICS determines through the use of air monitoring that a decreased level of respiratory protection will not result in hazardous exposures to employees.
Superfund Amendments and Reauthorization Act (SARA Title III)

- Passed by US Congress in 1986 as a response to the chemical accident in Bhopal, India. This was the incident in which a toxic gas, methyl isocyanate, escaped from an industrial plant and killed or injured more than 1,000 people.
- Provides for community planning related to hazardous material emergencies
- Requires the hospitals to participate in the planning process
Joint Commission of Accreditation of Healthcare Organizations (JCAHO)

- JCAHO standard PL.1.11.2
- Information about how a hospital plans to implement specific procedures in response to an environmental or man-made event
- Are the facilities available for radioactive or chemical isolation and decontamination for these events?
TERRORISM
SHOULD WE BE SCARED?
The Federal Bureau of Investigation defines terrorism as:

"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."

**PURPOSE:**
- shock, terrorize, disturb sense of security
- create civil chaos & disorder
- attack perceptions & beliefs.

**3 TYPES:**
- Domestic
- International
- Transnational
MOTIVATIONS

• Religious
• Political
• Social
• Environmental

TARGET SELECTION

• A targets name
• A significant date
• A targets significance

Visible targets where they can avoid detection before or after an attack:

• International airports
• Large cities
• Major international events
• High-profile landmarks
WHAT DOES CBRNE STAND FOR?

C – CHEMICAL

B – BIOLOGICAL

R – RADIOLOGICAL (RDD)

N – NUCLEAR

E – EXPLOSIVE
CHEMICAL
During WW I Germans used Chlorine Gas (5,730 cylinders) which covered a 8 to 9 kms and killed roughly over 25,000 allied troops

1930 German scientist Gerhard Schrader developed nerve agent later called Tabun

Later the Nazi’s put him to work to work on the development of this nerve agent and he created Sarin and Soman

1949 British chemist developed a new nerve agent VX which was more toxic than the others produced
Container of Nerve Agent

CDC/SNS CHEMPACK
These chemicals are widely used in industries such as tanning, textiles, electroplating, and plastic and vinyl production.

Blood agents poison blood cells, so that they cannot process oxygen.

- CYANIDE
- HYDROCYANIC ACID
- CYANOGEN CHLORIDE
BLISTER AGENTS (vesicants)

- LEWISITE
- SULPHUR MUSTARD
- PHOSGENE OXIME

Causes deep penetrating blisters effecting skin, eyes, airways, and mucous membranes followed by cell death reacting with enzymes, proteins, and DNA.
PHOSGENE (CARBONYL CHLORIDE)
Damage the lungs and prevents the blood from absorbing O2. (pulmonary edema)
Can take from 2 to 24 hours to take effect.
NERVE AGENTS

Nerve Agent exposure
Miosis (pinpointing of the eye pupils)

SYMPTOMS:
Difficulty in breathing
Drooling
Sweating
Nausea
Dimness in vision (pinpointed pupils)
Vomiting
Cramps
Twitching
Involuntary Defecation / Urination
Headaches
Jerking and Staggering
Coma
Confusion and Drowsiness
Convulsion

Lethal dose of nerve agent.
BIOLOGICAL
BRIEF HISTORY of BIOLOGICAL AGENTS

• **14th Century** Tartar Army catapulted bodies of **plague** victims over the walls of Kaffa in an attempt to initiate an epidemic upon the residents

• **18th Century** British Army gave native American Indians blankets with **smallpox**

• **WWI** Germany conducts covert operation in Romania by infecting sheep there with **anthrax** that were to be exported to Russia

• **1932-1942** Japan experimented on prisoners using cholera and bubonic plague. Eleven Chinese cities were later attacked with these bio agents, they ranged from contamination of **cholera, anthrax, salmonella**, and the **plague**. This was all done under the direction of Unit 731
PLAGUE

- **Caused by:** Bacteria - Fleas that have been infected with Yersinia Pestis. Direct contact with infected tissues or fluids from handling sick or dead animals with the virus. Transmission can be respiratory droplets from rodents and humans with pneumonic plague.

- **Incubation:** 2-10 days after being infected

- **Symptoms:** High fever, Tender lymph nodes, Skin Lesions, Hemorrhages, Circulatory

- **Spread:** Poor hygienic habits

- **Mortality:** Depends on how fast antibiotics are administered
SMALLPOX

• **Caused by:** Virus - Variola Virus

• **Incubation:** 12-14 days but can range from 7-17 days.

• **Symptoms:** Fever, malaise, head and body aches, sometimes vomiting. This is called the prodrome phase last for 2 to 4 days

• **Spread:** Can spread in the prodrome phrase. Contagious during the rash phase

![Smallpox Vaccination - Accelerated Response](image-url)
RICIN

- **Caused by:** Toxin - from Castor Plant
- **Incubation:** 18-24 hours after inhalation
- **Symptoms:** Weakness, fever, cough, pulmonary edema occur after 18-24 hours after inhalation exposure, followed by severe respiratory distress and death from hypoxemia in 36-72 hours.
- **Spread:** Inhalation, Ingestion
ANTHRAX

- **Caused by:** Bacteria – Bacillus Anthracis
- **Incubation:** 1-6 days
- **Symptoms:** Flu like, slight improvement, rapid onset of severe respiratory problems, shock, pneumonia
- **Spread:** (inhalation anthrax) - The spores can be inhaled in contaminated soil or other particles containing the spores. The spores have no smell, taste or color
- (cutaneous or skin anthrax) - Open cuts and scrapes can allow entry of the spores into the body to an environment in which they can germinate
- (gastrointestinal anthrax) - Eating undercooked meat that is infected with the anthrax bacteria, or drinking unchlorinated water that harbors the spores, can introduce the bacteria into the gastrointestinal tract
RADIOLOGICAL (RDD)
BRIEF HISTORY

RADIOLOGICAL / NUCLEAR

- **1895** Wilhelm Roentgen discovers x-rays. It’s medical use is immediately recognized
- **1898** Marie Curie discovers radioactive elements Radium and Polonium
- **1905** Albert Einstein develops theory on Mass and Energy
- **1938** Otto Hahn-Fritz Strassman discover Nuclear Fission
- **1939** The race for the first Nuclear Bomb underway
- **1945** US develops the first two Nuclear Bomb (resulting in over 200,000 deaths in Japan)
- **1949** Soviet Union develops its first Nuclear Bomb
- **1950-1970** Arms race is on
- **1990** Fall of the Soviet Union results in possible lost, stolen, or sold nuclear arms
- **1998** India and Pakistan use nuclear testing as a show of force against each other
WHAT IS A WEAPON OF MASS DESTRUCTION?

Refers to any weapon that is designed or intended to cause death or serious physical harm through the release, dissemination, or impact of toxic or poisonous chemicals, or their precursors, a weapon involving a disease organism or biological agent, or a weapon that is designed to release radiation or radioactivity at a level dangerous to human life.

- Radiological Dispersal Device (RDD)
- Dirty Bomb
- Nuclear Weapons
WHAT IS A RADIOLOGICAL ATTACK, RDD OR DIRTY BOMB?

A **RADIOLOGICAL ATTACK** is the spreading of radioactive material with intent to do harm. Radioactive materials are used every day in laboratories, medical centers, food irradiation plants, and for industrial uses. If stolen or otherwise acquired, many of these materials could be used in a “**RADIOLOGICAL DISPERSAL DEVICE**” (RDD)

A **DIRTY BOMB** is one type of RDD that uses a conventional explosives to disperse radioactive material over a targeted area. The term dirty bomb and RDD are often used interchangeably in technical literature. However, RDD’s could also include other means of dispersal such as placing a container of radioactive material in a public place, or using an airplane to disperse powdered or aerosolized forms of radioactive material
HOW AN RDD MIGHT BE USED?

It is very difficult to design an RDD that would deliver radiation doses high enough to cause immediate health effects or fatalities in a large number of people. Therefore, they would most likely be used to:

• Contaminate facilities or places where people live and work, disrupting lives and livelihoods
• Cause anxiety in those who they think are being, or have been, exposed.
WHAT DO RDD’s DO?

Most dirty bombs and other RDD’s would have very localized effects, ranging from less than a city block to several square miles. The area over which radioactive materials would be dispersed depends on factors such as:

- The **amount** and **type** of radioactive material dispersed
- The **means of dispersal** (explosive, spraying, or fire)
- The **physical and chemical form** of the radioactive material. For example, if the material is dispersed as fine particles, it might be carried by the wind over a relatively large area
- **Local topography, location of buildings**, and other **landscape characteristics**
- Local **weather** conditions
NUCLEAR
TYPES OF RADIATION

• ALPHA
  • Large positively charged particles
  • Only travel a few inches in air, easy to clean up
  • CANNOT penetrate skin
  • Extremely dangerous if particles are inhaled

• BETA
  • Small negatively charged particles (Rouge Elections)
  • Only travels between 12-28 feet in the air
  • Regular clothing will stop penetration
  • Will affect skin if unprotected

GAMMA
  • Photon particles, similar to light
  • Very dangerous in large quantities
  • It would take a lead wall to block gamma
  • You would only see dangerous quantities in a nuclear explosion
FOUR MAIN CLASSIFICATIONS

**Air Burst** -
- occurs totally in the air
- below 100,000 feet above sea level
- must occur higher in the air than own total radius

**High Altitude Burst** -
- occurs above 100,000 feet above sea level
- less energy needed to create the shockwave allowing for a higher amount of thermal energy to be given off
- the lower density also allows for the blast radius to get much bigger.

**Subsurface Burst** -
- occurs underground
- some of the nuclear explosion will become an air burst while the blunt of it will stay underground
- the products of the fission reaction stay underground and contaminate a large amount of water and/or soil
- more contained than other bursts.

**Surface Burst** -
- occurs either on the ground/water or very close to it
- much like an air burst, except a second shockwave appears on the ground
KEY THINGS TO REMEMBER

1. **Shielding**: If you have a thick shield between yourself and the radioactive materials more of the radiation will be absorbed by the thick shield, and you will be exposed to less.

2. **Distance**: The farther away you are from the radiation the lower your exposure.

3. **Time**: Minimizing time spent exposed will also reduce your risk.
LU DLUM RADIATION METER
LUDLUM RADIATION METER

- The Ludlum Model 3 is a general purpose survey meter.
- Reads in counts per minute
- **RESET Button:**
  - This switch provides a rapid means to drive the meter to zero.
  - Use after changing Range Knob setting.
- **Battery Compartment:**
  - Sealed compartment to house two "d" cell batteries
  - Check batteries prior to every use
  - Turning the range selector switch from OFF to BAT provides the operator with a battery check of the instrument.
  - A BAT check scale on the meter provides a visual means of checking the battery-charge status.
LUDLUM RADIATION METER

- Next check your instrument by moving switch to X100 position and placing meter next to source located on the side of meter.
- Audible clicks will be heard.
- Can be silenced by moving “AUD ON/OFF” to off position to conserve battery power.

- **Range Selector Switch:** A six-position switch marked off, bat, x100, x10, x1, x0.1. Moving the range selector switch to one of the range multiplier positions (x100, x10, x1, x0.1) provides the operator with an overall range of 0 to 500,000 cpm. Multiply the scale reading by the multiplier to determine the actual scale reading.
**LUDLUM RADIATION METER**

- **AUD ON-OFF Switch**: In the ON position, operates the unimorph speaker, located on the left side of the instrument. The frequency of the clicks is relative to the rate of the incoming pulses. The higher the rate, the higher the audio frequency.
- The audio should be turned OFF when not required to reduce battery drain.

- **F-S Toggle Switch**: Provides meter response. Selecting the fast “F” position of the toggle switch provides 90% of full scale meter deflection in four seconds. In the slow, "s" position, 90% of full scale meter deflect takes 22 seconds.
  - “S” position used to measure background readings of radiation
  - “F” position used to do survey of area or patient with possible contamination
LUDLUM RADIATION METER

- Always start with range knob in lowest setting when you get to 80 percent of full scale switch to next highest range.
- Never cover probe doing so can stop you from detecting alpha radiation.
- Can detect alpha, beta, and gamma type radiation, but cannot tell difference between them.
- Contamination is considered when you get 2 times background readings.
- CPM is the average number of emissions, over a period of time, that is detected.
- 1 uR/hr (u=microroentgen) is one millionth of 1 R/hr
LUDLUM RADIATION METER

- **Detect**: presence of radiation and contamination.
- **Locate**: the areas contaminated on people, places, or things.
- **Measure**: contamination levels on people, places, or things.
- **Identify**: categorize the material as alpha-source or beta-gamma-source. (not a full identification of the material)
LUDLUM RADIATION METER

• For alpha and beta, the probe head is held about ¼ inch to ½ inch from the surface of the object and moved laterally at a rate of one probe length per second.

• Alpha particles travel on ¼ to 2 inches in air so if probe is further away it will not detect alpha contamination.

• For gamma, the probe head is held about ½ to 1 inch above the surface and moved laterally about 1 to 2 inches per second.

• Most likely place for contamination are the hands and feet.

• Always begin your survey with meter set on lowest scale setting and take a background reading first on slow setting prior to surveying an area or patient.

• Most common mistakes made during surveying are: Holding the probe too far away from the surface and moving the probe too fast, should be about one probe diameter per second or 1 to 2 inches per second.
LUDLUM RADIATION METER

• Reminder:
  • Even a thin layer of water, dirt, blood or clothing will block alpha radiation and prevent the detection of alpha source contamination.
  • Start at head with Z path and move to body and then to extremities.
  • Always check wound area first then intact skin next.
EXPLOSIVE
EXPLOSIVES CATEGORIES:

- Pyrotechnics
- Propellants
- Explosives

EXPLOSIVE TYPES:

- Cast Explosives
- Sheet Explosives
- Plastic Explosives
- Dynamites
- Ammonium Nitrate Fuel Oil (ANFO)
- Binary Explosives

IMPROVISED EXPLOSIVES:

- Potassium Chlorate & Vaseline
- Peroxide Based Explosives
- Fertilizer Grade Ammonium Nitrate
- Urea Nitrate
TYPE I PACKAGE BOMB

- Backpacks, briefcases
- Musical instrument case
- 11-33 pounds or more of explosives (as much as the terrorist can carry)

TYPE II SUICIDE VEST/BELT

11 to 22 lbs of explosives (or more)
- Concealed under clothing

TYPE III VEHICLE BOMB

- Large amounts of explosives 40 - 500 lbs (depending on the size of the vehicle)
- Any size vehicle
WHAT IS THE HOSPITALS ROLE?

• Respond quickly and effectively to contaminated patients

• Caring for and decontaminating chemical/biological casualties

• Maintain and utilize chemical protective clothing properly

• Maintain a working knowledge of decontamination procedures
PERSONAL PROTECTIVE EQUIPMENT (PPE)
PPE

PPE must be selected which will protect employees from the specific hazards which they are likely to encounter during their work on-site.

Key Factors in selecting PPE are the identification of the hazards, or suspected hazards; their routes of potential hazard to employees:

- Inhalation
- Skin absorption
- Ingestion
- Skin and eye contact
**LEVELS OF PROTECTION**

**Level A** - To be selected when the greatest level of skin, respiratory, and eye protection is required.

**Level B** - The highest level of respiratory protection is necessary but a lesser level of skin protection is needed.

**Level C** - The concentration's and type's of airborne substance's is known and the criteria for using air purifying respirators are met.

**Level D** - A work uniform affording minimal protection: used for nuisance contamination only.
LEVEL A

- Highest level of protection
- Fully encapsulated
- Supplied air system required
- Protects against vapors, mist, gases, liquids, solids

LIMITATIONS:
- No thermal protection
- High heat stress hazard
- Reduced working time
- Poor mobility
LEVEL B

- Highest level of protection
- Supplied air system required
- Protects against splash hazards and solids
- Protects against respiratory hazards

LIMITATIONS:
- Not recommended for IDLH skin
- Cannot submerge hands & feet
- Decon of exposed air system is difficult
LEVEL C

- Particulate filter
- Minimal splash protection
- High mobility
- Ability to work for long periods of time

LIMITATIONS:
- Must have adequate oxygen in the air
- Filters have different breakthrough times for different chemicals
- Suit is not considered air tight or water tight
LEVEL D

- Provides minimal skin protection and little to no respiratory protection
OSHA REGULATION 29 CFR 1910.134

Respiratory Protection Program

- Requires the employer to develop and implement a written respiratory protection program with required worksite-specific procedures and elements for required respirator use.
- The program must be administered by a suitably trained program administrator.
3M 7800S Fullfacepiece, Silicone Protective Mask

3M Cartridge FR-64
Multi Gas / Vapor Cartridge
P100 Filter

INSPECTION, CLEANING and STORAGE

PUTTING ON THE MASK
BULLARD
Powered Air Purifying Respirator PAPR
1. Use only in adequately ventilated areas containing at least 19.5% oxygen
2. Do not use when concentrations of contaminants are immediately dangerous to life or health (IDLH)
3. Do not use during abrasive blasting or clean up
4. Do not use in circumstances where the airborne concentration level of contaminant exceeds maximum use concentrations for this type of respirator.
PAPR WARNING!

5. Leave area immediately if:
   – Breathing becomes difficult
   – Dizziness or other distress occurs
   – You taste or smell contaminant
   – Unit becomes damaged
   – Battery alarm sounds

6. Do not use if blower unit is off.

7. Never alter or modify the respirator.

Failure to follow these instructions could result in death or serious injury!
BATTERY PACK

- Fully charged battery back
- 4 – 8 hours under normal working circumstances
- Rechargeable Nickel Metal Hydride
  - No memory
- 4 – 5 hour of performance
  - Use one battery
- 8 – 10 hours of performance
AUDIBLE ALARM

• Airflow indicator
• Low battery alarm

FILTER CARTRIDGES
MOUNTING & REPLACING CARTRIDGES ON THE BLOWER UNIT

- Remove air-purifying element from package
  - Check “use-by” date
  - Ensure proper type cartridge
  - Check threads on blower unit
  - Check blower ports have gray rubber gasket seals
  - Remove air-purifying element seals
  - Screw air-purifying elements into the receptacles
  - Repeat with appropriate number of cartridges
DONNING THE BLOWER & RESPIRATOR

- Prepare to don the blower, battery and hood in a safe, hazard free area
- Check that cartridges are properly mounted on the blower unit
- Place battery(s) in back of blower
- Fit and adjust the blower belt
- Remove belt and blower
- Ensure cartridges are suitable for contaminant and compatible with blower
DONNING THE BLOWER & RESPIRATOR

• Headpiece
  – Remove protective film covering the visor of the hood
  – Put on belt and blower assembly and make any final adjustments, keeping breathing tube and hood behind the head
  – Switch the blower to ON
  – Place hood on head making final adjustments
• PAPR DONNING CHECKLIST

• Preparatory
  • _____ Remove air-purifying element from package
  • _____ Check “use-by” date
  • _____ Ensure proper type cartridge
  • _____ Check threads on blower unit
  • _____ Check blower ports have gray rubber gasket seals
  • _____ Remove air-purifying element seals
  • _____ Screw air-purifying elements into the receptacles
  • _____ Repeat with appropriate number of cartridges
  • _____ Prepare to don the blower, battery and hood is a safe, hazard free area
  • _____ Check that cartridges are properly mounted on the blower unit
  • _____ Place battery(s) in back of blower
  • _____ Fit and adjust the blower belt
  • _____ Remove belt and blower
  • _____ Ensure cartridges are suitable for contaminant and compatible with blower

• For Hoods
  • _____ Insert breathing tube into air sleeve at rear of hood being used
  • _____ Install nylon clamp over air entry sleeve and breathing tube, inserting clamp through two holes in plastic anchor plate
  • _____ Locks should face away from user’s neck
  • _____ Attach other end of breathing tube to blower by screwing adapters together

• Headpiece
  • _____ Remove protective film covering the visor of the hood
STEP 1-DONNING

Assemble the components to verify all are present.

Insert the battery(ies) for use.
STEP 1-DONNING

If one battery is used, ensure the blank is also inserted before use. Select the proper filters for the task ahead & remove the caps and plugs from filters.
STEP 1-DONNING

Test PAPR flow rate to be sure it meets rate specified by the manufacturer.
STEP 2-DONNING
Remove jewelry & clothing, put on scrubs.
STEP 3-DONNING

Select the proper nitrile glove liners.  

Put on inner nitrile gloves.
STEP 4 & 5-DONNING

-Cold weather: Put on inner insulating suit. Tape gloves at wrist & zipper at neck.
-Warm weather: put on scrubs.
STEP 6-DONNING

Put on outer chemical protective suit to waist.

Pull chemical protective suit up and on.
STEP 6-DONNING

Put on chemical protective gloves.

Put on chemical protective boots.
STEP 6-DONNING

Tape boot tops in place. Be sure to "blouse" the tops for water

Finish with taping all areas of access. All tape should finish with quick release tab.
STEP 7-DONNING

Ensure zipper is covered & secured, put tape on top.

Connect PAPR to hood with hose, turn airflow on.
STEP 7-DONNING PAPR

Prepare to belt PAPR to waist.

Belt PAPR to waist. Ensure right-side-up donning.
STEP 7-DONNING PAPR

Put outer butyl hood shroud over suit. Straps sit under the arms.
STEP 7-DONNING PAPR

• Place a piece of tape on the hood exterior and label with the employee’s name, job function & time that employee is entering Hospital Decontamination Zone.
STEP 1- DOFFING

When patient decon is completed, wash hands thoroughly.
STEP 2- DOFFING

Still wearing PPE, wash self, starting at the top of the head and working down to the bottom of the boots. Have a partner wash your back.
STEP 2- DOFFING

Still wearing PPE, wash self, starting at the top of the head and working down to the bottom of the boots. Have a partner wash your back.
STEP 3 - DOFFING

Untape boots but do not remove them.

Untape gloves, but do not remove them.
STEP 4-DOFFING

Disconnect and unlock PAPR waist pack and place it on chair / gurney / floor / etc.
STEP 5-DOFFING

Remove hood from outer suit taking care to avoid contact with hood exterior.

Remove PAPR hood, place in waste.
STEP 5-DOFFING

Remove tape from outer suit.

Remove outer suit – roll the suit outside surface away from you. An N-95 mask should be worn.
STEP 5-DOFFING

Remove outer suit – roll the suit away from you. Remove outer gloves along with the outer suit.
STEP 5-DOFFING

Continue to remove outer suit – roll the suit away from you.
Remove outer boots along with the outer suit.
Step out of boots and suit into final rinse area (keep inner gloves and clothing on). Wash and rinse thoroughly (with partner’s help).
STEP 7-DOFFING

Remove nitrile gloves: first pinch one glove and roll it down partially, then place thumb in other glove & remove both gloves simultaneously.
STEP 8-DOFFING

Wash again, removing inner clothing, then step out of decontamination shower and into towels / blankets.
AIR CART SYSTEM
Warning Whistle (500 psi)

Pressure Gauge

Adjust Air Flow

Pressure Gauge (90 psi)

Air Hose Connections (4)

Bleed Valve
DECONTAMINATION OPERATIONS
The process that reduces toxic chemicals or pathogenic biological organisms to levels that minimize the risk of:

- Further harm to the victim
- Cross contamination
The primary **PURPOSES** for decontamination are:

- To remove the agent from the victim to reduce further agent exposure and health effects
- To protect emergency responders, medical personnel, and unexposed victims from secondary exposures
- To provide victims with psychological comfort at or near the incident site and to prevent them from spreading contamination over greater areas
The **GOAL** of decontamination operations in mass casualty incidents is to provide the greatest good for the greatest number of people. The type of agent and the number of victims will drive the time criticality and effectiveness of various decontamination methods.
General Decontamination Considerations:

- Decontaminate only what is necessary. Decontamination requires a significant amount of time and materials.
- Decontaminate as soon as possible. Decontamination done within two minutes of exposure, particularly chemical exposure, maximizes effectiveness.
- Avoid becoming a victim. Stay away from anyone who may be contaminated and avoid walking or driving through any spilled materials.
General Decontamination Considerations (continued):

- Wear appropriate personnel protective equipment (PPE) Perform decontamination as close as possible to, but outside, the contaminated area to limit the spread of contamination
- Separate victim and responder decontamination operations
- Establish and clearly mark an entry point to guide contaminated personnel in the decontamination area. Make sure that the entrance can be easily seen and quickly assessed, even by a responder in full PPE
- Decontaminate EVERYONE who goes from a contaminated area to a clean, uncontaminated area
General Decontamination Considerations (continued):

- Clothing removal is the first step of chemical decontamination. The more clothing removed the better; however, at a minimum, the outer layer of clothing should be removed.

- Use megaphones, nonverbal communication, and signs with instructions and pictograms to lead people to and through decontamination. Consider using multilingual instructions.

- Anticipate psychological and behavioral actions of victims. Provide clear and constant instructions to victims to ensure a controlled evacuation and to ease fears and anxieties.
General Decontamination Considerations (continued):

- When wetting down or showering victims, expose them to the water gradually to decrease the chance of cold shock.

- When possible, provide climate control, water temperature control, and privacy from onlookers and opposite sex victims to prevent hesitancy to fully disrobe and wash.

- Consider deceased victims as your last concern.
FACTORS IMPACTING DECONTAMINATION OPERATIONS
Factors Impacting Decontamination:

- Number of Casualties
- Types of Casualties
- Type of Agent
- Agent Properties
- Available Resources
- Decontaminant Effectiveness and Operational Desirability
- Environmental Conditions
- Victim Safety
- Victim Privacy
- Victim’s Perception of Safety
DECONTAMINATION PRIORITIZATION
DECONTAMINATION PRIORITIZATION

- A mass casualty incident is defined as an incident involving a number of victims that exceeds the response capabilities of emergency responders. One of the first steps of mass decontamination is deciding the need for and order of victim decontamination – this process is known as *Decontamination Prioritization*.  

![Image of a mass casualty incident](image_url)

- The number of non-exposed to exposed victims in a mass casualty incidents has been estimated to be at least 5:1. Responders must prioritize rescue, treatment and decontamination of victims to provide the greatest good for the greatest number of people. This may require making special adjustments for certain victim groups, such as children and the elderly.
DECONTAMINATION PRIORITIZATION

Recommended Prioritization for Victim Decontamination

1. Casualties closest to the point of release that report being exposed to an aerosol or mist, show evidence of liquid agent deposition on clothing or skin, or have serious injuries or major symptoms of agent exposure.

2. Casualties that were further from the point of release and are not showing evidence of liquid agent deposition on clothing or skin, but are clinically symptomatic of agent exposure.

3. Casualties that were not close to the point of release, are showing no evidence of liquid agent deposition on clothing or skin, are clinically asymptomatic of agent exposure, but have non-life-threatening conventional injuries (particularly open wounds).

4. Casualties that were far from the point of release, show no evidence of liquid agent deposition on clothing or skin, are clinically asymptomatic of agent exposure, and have no conventional injuries.

For all immediately life-threatening injuries, treatment should take priority over decontamination.
TYPES of CONTAMINATION
TYPES OF CONTAMINATION

• Gases and Vapors
• Liquids
• Solids
• Infectious Wastes

Direct Contamination
• Contact with product or vapors

Cross Contamination
• Contact with a contaminated objects
TYPES of DECONTAMINATION
TYPES OF DECONTAMINATION

- Disrobing removes greatest %
- Aqueous-based solutions
- Dry materials
Disrobing is decontamination!

Clothing removal is one of the quickest ways to remove chemical and biological agents from the victim and is critical first step in decontamination procedures.

Clothing can absorb liquid contaminants, creating a skin contact hazard, or trap biological particles, creating a continuing vapor or inhalation hazard for victims. Removing the outer layer of clothing alone should remove most liquid contamination and nearly all vapor contamination.

Because of privacy and modesty issues, disrobing can create a “BOTTLENECK” in decontamination procedures. If victims are showing no medical signs or symptoms or are not suspected of contamination, the Incident Commander should evaluate the decision to disrobe.
Aqueous-based Solutions

Water

- Water alone is an effective decontamination solution for chemical and biological and is also a readily available resource for firefighters. Flushing or showering with large volumes of water removes chemical agent from the skin through sheer force and dilution.

Soap and Water

- Soap and Water solutions should be used for biological decontamination and may slightly improve decontamination effectiveness for chemicals because soaps can aid in dissolving some of the oilier agents.
Aqueous-based Solutions

Bleach and Water

- Bleach and Water solutions remove, hydrolyze, and neutralize most chemical and biological agents. These solutions are NOT RECOMMENDED FOR PERSONNEL IN MASS DECONTAMINATION SITUATIONS due to operational and safety considerations.

Contact or shower time required depends on factors such as agent type, contamination level, and clothing type. Victims should remain in the shower long enough to thoroughly wash their entire body. Two to three minutes has been recommended under ideal conditions.
Dry Materials

In the absence of water, or if the weather is too cold for water, dry materials can remove liquid chemical agents from the skin. Use these materials to absorb, scrape, or blot agents from the skin and clothing.

- Dirt
- Flour
- Baking Powder
- Charcoal
- Sawdust

Most absorbents do not detoxify chemical agents and must be treated as contaminated waste.
TYPES of DECONTAMINATION SYSTEMS
DECONTAMINATION SYSTEMS

PERMANENT SHELTERS

ADVANTAGES
• Minimal setup
• Less weather exposure
• Privacy

DISADVANTAGES
• Expensive
• Impractical for multiple casualties
• Unused space
• Cleanup
DECONTAMINATION SYSTEMS

PORTABLE SYSTEMS

ADVANTAGES
• Can be setup outside
• Disposable
• Decon of multiple victims

DISADVANTAGES
• Weather
• Privacy
• Moving equipment
• Security issues
DECONTAMINATION PLAN
<table>
<thead>
<tr>
<th>HOT ZONE</th>
<th>WARM ZONE</th>
<th>COLD ZONE</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXCLUSION ZONE</td>
<td>DECONTAMINATION REDUCTION ZONE</td>
<td>SUPPORT ZONE</td>
</tr>
</tbody>
</table>

- **HOT ZONE**: The **HOT ZONE** is the area immediately surrounding a hazardous release and extends as enough to prevent adverse effects on individuals from released material. This zone is also referred to as the exclusion, red, or restricted zone.

- **WARM ZONE**: The **WARM ZONE** is the area between the Hot and Cold Zones where personnel decontamination and hot zone support takes place. It includes control points for the access corridor and thus assists in reducing the spread of contamination. This zone is also referred to as the contamination reduction corridor (CRC), contamination reduction zone (CRZ), yellow, or limited access zone.

- **COLD ZONE**: The **COLD ZONE** is the outer zone that should be free of hazardous material contamination of all kinds, including discarded protective clothing and respiratory equipment. This is the area where the command post and support functions that are necessary to control the incident are located. This is also referred to as the support, clean, or the green zone.

Contamination Wind Direction
**OSHA REGULATION 1910.120 (q) (1)**

*Emergency Response Plan:* An emergency response plan shall be developed and implemented to handle anticipated emergencies prior to the commencement of emergency response operations. The plan shall be in writing and available for inspection and copying by employees, their representatives and OSHA personnel.

1910.120(q)(2)(i) Pre-emergency planning and coordination with outside parties.
1910.120(q)(2)(ii) Personnel roles, lines of authority, training, and communication.
1910.120(q)(2)(iii) Emergency recognition and prevention.
1910.120(q)(2)(iv) Safe distances and places of refuge.
1910.120(q)(2)(v) Site security and control.
1910.120(q)(2)(vi) Evacuation routes and procedures.
1910.120(q)(2)(vii) Decontamination Plan.
1910.120(q)(2)(viii) Emergency medical treatment and first aid.
1910.120(q)(2)(ix) Emergency alerting and response procedures...

1910.120(q)(2)(x) Critique of response and follow-up.
1910.120(q)(2)(xi) PPE and emergency equipment.
PURPOSE OF DECON

- To handle contaminated patients from MCI, HMI, or WMD event
- Set up as a controlled area
- Only one entrance and exit
- Exclusive for contaminated and suspected contaminated patients:
  - Brought from incident site
  - Walking into the hospital
Layout of the Decon Area

Hospital Decontamination Zone
7 POINTS IN A DECON PLAN

• Number and layout of decon stations
• Equipment needs at each station
• Appropriate decon methods
• Minimize worker contact w/ contaminants during removal of PPE
• Prevent contamination of clean areas (site control)
• Disposal of clothing and equipment
• Undergo revision whenever the type of personal protective clothing or equipment changes
DECONTAMINATION
METHODS and LAYOUTS
Decontamination Time Line

CONTAMINATED AREA

ON-SITE DECONTAMINATION

OFF-SITE DECONTAMINATION

HOT ZONE

WARM ZONE

COLD ZONE

Decontamination Prioritization

Immediate Decontamination Procedures

Field-Expedient Decontamination Procedures

Through Fixed-Site Decontamination Procedures

Self-Decon Emergency Decon

Field-Expedient or Through Decon

Hospital Decon

Contamination

Wind Direction
Different types of Decontamination Methods

Self-Decontamination

Emergency Decontamination
- Two hand held hose
- Two fire engines creating a decontamination corridor

Field Expedient Decontamination
- Ladder Pipe Decontamination System (LDS)
- Emergency Corridor Decontamination System (ECDS)

Through Decontamination
- Decontamination Tents
- Mobile Decontamination Units

Hospital Decontamination
HOSPITAL DECONTAMINATION
RHODE ISLAND ASSETS
Rhode Island Regional Decon Teams

- Hopkins Hills Fire Dept
- Kingston Fire Dept
- N. Kingston Fire Dept
- Newport Fire Dept
- N. Providence Fire Dept
- E. Providence Fire Dept
- Westerly Fire Dept
Rhode Island Regional Hazmat Teams

- Woonsocket Fire Dept
- Providence Fire Dept
- West Warwick Fire Dept
- Warwick Fire Dept
- Hope Valley Fire Dept
- Cranston Fire Dept
- Newport Navy Base
Rhode Island Regional Mass Causality Incidents Trailers (MCI)

- Cumberland EMS
- Pawtucket Fire Dept
- TF Green Airport
- Scituate Ambulance Corps

- Portsmouth Fire Dept
- Hope Valley Ambulance
- Charlestown EMS
- Block Island Fire Dept