

**CBRNE Awareness**      **Radiological/Nuclear**



Overview 1      NJSP HMRU

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**CBRNE Awareness**      **Objectives**

- **Student will**
  - demonstrate a knowledge of self protection techniques
  - identify types of radiation and their associated hazards
  - demonstrate a knowledge of terminology



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### HALF LIFE

- The "Half-Life" describes how quickly Radioactive Material decays away with time.

It is the time required for half of the unstable atoms to decay.

- **Some Examples:**
  - Some natural isotopes (like uranium and thorium) have half-lives that are billions of years,
  - Most medical isotopes (like Technicium-99m) last only a few days

*Decay rate of radioactivity: After ten half lives, the level of radiation is reduced to one thousandth*



Time:    One half life   two   three   four   five   six   seven   eight   nine

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### Some Isotopes & Their Half Lives

ISOTOPE	HALF-LIFE	APPLICATIONS
Uranium	billions of years	Natural uranium is comprised of several different isotopes. When enriched in the isotope of U-235, it's used to power nuclear reactor or nuclear weapons.
Carbon-14	5730 y	Found in nature from cosmic interactions, used to "carbon date" items and as radiolabel for detection of tumors.
Cesium-137	30.2 y	Blood irradiators, tumor treatment through external exposure. Also used for industrial radiography.
Hydrogen-3	12.3 y	Labeling biological tracers.
Iridium-192	74 d	Implants or "seeds" for treatment of cancer. Also used for industrial radiography.
Molybdenum-99	66 h	Parent for Tc-99m generator.
Technicium-99m	6 h	Brain, heart, liver (gastroenterology), lungs, bones, thyroid, and kidney imaging, regional cerebral blood flow, etc.

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### Definitions

- **Radiation**
  - Electromagnetic or particulate emission
- **Radioactive material**
  - Material giving off one or more forms of radiation

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### Types of Radiation

- **Ionization**

- **Non-Ionization**
  - Micro wave
  - X-ray
  - Radio Frequency

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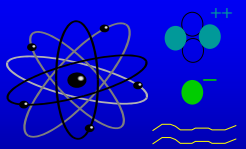
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**CBRNE Awareness** **Ionizing Radiation**

- Alpha particles
- Beta particles
- Gamma rays
- Neutrons



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**CBRNE Awareness** **Detection**



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**CBRNE Awareness** **Health Risks**

- Risks depend on:
  - Amount
  - Rate
- Categorized as:
  - Acute
  - Chronic
  - Delayed

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### Health Hazards During an Incident

- Exposure
- Ingestion
- External contamination




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### Protection

- Time
- Distance
- Shielding

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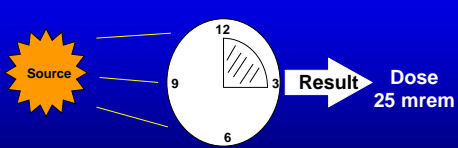
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### Time



100 mrem per hour x 15 minutes (.25 hour) = 25 mrem

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### Distance

The diagram shows a yellow starburst labeled 'Source' on the left. Two vertical lines represent distances of 1 meter from the source. At the 1-meter distance, the dose rate is 100 mrem/hr. At the 2-meter distance, the dose rate is 25 mrem/hr. A white arrow labeled 'Dose Rate' points to the right. The text '1 meter' is written in blue boxes above each distance line. Below the dose rate values, there is a box containing '100 mrem/hr' and '25 mrem/hr'. At the bottom left is a logo and the text 'Overview 13'. At the bottom right is the text 'NJSP HMRU' and another logo.

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### Shielding

The diagram shows three types of radiation and their penetration through different materials. Alpha radiation is stopped by 'Unbroken Skin/Paper'. Beta radiation is stopped by a yellow book labeled 'DICTIONARY'. Gamma radiation is 'Attenuate' by '3 inches of Lead'. Dashed lines represent the penetration paths. At the bottom left is a logo and the text 'Overview 14'. At the bottom right is the text 'NJSP HMRU' and another logo.

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### Decontamination

A vertical stack of four colored boxes containing the following text from top to bottom: 'Wet' (light blue), 'Strip' (teal), 'Flush' (green), and 'Cover' (purple). At the bottom left is a logo and the text 'Overview 15'. At the bottom right is the text 'NJSP HMRU' and another logo.

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**CBRNE - Awareness** **Key Points**

- **Types of radiation**
  - Alpha, Beta, Gamma & Neutron
- **Protection**
  - Time
  - Distance
  - Shielding
- **Once detected - back out**

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**CBRNE - Awareness** **Nuclear Weapons**

<u>Advantages</u>	<u>Disadvantages</u>
<ul style="list-style-type: none"> <li>• Available</li> <li>• Tie up resources</li> <li>• Psychological Impact</li> <li>• Difficult to Prepare For</li> <li>• Next Level of Escalation</li> </ul>	<ul style="list-style-type: none"> <li>• Heavy</li> <li>• Delayed effects</li> <li>• Deployment hazardous to Terrorist</li> <li>• Requires Numerous Difficult steps</li> <li>• Expensive</li> </ul>

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**CBRNE - Awareness** **Nuclear Materials**

- Natural Sources
- Radon ( Soil) – 200mrem
- Cosmic (sun and outer space) – 28 mrem
- Terrestrial – 28 mrem
- Internal ( Potassium 40) – 40 mrem
- Medical X-rays – 40 mrem
- Nuclear Medicine -14 mrem
- Consumer products – 10 mrem
- Other – 3 mrem
- **Background level can vary depending upon location.**



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### Common Radiation Exposures

Radiation Source	Relative Dose (millirem)
Gastrointestinal series (upper and lower)	1,400
Radon in average household in the United States	200 annually
Living in Denver	81 annually
X-rays and nuclear medicine	50 annually
Natural radioactivity in the body	39 annually
Living in Chicago	34 annually

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### Common Radiation Exposures (cont'd)

Radiation Source	Relative Dose (millirem)
Cosmic Radiation	31 annually
Mammogram	30
Living at sea level	28 annually
Consumer products (such as drinking water)	11 annually
Chest X-ray	10
Living near a nuclear power station	< 1 annually

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### Responder Exposure Limits

- ◆ Recommended limits established by the Environmental Protection Agency (EPA)
- ◆ Not considered safe limits because they still present some risk
- ◆ Recommended: **Maximum 25 rem total dose for any single life-threatening emergency**

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Emergency Response Exposure Limits		
Dose Limit (REM)	Activity	Condition
5	All	
10	Protecting valuable property	Lower dose not practical
25	Lifesaving or protection of large populations	Lower dose not practical
>25	Lifesaving or protection of large populations	Only on a voluntary basis to persons fully aware

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## Radiological Dispersion Device

**RDD**

- Most like Nuclear Threat
- Conventional Explosive packed around Nuclear Materials

**SIGNS & SYMPTOMS**

- Acute Poisoning
- Radiation Burns

**ROUTES OF ENTRY**

- Inhalation
- Ingestion
- Skin Absorption
- Injection ( Open Wounds or shrapnel



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## Summary

- Nuclear devices are extremely expensive lethal and difficult to deliver and handle.
- Nuclear devices effects are both instantaneous and long lasting
- Radiological devices are long lasting "Dirty Bombs"
- "Dirty Bombs" are most likely application of nuclear agents.

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