



I. Radiation Countermeasures: Why Do We Need Them?

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Objectives

- Understand why protective measures are needed.
- Understand how terrorists might employ radioactive materials or radiation sources as weapons.
- Identify radionuclides that might be used in terrorist attacks.
- Preview the topics pertinent to medical countermeasures against radiation.



Introduction

- Radiation and radioactive materials are beneficial to society with respect to health care, energy supply, industry and national defense.
- However, radiation has deleterious side effects, especially if it misused.
- What are some of the reasons we should study countermeasures against radiation?



Nuclear Power Accidents

- **Accidental release of radioactive material from nuclear power plants or fuel processing facilities may result in both immediate deaths from direct radiation effects and delayed deaths from cancer induction.**
- **Widespread contamination of the environment may also occur.**



Effects of Medical Radiation

- **Radiation therapy of cancer and radiation therapy for bone marrow transplant preparation can have collateral effects on function of the gastrointestinal and hematopoietic systems.**
- **Medical countermeasures can reduce the collateral effects, allowing optimization of radiation dose for therapeutic purposes.**



National Security

- **Radiation sources and radioactive materials can be misused against a population by terrorists.**
- **Adverse medical effects and economic disruption may result.**
- **Terrorist attacks may not be totally preventable. This makes the development of countermeasures, both operational and medical, important.**

What is Terrorism?



- There is currently no legally binding United Nations definition of “terrorism”.
- “I can’t tell you exactly what it is, but I know it when I see it.”
- “One man’s terrorist is another man’s freedom fighter.”



Definitions of “Terrorism”

"All criminal acts directed against a State intended or calculated to create a state of terror in the minds of particular persons or persons in the general public." (League of Nations, 1937)

“...criminal acts intended or calculated to provoke a state of terror in the general public, a group of persons or particular persons for political purposes are in any circumstance unjustifiable, whatever the considerations of a political, philosophical, ideological, racial, ethnic, religious or other nature that may be invoked to justify them". (UN General Assembly Resolution 51/210)



Definitions of “Terrorism”

...The term “international terrorism” means activities that...involve violent acts or acts dangerous to human life that are a violation of the criminal laws of the United States or of any State...[and] ...appear to be intended to intimidate or coerce a civilian population; to influence the policy of a government by intimidation or coercion; or to affect the conduct of a government by mass destruction, assassination, or kidnapping; and occur primarily outside the territorial jurisdiction of the United States... (U.S. Code, Title 18, Part I, Chapter 113B, 2331(1))



What Could They Do?

“Our discoveries in Afghanistan confirmed our worst fears, and showed us the true scope of the task ahead. We have seen the depth of our enemies' hatred in videos, where they laugh about the loss of innocent life...We have found diagrams of American nuclear power plants and public water facilities, detailed instructions for making chemical weapons, surveillance maps of American cities, and thorough descriptions of landmarks in America and throughout the world.” – *George W. Bush, State of the Union Address, January 29, 2002*





What Could They Do?

“...we have disrupted an unfolding terrorist plot to attack the United States by exploding a radioactive ‘dirty bomb.’ Now, a radioactive ‘dirty bomb’ involves exploding a conventional bomb that not only kills victims in the immediate vicinity, but also spreads radioactive material that is highly toxic to humans and can cause mass death and injury. From information available to the United States government, we know that Abdullah Al Muhajir is an Al Qaeda operative and was exploring a plan to build and explode a radioactive ‘dirty bomb’...” –
Statement of Attorney General John Ashcroft, June 10, 2002



Dispersal of Radiation

- **Ionizing radiation can be harmful to exposed individuals.**
- **Radiation could be dispersed in several ways:**
 - **Without Detonation**
 - **Detonation with Conventional Explosives**
 - **Nuclear Detonation**



Dispersal: No Detonation

- Terrorists could acquire an unshielded industrial radiography or medical irradiator gamma source.
- Could deploy it in a public place (hidden in a mailbox or parked vehicle, for example).
- Would irradiate a large number of passers-by.
- Person deploying the device will probably die (“suicide” operation).



**10,000 Curies
of Cesium-
137 hidden in
a street
vendor's
pushcart.**

If the any of the young women standing next to the pushcart is in early gestation, she will miscarry following 45 seconds of exposure. She will likely double her risk of breast cancer, and experience nausea / vomiting, following 3 minutes of exposure. Her chance of dying following an exposure of 8 minutes is greater than 50%.

People in the office building across the street will accrue the NRC annual occupational radiation exposure limit in 4 hours.



Dispersal : No Detonation

- **Dispersal of unsealed radioactive material into water supply.**
- **Contamination of food distribution system.**
- **Dispersal via “crop-duster” type aircraft.**



Dispersal: Conventional Explosives

- So-called “Dirty Bomb”
- Particulate / aerosolized material mixed with explosive.
- Low potential for lethality or widespread health hazard due to radiation.
- High potential for disruption.



Dispersal: Nuclear Detonation

- Shock + thermal + ionizing radiation.
- Neutron + gamma (initial); beta + alpha (fallout).
- Local mass casualties.
- Distant adverse health effects.



Goldmine for Terrorists?



“Orphan” radiation sources continue to be stored under unsatisfactory conditions throughout the world. They are an easy target for theft by terrorists.





Management of Radiological Terrorism

- Prevention Through Security of Radiation Sources: Bills such as the “Dirty Bomb Prevention Act” have been introduced in the House and Senate (H. R. 891, S. 350).
- Management with Medical Countermeasures: Treatment of radiation injuries, radioprotectant drugs, education of physicians, and so forth.



Medical Countermeasures

- **Need to understand the basics of:**
 - **Physics of Ionizing Radiation**
 - **Biological Effects of Ionizing Radiation**
 - **Fundamentals of Operational Radiation Protection**
- **These topics will be covered in Modules II - IV.**



Some Resources

- **REAC / TS** (Phone 865-576-1005; Web www.orau.gov/reacts)
- **Medical Management of Radiological Casualties Handbook**
(www.afrrri.usuhs.mil)



End Of Module I

- **This is the end of Module I.**
- **Please proceed to Module II, “Basic Physics of Ionizing Radiation”.**