Radiological Terrorism: Dirty Bombs – Fact and Fiction

An Educational Briefing By The

HEALTH PHYSICS SOCIETY

Specialists in Radiation Safety

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Radiological Terrorism: Dirty Bombs – Fact and Fiction

Briefing Moderator

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President, Health Physics Society

Presentation Agenda

- Dirty Bombs: Fact and Fiction

  Eric E. Kearsley, Ph.D., CHP

- How Do We Control Radioactive Material Under The Old and New Paradigm?

  Keith H. Dinger, CHP

- Who Will Mind The Store?

  Kenneth R. Kase, Ph.D., CHP

- Questions & Answers

  Panel of Experts in the Audience

Dirty Bombs: Fact and Fiction

Eric E. Kearsley, Ph.D., CHP

High Point High School

Beltsville, Maryland

What kinds of bombs are we talking about?

- Radiological Dispersion Devices—RDD's
- Radioactive materials spread around by conventional explosives or other means
- "Poor man's nuclear weapon"—NOT!

Background

- Considered by Allies during WW II
- Recent threats

RDD Design

- Type of radioactive material
- Dispersal strategy

RDD Design

Type of radiation

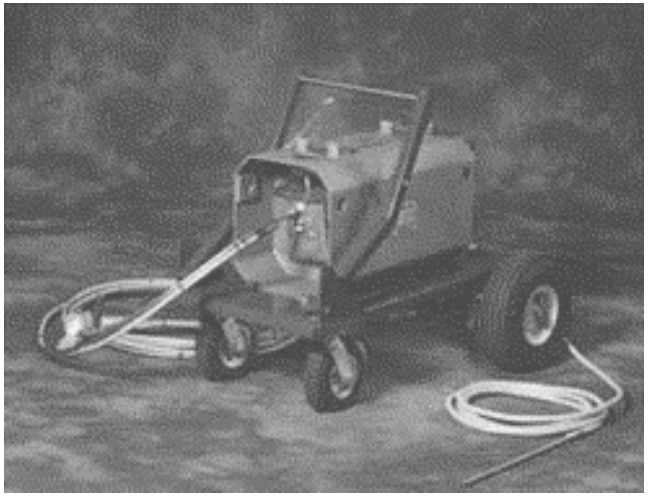
- Penetrating radiation—external hazard; difficult to shield/conceal
- Non-penetrating—internal hazard; easier to shield/conceal; more difficult to detect

RDD Design

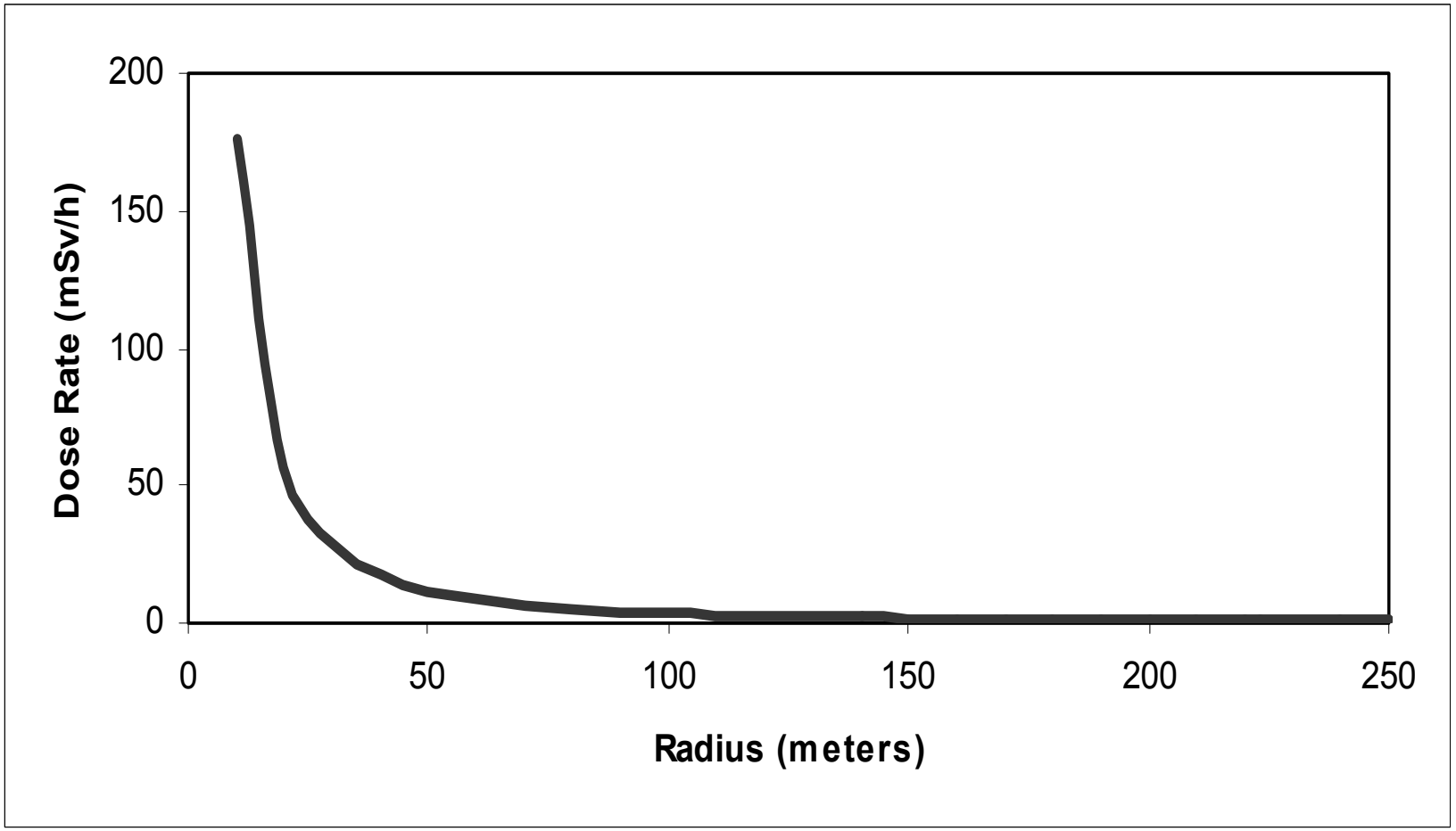
Some sources of material

- Radiotherapy sources
- Industrial radiography sources
- Thermal generators

Potential Sources



Dose Rate vs Radius for 1000 Curies of Cesium-137



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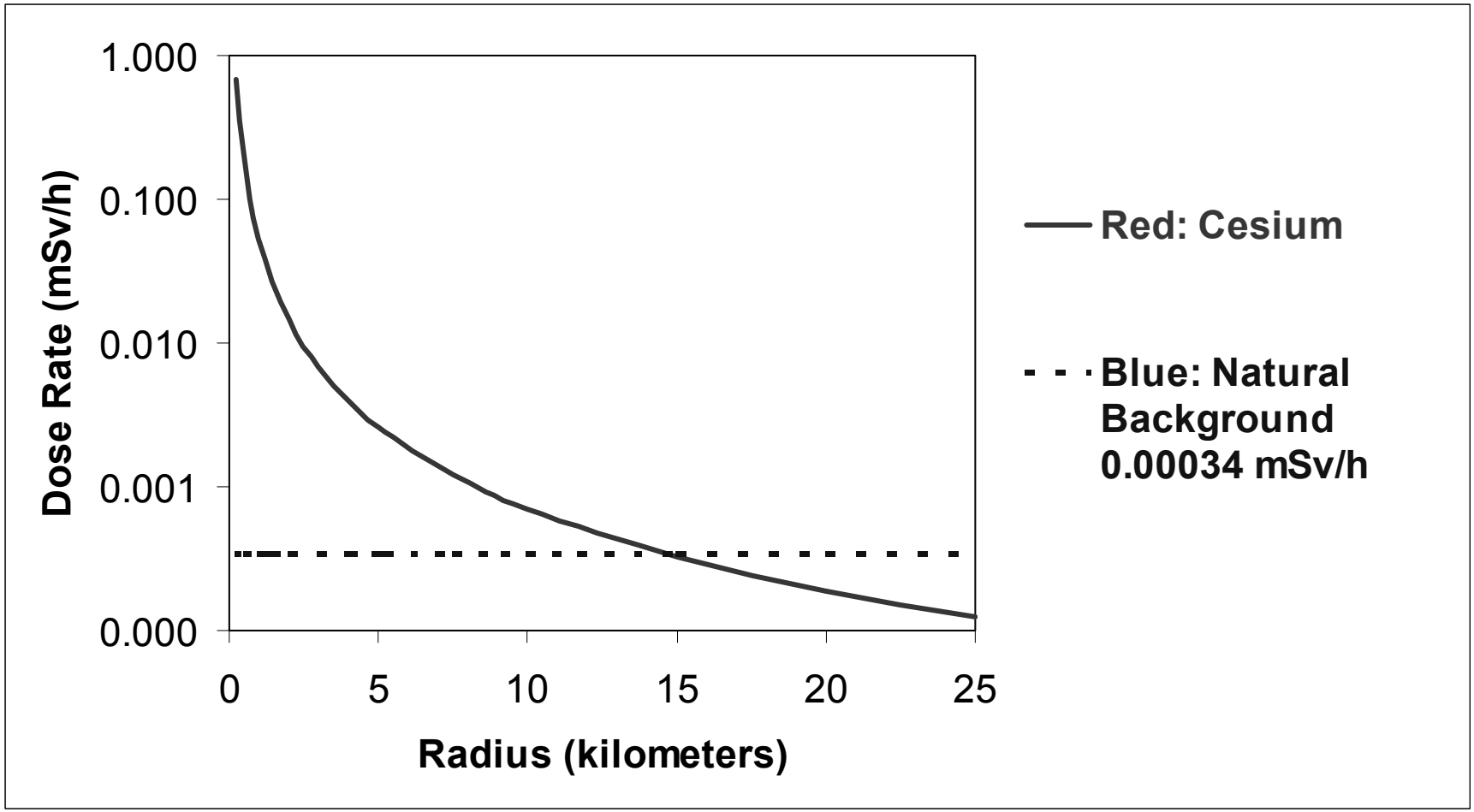

Dose Rates for the 1000 Curie Example

Radius (meters)	Dose Rate (mSv/h)
50	12
100	3.5
150	1.7
200	1

What are the effects?

- Medical/Health
- Psychological
- Economic

Medical/Health Effects

- No clinical effects below 350 mSv
- For 1000 Ci spread out over an area with a radius of 100 meters, an individual would have to remain for 100 hours to receive this dose (i.e., continuously for 4 days).

Medical/Health Effects

- Other than the injury from the explosion, the principle health risk at expected dose levels is the possible increased risk of cancer.
- At 100 mSv the lifetime risk of fatal cancer is believed to be increased from about 20% (all causes) to about 20.5 %.

Psychosocial Effects

Fear/Panic

- Transportation paralysis
- Demand for medical evaluation

Psychosocial Effects

- Emotional, physical, and cognitive effects
- Social withdrawal
- Stigma
- Potential for immediate and long-term care

Economic Effects

- Clean up costs
- Impact on commerce

Public Policy Issues

Education of

- Leaders
- Emergency responders
- Press
- Public

Public Policy Issues

Clean-up criteria

- Agriculture
- Urban areas
- National monuments

Public Policy Issues

Detection--how do first responders distinguish between a "clean" bomb and a "dirty" bomb?

Public Policy Issues

How do we control radioactive material?

Old paradigm: safety

New paradigm: security & safety

How Do We Control Radioactive Material Under The Old and New Paradigm?

Keith H. Dinger, CHP

Harvard School of Public Health

Boston, Massachusetts

Radiation Controls in the U.S.

- A Word About the Current (Old) Paradigm -

Today's regulatory framework for control of exposure from radioactive material and radiation producing machines is the result of over 100 years of *evolution* in the use and understanding of radioactive materials and radiation.

How do we control radioactive material under the old and new paradigm?

- How is it done?
- Who does it?

How is radioactive material controlled?

Old Paradigm: Based on an “inherent” classification system that

- Is based on the potential for use by responsible parties of radioactive material [for the benefit of society] and the extent of the threat to public health and safety posed by that potential

How is radioactive material controlled?

New Paradigm: Develop a classification system that

- Is based on the potential for use by terrorists of radioactive material [for the harm of society] and the extent of the threat to public health and safety posed by that potential*

** paraphrase from S350/HR891 "Dirty Bomb Prevention Act of 2003"*

How is radioactive material controlled?

Old Paradigm: The “classification” takes into account

- Radioactivity levels of the material
- Dispersibility of the material
- Chemical and physical form of the material
- Intended use of the material
- Other appropriate factors

How is radioactive material controlled?

New Paradigm: The classification takes into account

- Radioactivity levels of the material
- Dispersibility of the material
- Chemical and physical form of the material
- Intended use of the material
- Other appropriate factors

** paraphrase from S350/HR891 "Dirty Bomb Prevention Act of 2003"*

Comparison of Old and New Paradigm for Control

- Old Paradigm requires control of the *exposure* of people and the environment from the *beneficial* use of sources
- New Paradigm requires control of the *sources* to not allow the exposure of people and the environment from a *sinister* use of sources

Comparison of Old and New Paradigm for Control

- Both require a “classification” system for radioactive material to ensure resources are properly focused on the potential for a threat to public health and safety
- The New Paradigm requires greater security controls for a small number of radioactive sources
- The Old Paradigm will continue to require lesser safety controls for a large number of radioactive sources

Who controls the radioactive material in the U.S.?

Major Entities with Regulatory Responsibilities for Radioactive Material:

- Nuclear Regulatory Commission (NRC)
- Department of Energy (DOE)
- Department of Defense
- States

Which entity controls the radioactive material in the U.S.?

It Depends

- Intended Use and Activity
  - Civilian
    - Commercial power, research, test reactor
    - Industry
    - Medical
    - Academia
    - Consumer Products
    - Transportation, storage, and disposal
  - Military
    - Nuclear weapons
    - Naval Reactors Program
    - Research reactors

Which entity controls the radioactive material in the U.S.?

It Depends

- Origin
  - Made in a reactor or result of a reactor's operation *
  - Left over from extraction of U or Th from ores *
  - Made in an accelerator
  - Naturally occurring

* Termed "Byproduct material"

- Type
  - Source material (U and Th)
  - Special nuclear material (U-233, U-235, Pu)

Which entity controls the radiation exposure in the U.S.?

If radiation protection standards and radiation producing machines are considered add the:

- Environmental Protection Agency
- Food and Drug Administration
- Department of Labor
  - OSHA
  - MSHA

Radiation Regulatory Framework – Old Paradigm

- Complex
- Inefficient
- Redundant
- Incomplete

Effectiveness of Radioactive Material Control Under Current Regulatory Framework

- Orphaned Sources
  - Up to 500,000 of the estimated 2,000,000 sources in the U.S. are no longer needed [1]
  - About 375 sources are *reported* orphaned in the US each year [1]
  - Can infer only a small fraction of these have the potential for a heightened security concern [2]

[1] *Background Information Paper*, Health Physics Society, April 2002

[2] *Commercial Radioactive Sources: Surveying the Security Risks*, Monterey Institute of International Studies, Occasional Paper No. 11, Jan 2003

Radiation Regulatory Framework – New Paradigm

Technical and Organizational Complexity Requires Competence

Who will mind the store?

Who Will Mind The Store?

- The Health Physics Human Capital Crisis -

Kenneth R. Kase, Ph.D., CHP

Stanford Linear Accelerator Center

Menlo Park, California

The Human Capital Crisis

Where are *professional* health physicists needed?

- Security
- Health
- Energy

The Human Capital Crisis - Indicators

There is a serious projected shortage of *professional* Health Physicists over the next 10 years

- NEI Commissioned Study Reported in 2001

  "Insufficient workers will be available to meet industry demand in two job pipelines:- Health Physicists (shortage is about 700 HPs over 10 years)" [1]

- NEI Chairman noted

  "A particular difficulty in employing degreed HPs is that the demand for these candidates extends well beyond the nuclear energy industry. Most degreed HPs go directly from college and pursue careers in medicine, research and other industrial applications." [2]

[1] *Nuclear Pipeline Analysis Report* for NEI by Navigant Consulting, 12/17/01

[2] *Staffing Nuclear Energy's Future*, remarks by Joe Colvin, President and CEO, NEI, at INPO CEO conference 11/8/01

The Human Capital Crisis – Indicators (continued)

- HPS Position Statement

  "present demand for radiation safety professionals is approximately 130% of supply. Demand during the next five years, which appears to be related solely to attrition, outstrips supply by nearly 160%." [1]

- Four Health Physics University Programs closed in 1990's
- HP University Program support by DOE (EH&S) was terminated in 1999

[1] *Human Capital Crisis in Radiation Safety*, Position Statement of the Health Physics Society, August 2001

The Human Capital Crisis – HPS Actions

- Commissioned Health Physics Manpower Assessment
- Communicating with Congress
  - Authorizing legislation introduced in 107th
  - Providing testimony to Appropriations Committees for FY04
- Communicating with Federal Agencies
  - DOE, NSF, DNFSB, NRC, EPA
- Working with Industry
  - NEI, EFCOG

Briefing Summary
“Take Home” Messages

Briefing Moderator

John R. Frazier, Ph.D., CHP

President, Health Physics Society

“Take Home” Messages

- Dirty Bombs
  - The spread of radioactive material is unpredictable due to all the variables associated with a specific bomb and location
  - The more the material is dispersed the lower the radiation dose to anyone in the area
  - It is very unlikely anyone will have clinically observable effects due to radiation exposure
  - The primary health effect will be Psychosocial effects
  - There will be some economic burden resulting from a dirty bomb explosion
  - An important strategy to mitigating a dirty bomb’s effects is education – leaders, general public, first responders

“Take Home” Messages

- Source Control and Regulatory Framework
  - “New paradigm” for source controls requires consideration of security with safety
  - “New paradigm” requires a new focus but it must still be based on a Classification System, like that inherent in the “Old Paradigm.”
  - Only a small fraction of orphan sources in the U.S. may have a potential for security concerns, but the existence of orphan sources continues to be a public health issue from the focus of the “Old paradigm” – i.e., safety.
  - The Regulatory Framework for source control is decentralized and inefficient

“Take Home” Messages

- Health Physics Human Capital Crisis
  - Professional health physics expertise is needed to support the Nation’s Security, Health, and Energy policies.
  - There is a projected shortfall of professional health physicists for positions requiring professional radiation safety expertise
  - Health Physics Academic programs will continue to decline without Federal financial support

Questions?