

# **Response Considerations for Radiological Dispersal Devices (RDDs)**

**Heather M. Pennington**  
**Nuclear Incident Response Programs**  
**Sandia National Laboratories**  
**hpennin@sandia.gov**

**Lindsay Klennert**  
**Nuclear Incident Response Programs**  
**Sandia National Laboratories**  
**laklenn@sandia.gov**

**SANDOC 2011-???**

# Different Methods of Releasing Radiological Materials

Fire-Driven Release



Non-Explosive Release



Aerial Release



Explosive Release





# Introduction

- **Although federal assets exist to respond to and deal with RDDs...**
- **Local bomb technicians and HAZMAT personnel will likely be the first on scene**
- **It is crucial that these personnel understand**
  - **Consequences of a dispersal**
  - **How to identify a device as an RDD**
  - **Actions to protect first responders and the public**
    - **Before detonation**
    - **After detonation**



# IEDs and RDDs

- **Radiological dispersal devices (RDDs), or dirty bombs, and improvised explosive devices (IEDs) are similar in some ways**
  - Both contain explosives
  - Both have a firing mechanism to set off the device
  - Detonation results in immediate consequences (prompt effects)
- **However, there is one key difference that changes the way in which the device causes disruption**  
**RDDs contain radiological material**



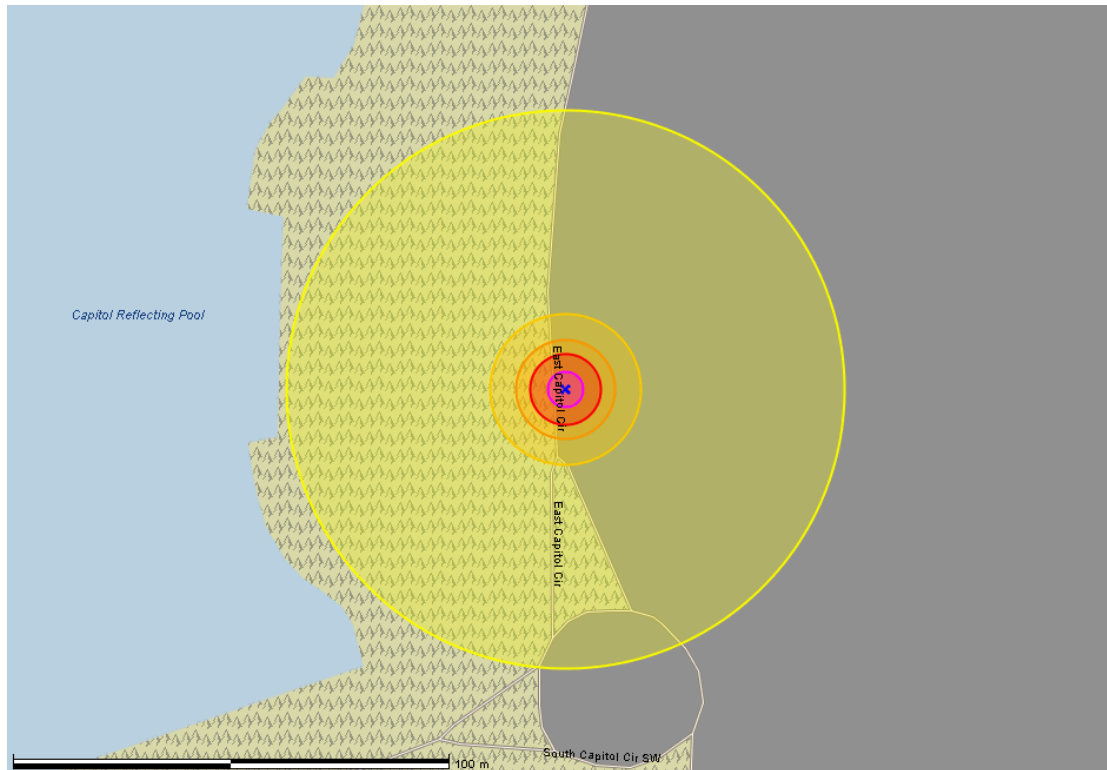
# The Scenario

- A suspicious package has been found near the Capitol Building in Washington, D.C.
- It is estimated that there may be 20 lb of explosive in the package.
- The decision is made to cordon off the area and use a 5-lb charge to attack the device.
- The radiological material within the device was not detected.



**What are the implications of this decision?**

# Blast Effects from 25 lb HE



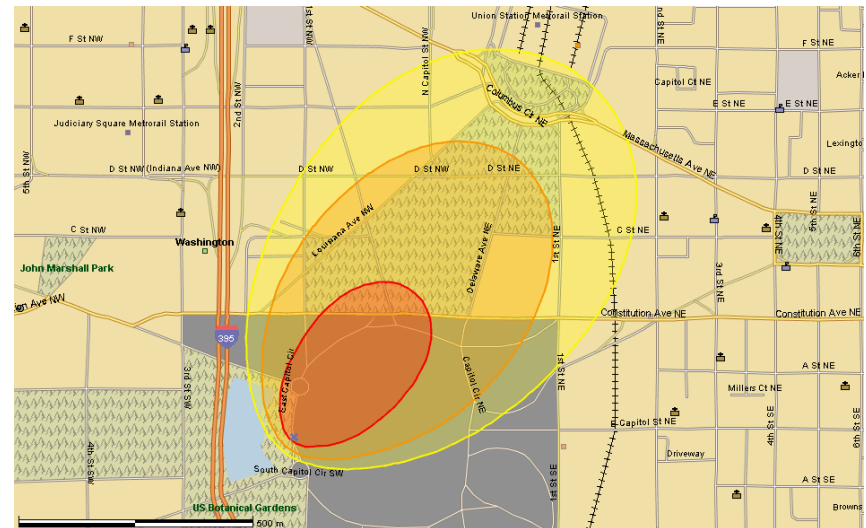
	Overpressure (psi)	Area (m <sup>2</sup> )	Description
	50	57.3	99% Fatalities in Population
	11	232	Onset of Lethality
	6	438	Onset of Lung Damage
	3	102	Onset of Eardrum Damage
	0.5	1,370	Outer Range of Shattered Glass






# Additional Consequences of an RDD

- In addition to the blast effects, the dispersal of radiological material may cause
  - Chronic health effects (an increased risk of cancer)
  - Ground and surface contamination (denial of the area for long periods of time) very expensive to clean up
- An RDD will cause wide-spread panic!




Relocation Protective Action Guides



	Equivalent Dose (rem)	Area (km <sup>2</sup> )	Description Exceeds EPA
	> 2	0.12	1 <sup>st</sup> year relocation PAG
	> 5	0.5	50 year relocation PAG
	> 0.5	0.8	2 <sup>nd</sup> year relocation PAG

# How Is an RDD Different from an IED?

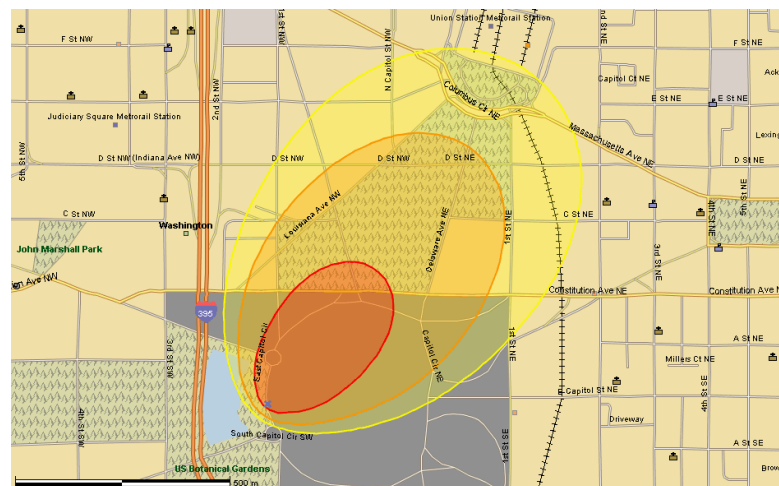
- People within the area may have an increased risk of cancer in their lifetime
- The cost to clean up this area would be enormous
  - For example, a cost of \$1 billion per square kilometer could be estimated

	Equivalent Dose (rem)	Impacted Area (km <sup>2</sup> )	Cleanup Cost (in millions)
	> 2	0.12	\$120
	> 5	0.5	\$500
	> 0.5	0.8	\$800

Blast Effect from 25 lb HE



Relocation Protective Action Guides





# Considerations Before Detonation

- Actions to render safe an RDD must take into account the consequences of doing so
- Furthermore, the render safe environment is different due to the presence of the radiological material
  - Radiological signature around the device
  - Dose rates potentially large enough to cause acute health effects to responders
    - Such as vomiting, loss of consciousness, even death
  - Altered electronics and explosives
- There are mechanisms to mitigate the consequences of an explosive RDD

