

Example Scenarios of Radiological Terrorism

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

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Objective:

- **Define 3 examples of radiological terrorism**
 - **Low level threat**
 - **Medium level threat**
 - **High level threat**

Incidents in Radiological Terrorism

- September 2003, a Chinese nuclear medicine expert, is given a suspended death sentence after being convicted of placing radioactive iridium-192 pellets in a colleague's office.¹
 - Used forged official papers to buy the iridium-192.
 - He placed the pellets in his colleague's ceiling as a form of revenge.
 - Soon after, the poisoned colleague began complaining of memory loss, fatigue, loss of appetite, headaches, vomiting, and bleeding gums.
 - Before the radioactive pellets were uncovered, another 74 hospital staff members were found to have similar symptoms
 - Dose rate from 10 Ci Ir-192, lethal dose 350 rad at 4 ft ~ 3 weeks (8 hr days)

Distance from Source (ft)	Dose R/hr	Time to 5 R	Time to 25 R
On contact	5,210	3.6 sec	18 sec
1	52	6 min	29 min
2	13	23 min	2 hr
3.25	5	1 hr	5 hr



Moscow, Russia November 1995

- Chechen rebels partially bury a container with a small quantity of cesium-137 in Moscow's Ismailovsky Park¹
- The Chechen leader then notifies a Russian television crew, which locates the container
- First widely reported incident of radiological terrorism



Chechen Leader Shamil Basaev
(Photo Courtesy of NTI)

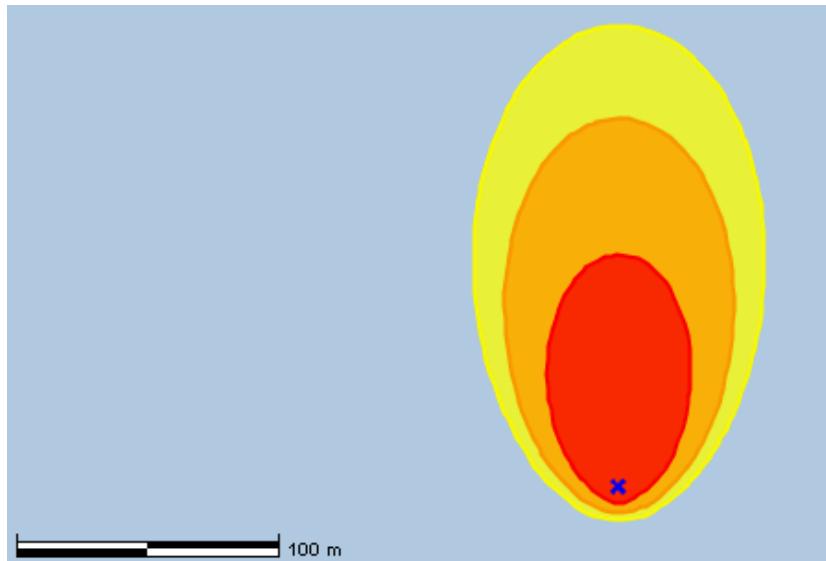


Dose Rate and Possible Plume from a 2 Ci Cs-137 Well Logging Source

- **Unshielded**

Distance from Source (ft)	Dose R/hr	Time to 5 R	Time to 25 R
On contact	6,712	2.4 Sec	12 Sec
1	7	41 min	3.5 hr
1.25	5	1 hr	5 hr
2	2	3 hr	14 hr
3	1	6 hr	31 hr

- **Example Dispersal with 10 kg HE**



Effects and Actions			
	Total Effective Dose (rem)	Area (km ²)	Description
Red	>2.00	0.003	Exceeds first-year relocation PAG.
Orange	>0.500	0.008	Exceeds second-year relocation PAG.
Yellow	>5.00	0.013	Exceeds 50-year relocation PAG.

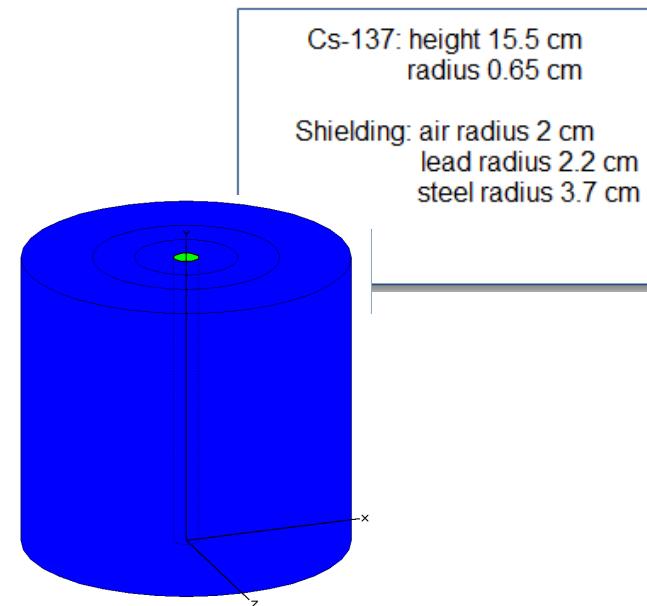
Note: Areas and counts in the table are cumulative.

Incidents in Radiological Terrorism

- June 2003, Thai police arrest a public school teacher in Bangkok after he attempts to sell a container filled with cesium-137 for \$240,000.¹
 - The confiscated material reportedly amounts to less than one ounce (66 pounds with the lead-lined shielding), and is believed to be of Russian origin.
 - 1 oz is equivalent to ~567 Ci Cs-137
 - Dose rate unshielded

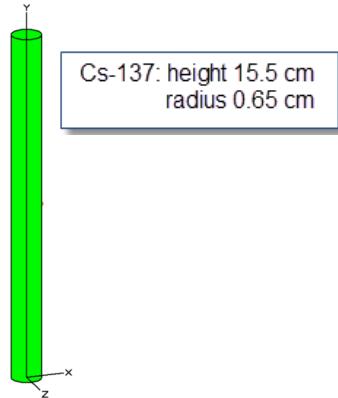


Distance from Source (ft)	Dose R/hr	Time to 5 R	Time to 25 R
On contact	1,714	10.8 sec	1 min
1	131	2 min	11 min
2	42	7 min	35 min
3	20	15 min	1 hr
4	12	25 min	2 hr
6.5	5	1 hr	5 hr



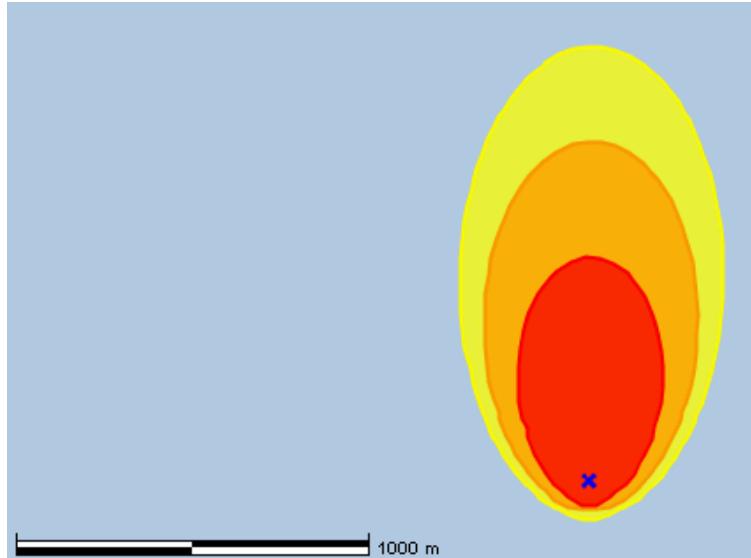
Dose Rate and Possible Plume from 567 Ci Blood Irradiator

- Dose rate unshielded



Distance from Source (ft)	Dose R/hr	Time to 5 R	Time to 25 R
On contact	642,700	-	-
1	1,828	10 sec	48 sec
2	474	38 sec	3 min
4	120	2.5 min	12.5 min
5	77	4 min	19.5 min
10	19	15.5 min	1 hr 18 min
20	5	1 hr	5 hr

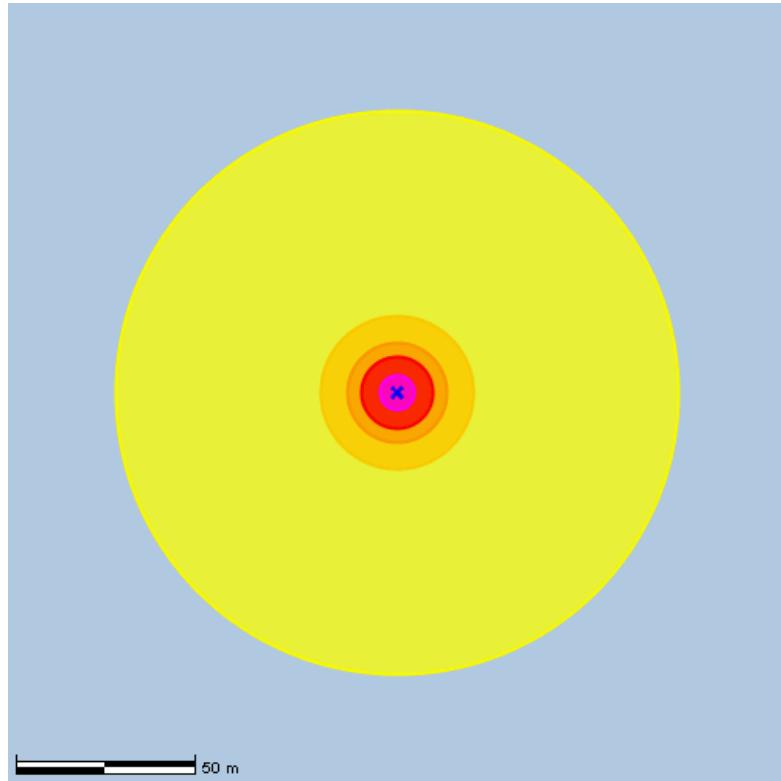
- Example Dispersal with 10 kg



Effects and Actions			
	Total Effective Dose (rem)	Area (km ²)	Description
Red	>2.00	0.2	Exceeds first-year relocation PAG.
Orange	>0.500	0.4	Exceeds second-year relocation PAG.
Yellow	>5.00	0.6	Exceeds 50-year relocation PAG.

Note: Areas and counts in the table are cumulative.

Blast Effects from 10 kg HE



Blast Effects				
	Overpressure (psi)	Area (m ²)	Extent (m)	Description
	>50.0	53	4.10	99%+ Fatalities in Population
	>11.0	213	8.24	Onset of Lethality
	>6.00	403	11.3	Onset of Lung Damage
	>3.00	938	17.3	Onset of Eardrum Damage
	>0.500	12,600	63.4	Outer Range of Shattered Glass

Note: Areas and counts in the table are cumulative.

Reference

1. This material is excerpted from NTI by the Center for Nonproliferation Studies at the Monterey Institute of International Studies. Copyright © 2004 by MIIS.

- http://www.nti.org/h_learnmore/radtutorial/chapter03_01.html

• Explanation of Contour Levels:

The U.S. Environmental Protection Agency (EPA) and the Department of Homeland Security (DHS) have developed a set of Protective Action Guides (PAGs) to indicate when relocation (long-term removal) of individuals should be considered. These Guides are primarily based on an assessment of the risk in developing cancer over an exposed individual's lifetime, and thus the health effects produced by the doses may develop over a period of years. Note that although PAGs were developed based on avoidable dose, whereby the dose received before protective actions can be initiated is not considered, these predictions are based on the conservative assumption that individuals are unsheltered and remain in the area during the time period described for each of the contours. The contours that may be displayed include the first-year relocation contour where individuals are projected to receive a committed dose in excess of 2.00 rem over the year following the release; the second-year relocation contour where individuals are projected to receive a committed dose in excess of 0.500 rem during the second year (or any single subsequent year) following the release; and the 50-year relocation contour showing where committed doses will exceed 5.00 rem over the first 50 years following the release.