

Perception Versus Reality: UCS Views on Nuclear and Radiological Terrorism Risk

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INMM Reducing the Risk Workshop

Washington, DC

March 17-18, 2015

Union of Concerned Scientists

- *The Union of Concerned Scientists is a leading science-based nonprofit working for a healthy environment and a safer world. UCS combines independent scientific research and citizen action to develop innovative, practical solutions and to secure responsible changes in government policy, corporate practices, and consumer choices.*
- UCS currently has 485,000 members and supporters; most are active members of our e-mail network

UCS and nuclear security

- UCS works to promote common-sense policies to ensure that nuclear energy and materials are utilized without causing unacceptably high risks of nuclear and radiological terrorism
- We strive to use available open-source information to come to our own conclusions about the highest priority nuclear security vulnerabilities and how they should be addressed

What is “risk”?

- In accident space, risk = probability x consequences
- But for deliberate acts, there is no plausible way to define numerical probabilities
 - The likelihood of a particular threat scenario is a complex and subjective mix of perceptions regarding terrorist intentions and capabilities, balanced by judgments of the effectiveness of counterterrorism and physical protection measures
 - The likelihoods also change as circumstances change
 - From the point of view of public perception, these judgments are further muddled by the often political motivations of those who control the release of information and shape public dialogue
- For this reason, UCS perception of risk tends to give heavier weight to potential consequences (where information is available) and not dwell on the more speculative considerations of likelihood

A range of threats

- IND, nominal to fizzle yield: HEU gun-type or Pu implosion
- IND, low yield (10-20 t): Pu gun-type or low efficiency implosion
- Radiological dispersal devices (RDDs) of varying size and type
- Radiological emission (or exposure) devices (REDs)
- Power reactor sabotage
- Research reactor sabotage
- Spent fuel pool sabotage
- Dry storage cask sabotage

Considerations in ranking consequences

- Consequence ranking is itself not straightforward—depends on the endpoint (and cannot be divorced from capabilities and intentions)
 - Immediate fatalities (blast, fire)
 - Fatalities from acute radiation syndrome
 - Property destruction
 - Latent cancer fatalities
 - Widespread and long-term land contamination
 - Economic damage
 - Access denial of high-value targets
 - Public panic and anxiety

Examples of risk comparisons influenced by perception

- The risks of RDDs, or “dirty bombs” versus improvised nuclear explosive devices (INDs)
- The risks posed by RDDs versus radiological sabotage of nuclear facilities or material transports
- The risks posed by highly enriched uranium (HEU) versus plutonium
- The risks of reactor-grade plutonium (or bulk actinides) versus weapons-grade plutonium
- The risks of diluted special nuclear materials versus pure forms

RDDs vs. other threats

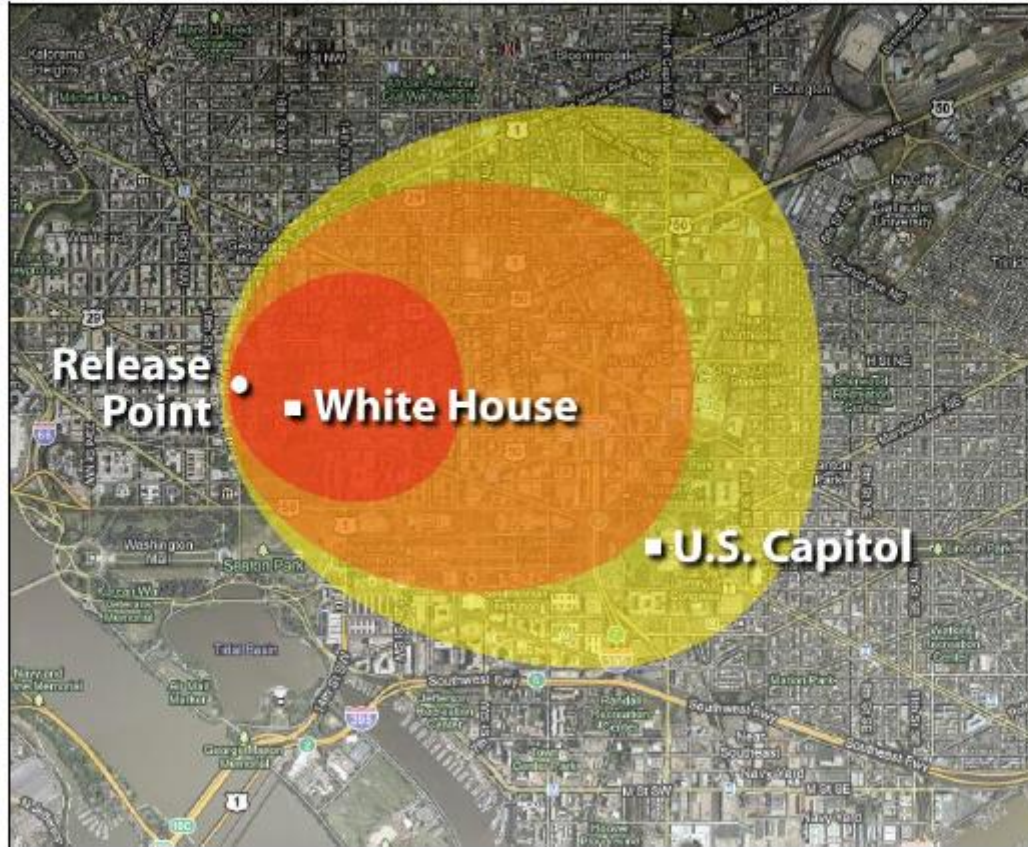
- Was the increased focus on the dirty bomb threat after 9/11 justified by the threat or was it a diversion from more intractable dangers (INDs, reactor sabotage)?
 - Are there really significant benefits for a terrorist over a “clean” bomb?
 - Did the alarm over dirty bombs become a self-fulfilling prophecy?
- John Ashcroft on José Padilla (June 2002):

"We have captured a known terrorist who was exploring a plan to build and explode a radiological dispersion device, or 'dirty bomb,' in the United States."

RDDs vs. other threats

- We now know that the “dirty bomb” plot was inspired by a satirical article co-authored by Barbara Ehrenreich in 1979 called “How to Make Your Own H-Bomb,” which detailed a method of enriching uranium by swinging a bucket attached to a rope around one’s head for 45 minutes
- The CIA concluded early on that the plot was never “operationally viable” (Senate Study on CIA Detention and Interrogation Programs, Executive Summary, p. 231)
- Yet the USG hyped the “dirty bomb” threat anyway for political reasons

Figure A-5.A Possible RDD Attack on Washington, DC
 Using 1,000 Curies of Cesium-137 Chloride



Effects and Actions

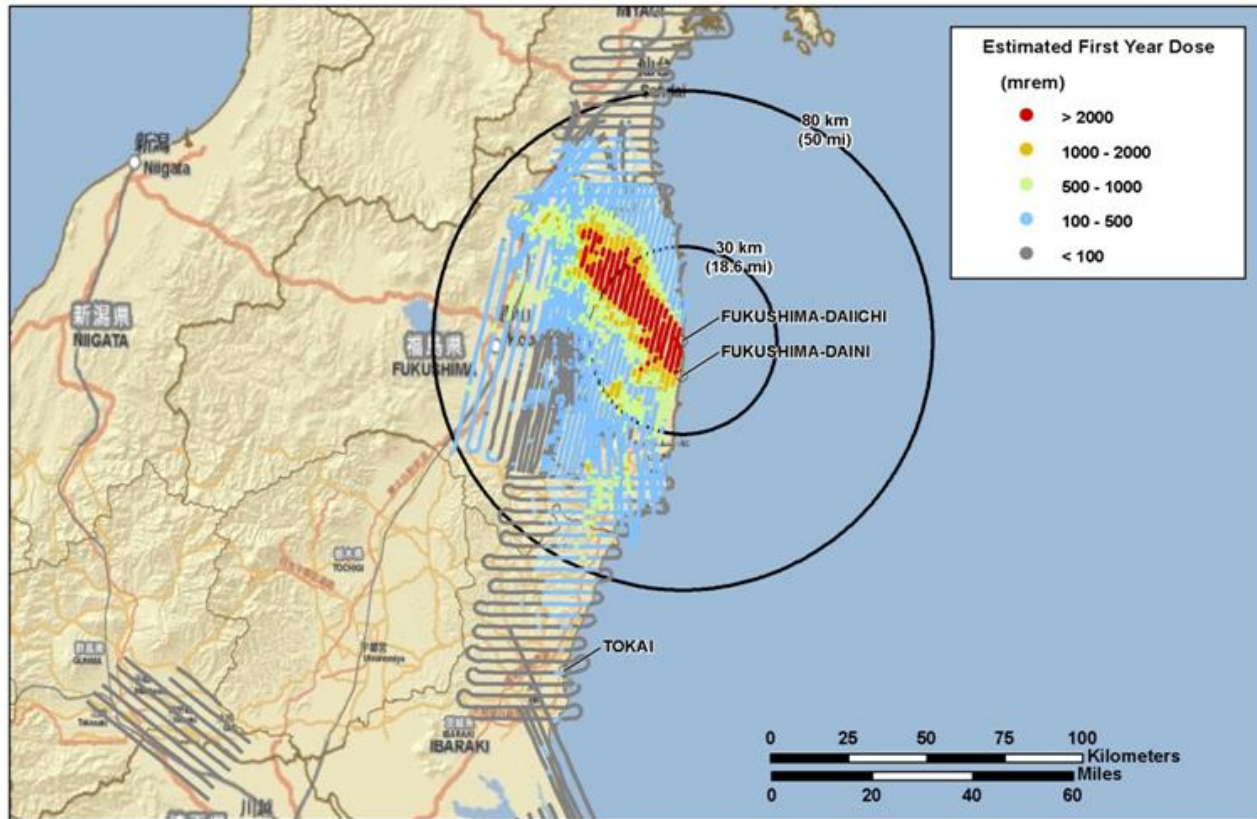
	Area km ² mi ²	Equivalent Dose (rem)	Exceeds relocation PAG for which year:	Population	All Cancers	Fatal Cancers
	2.10 0.81	>2.00	First year only	38,000	233	159
	7.60 2.93	>0.500	Any subsequent year	94,700	278	189
	13.2 5.10	>5.00	50 years (cumulative)	125,000	461	314



First-Year Dose Estimate

Dose Commencing March 16, 2011 for 365 Days

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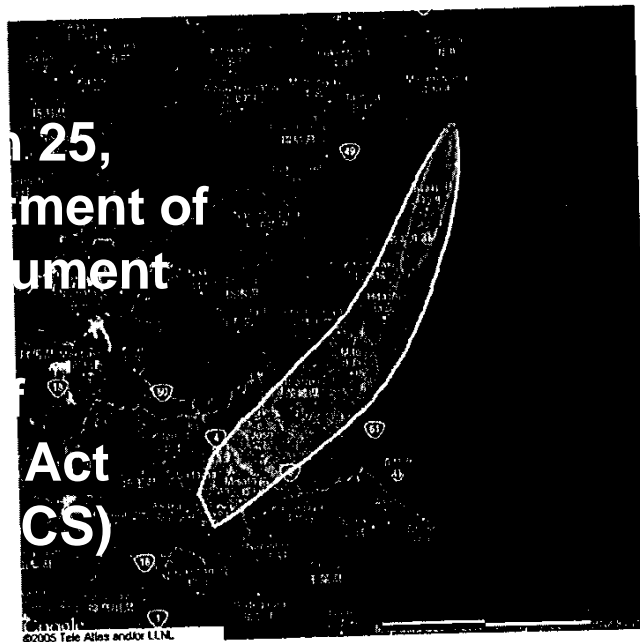
Map created on 04092011 1300 JST
Name: CMHT A 1stYrDoseEst 08Apr2011

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3. Plausible Severe Release

Release from 2 Spent Fuel Pools



The graphic indicates where the 96-hour total effective dose including plume passage exceeds 1 rem (yellow) and 5 rem (orange)

- In this hypothetical scenario, the US EPA Protective Action Guidelines for the total effective dose MAY be exceeded in Tokyo, as well as at locations closer to the release point.
- In this hypothetical scenario, the US EPA Protective Action Guidelines for both the adult and child thyroid dose will NOT be exceeded in Tokyo, but are exceeded at locations closer to the release point

Release magnitudes

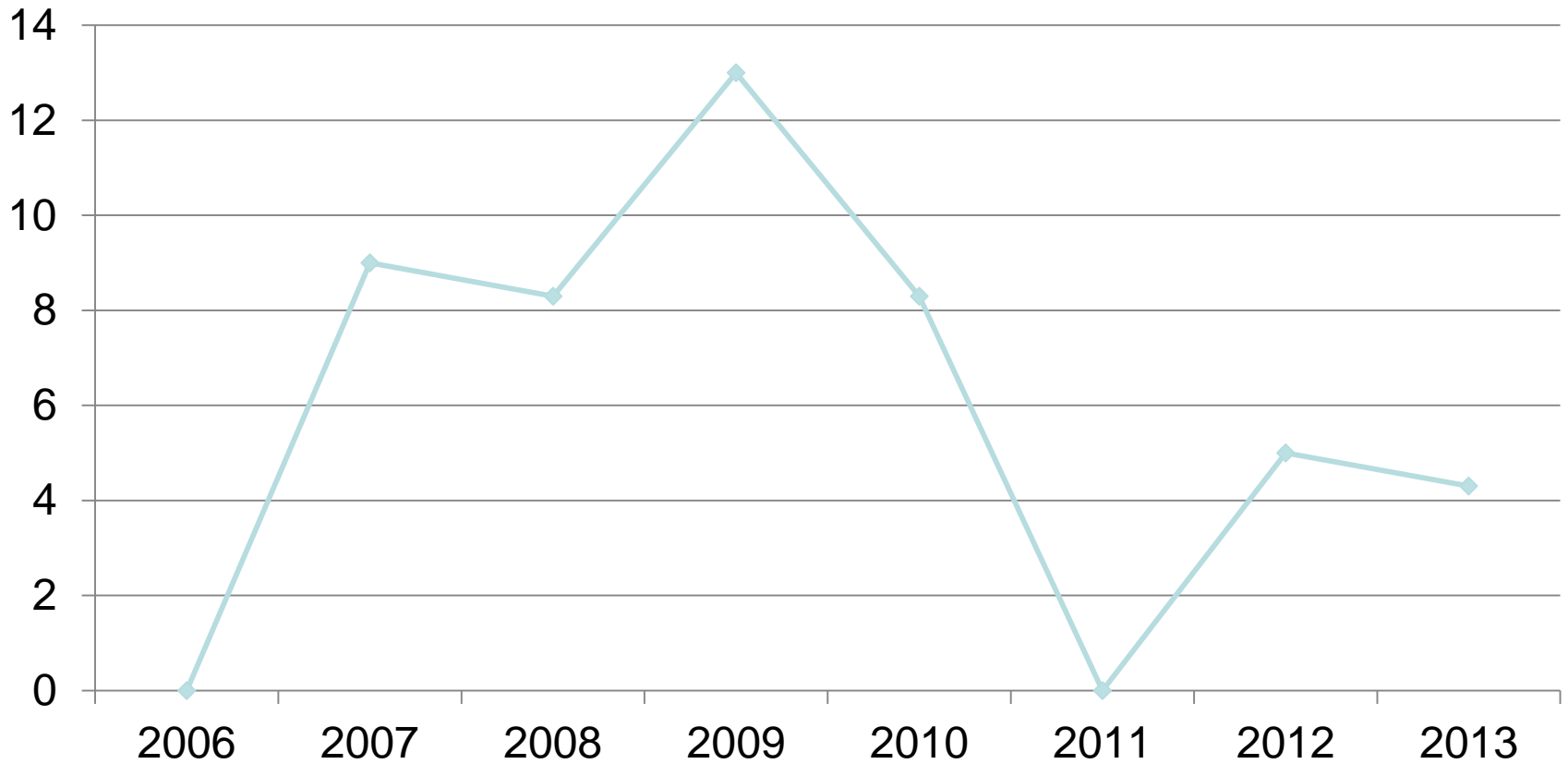
- Estimated atmospheric Cs-137 release from Fukushima Daiichi (of which 80% blew out to sea): 0.5 MCi
- Peak release estimate, high-density 1x4 pool fire (NRC Spent Fuel Pool Consequence Study): 24.2 MCi
- A successful radiological sabotage attack on a nuclear reactor or spent fuel pool would be vastly more severe than most conceivable dirty bomb attacks, and could even have comparable effects in urban areas that are in the vicinity of nuclear plant sites

Perceptions of reactor sabotage risk

- Public perception of reactor sabotage risk depends on whether the NRC's security programs are viewed as effective
- Unlike safety inspections, there is little public information about the results of security inspections
 - Inspection report cover letters and vague “color” findings
 - Annual compilation of security inspection findings
- In order for the public to have confidence in nuclear plant protection, there must be high confidence in the process for security oversight
- Constant pressure from licensees to weaken NRC's security inspection regime erodes public confidence

US NRC Force-on-Force Inspection Results

Force-on-Force "Failure" Rate



HEU versus Pu

- The media and many analysts continue to promote the idea that HEU poses a far more serious nuclear terrorist threat than plutonium
 - Rooted in the Luis Alvarez IND scenario or the relative ease of gun-type versus implosion
- But this perception tends to minimize the danger of vast plutonium stockpiles around the world and shifts attention away from the plutonium problem

Conclusions

- Risk perception drives public fears, which in turn can influence policy
- When risk perception deviates too far from risk reality, vulnerabilities can arise; underlying biases need to be recognized and accounted for
- Officials must strive to maximize transparency to bolster public confidence in the activities that take place behind closed doors