

Cooperative Threat Reduction and the 2017 Threat Environment

NATIONAL ACADEMY OF SCIENCES WORKSHOP ON COOPERATIVE THREAT REDUCTION PROGRAMS FOR THE NEXT 10 YEARS AND BEYOND

William Tobey September 18, 2017

Scope note

Threats that are susceptible to amelioration by cooperative efforts to prevent the proliferation of nuclear, biological, and chemical weapons, materials, technologies, and knowledge, including detecting, securing, and disposing of dangerous materials.

Threat matrix

- Type of threat: nuclear; biological; chemical
- Terrorist groups: al Qaeda; ISIS; others
- National or regional threat vectors: North Korea; South Asia; Russia; others
- Evolving technologies require dynamic analyses.

3 types of nuclear terrorism

Nuclear explosives

- Catastrophic consequences
- Difficult for terrorists to accomplish (though not as implausible as some believe)

Nuclear sabotage

- Potentially catastrophic if highly successful (very limited if not)
- Also difficult to accomplish
- "Dirty Bomb"
 - "Weapons of mass disruption" few if any deaths, but potentially \$10s billions of disruption, cleanup costs
 - Far easier to accomplish

Could terrorists cause a Nagasaki?



Source: *LIFE*, photographer: Bernard Hoffman

Could terrorists cause a "security Fukushima"?

- Fukushima caused by inadequate preparation and an extraordinary natural disaster
- Affirmed that a nuclear accident can cause extraordinary terror, disruption, and cost
- Can be caused by destroying offsite power and backup generators, or cooling systems
- Al Qaeda, Chechens, and other terrorist groups have considered sabotaging nuclear reactors



Source: Air Photo Service, Japan

Nuclear safety and security are closely linked – you can't be safe without being secure.

Cs-137 "dirty bomb"

Potentially dangerous sources used in hospitals, industry, in almost every country

Al Qaeda,
 Chechens have
 repeatedly
 considered dirty
 bomb attacks

Source: Congressional Research Service, modeling by Sandia National Laboratories, 2010



Effects and Actions

	Area km² mi	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	
A	Areas and counts are cumulative. RDD detonated at 38.9 N, 77.0 W. PAG: Protective Action Guide						

With nuclear material, terrorists may be able to make crude nuclear bombs

- With HEU, gun-type bomb as obliterated Hiroshima – very plausibly within capabilities of sophisticated terrorist group
- Implosion bomb (required for plutonium) more difficult, still conceivable (especially if they got help)





<u>Doesn't</u> take a Manhattan Project -- >90% of the effort was focused on producing nuclear material. And making a crude terrorist bomb is *far* easier than making a safe, reliable weapon

Al Qaeda has actively sought to get nuclear bombs

- Repeated attempts to purchase nuclear material or nuclear weapons
- Repeated attempts to recruit nuclear expertise
- Focused program that reported directly to Zawahiri
- Reached the point of carrying out crude (but sensible) explosive tests for the nuclear program in the Afghan desert
- Sought and received fatwa authorizing use of nuclear weapons against civilians



Source: CNN

Has the threat disappeared?

- Bin Laden dead, core al Qaeda profoundly disrupted
- Nuclear security is substantially improved at many sites many sites have no weapons-usable material left

D But:

- & al Qaeda has proved resilient—could resurge
- The Islamic State, although under attack, has more territory, people, and resources than al Qaeda—and an equally nihilist vision
- Other groups have pursued nuclear weapons as well—with 2-3 groups having gone the nuclear path in last 15 years, cannot expect they will be the last
- The problem of nuclear terrorism and the need for nuclear security will be with us for decades—no room for complacency
- No one knew about Aum Shinrikyo's efforts until after its gas attack

Key core al Qaeda nuclear operatives still at large

	1	1		i
Ayman al Zawahiri	Now head of the group. Nuclear project reported directly to him.		Sayf al-Adel	Senior al Qaeda operational planner, reportedly personally approved attempted purchase of 3 nuclear bombs in 2003
Abdul Aziz al-Masri Source: NCTC aka Ali Sayyid Muhamed Mustafa al-Bakri	CEO of al Qaeda's nuclear program, oversaw explosives experiments in Afghanistan.		"Pakistani Nuclear Expert"	2003 communications from al Qaeda leaders reportedly approved purchase of nuclear devices if the Pakistani expert confirms they are real – U.S. Government has never identified or found this expert

Recent incidents of concern

- Belgium, 2014-6; nuclear sabotage, surveillance
 &> Lesson: Inside threat severe, difficult to manage
- U.S., 2012: 82-year-old nun, 2 others penetrate 4 fences to HEU storage facility – cameras broken, alarms ignored, major breakdown of security culture

& Lesson: Complacency potentially disastrous

Moldova, 2011: HEU seized from a large group, with connection to real buyer; smugglers still at large with at least 1 kg of HEU

& Lesson: Fissile material smuggling an ongoing problem

- South Africa, 2007: Attack on Pelindaba HEU site by 2 armed teams; one penetrated 10,000-volt security fence, disabled alarms, shot staffer at emergency center
 - Lesson: Nuclear sites must be able to defend against more than one team of sophisticated adversaries, with insider knowledge

Summary: the nuclear terrorist threat

- Do terrorists want nuclear weapons?
- Is it conceivable terrorists could make a crude bomb if they got the material?
- Is there material that might be vulnerable to theft and transfer to terrorists?
- Is it likely that terrorists, if they had a crude device, could smuggle it to Moscow, London, Paris, Washington, or New York?

The probability may not be high – but no one would operate a nuclear reactor upwind of a city if it had a 1/100 chance each year of a catastrophic radiation release – risk of a terrorist nuclear bomb may well be higher

res	NO
\checkmark	
\checkmark	
\checkmark	

N I

****/

Security culture matters: Propped-open security door



Source: GAO, Nuclear Nonproliferation: Security of Russia's Nuclear Material Improving, Enhancements Needed (GAO, 2001)

State-level nuclear proliferation

- Threat is acute, but limited: North Korea, Iran are the only known current threats.
 - & But, regional responses to these threats cannot be excluded.
- □ Moreover, the threat is evolving:
 - 80 Relative abundance of fissile material in the DPRK will make sale of weapons or material more plausible.

DPRK made threats of sales in 2003

- Pakistan claims to be nearing targets for fissile material production sufficient to support its nuclear strategy; if so, what will become of the Kushab reactor complex?
- ∞ New reprocessing facilities may come on line in Japan, China, and the ROK.

Non-state biological weapons threat

- Remnants of state programs are a potential source of materials and expertise.
 - & Caches of incompletely destroyed agents
 - & Willing or coerced cooperation by experts
- Terrorist organizations, domestic militia groups, and lone wolves have all attempted to produce biological weapons agents.
- The convergence of chemistry and biology and advances in synthetic biology and genomic techniques creates the potential for novel threats.
- Safety/security incidents (2001, anthrax; 2014 smallpox; 2015 anthrax) reveal systemic weaknesses.

State-level biological weapons programs

The U.S. State Department assesses that China, Iran, North Korea, Russia, and Syria engage in dual-use activities with potential biological weapons applications.

Diminishing visibility

Several factors are diminishing our situational awareness:

- 👏 Ubiquity of technology hampers analysis
- & Technological advances are a source of surprise
- ∞ Resources are disproportionate to the scale of the threat

Non-state chemical weapons threat

- Aum Shinrikyo 1995 Tokyo sarin attack.
 - ∞ Killed 12, injured dozens more
- □ ISIS:
 - & recruited chemical weapons experts, both willing and coerced: and,
 - 80 employed mustard agent and chlorine.

State-level chemical weapons threat

- Recent incidents indicate a continuing interest by states and/or gaps in verification capabilities:
 - 🔊 Syria
 - 🔊 Libya
 - ∞ North Korea

The challenge of new technologies

- Novel methods and materials increase the potential sources of threats, heighten their severity, and make detection and verification more difficult.
- □ These include:
 - & Additive manufacturing
 - & Process-intensive chemical production
 - $\boldsymbol{\otimes}$ Genome editing
 - ∞ Cyber warfare
- Trends toward ubiquity of knowledge, empowered individuals, and diversifying threat vectors are accelerating.

Final thought

Plan to be surprised:

- \otimes Project Sapphire 1994 > 1 tonne weapons grade HEU
- 🔊 Degelen Mountain Kazakhstan 1996-2012 weapons-usable material
- 🔊 Libya 2004 nuclear, chemical weapons programs
- 🔊 Vinca, Serbia, 2010 HEU
- 🔊 Syria 2013-2014 chemical weapons