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Non-State Nuclear Attack Urban Target Arrays—Pathways and Risk Reduction Strategies

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by Peter Hayes

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I. Introduction

In this policy forum essay, Peter Hayes argues that a determined non-state nuclear terrorist can choose to threaten any one of hundreds of cities, with a nuclear weapon, with a radiological weapon, or by attacking nuclear facilities. The key risk reduction measures are to reduce numbers and increase security of nuclear weapons; favor urban form that increases urban resilience; and ensure spent fuel and reactors are extremely difficult to attack.

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II. Policy Forum by Peter Hayes

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A determined non-state actor armed with a weapon of mass destruction will be able to wreak havoc of global proportions. Some cities are now relatively well defended, with partial inspections of incoming airline bags, containers, and other cross border flows. But it is patently beyond the control of states to monitor all flows. And if one city, for example, Los Angeles, becomes relatively “hard” to target, there’s no shortage of “soft” cities to target instead.

Although good data are hard to come by, it is possible to be more somewhat more precise about the array of possibility in this context. Two decades ago, there were already about 3,000 cities with 100,000 or more people on Earth.[1] J. Vernon Henderson estimates that there were 2,684 cities with populations of at least 100,000 or more people in 2000.[2] Yet another accounting states that by 2009, there were about 21,905 urban areas containing more than 5,000 people, implying that there are about 18,948 urban areas sized between 5,000 and 100,000 people.)[3]

Thus, for the really determined city-hostage taker, there are hundreds of small and intermediate sized cities to choose from should big cities prove too hard. The city would need to be sufficiently large to get lost in; sufficiently interconnected by trade and mobility to make it easy to enter, and to

make it valuable to target—that is, it would likely be a port city.

Such a hostage-taking strategy needs only to be credible to work. Of course, the most credible strategy would be one based on a stolen actual weapon of mass destruction, that is, a nuclear weapon, with the loss of control pathway documented until it disappears at sea or in a favela somewhere. It would be almost impossible except for extraordinarily lucky police work to locate such a device, especially if the attacker threatens a decoy city for the initial threat, to force defenders to reveal their countervailing strategies. A transnationally networked non-state attackers could easily "switch and bait" to force states to show their hand.

A priori, a non-state threat to use a nuclear weapon is more likely to occur than simple detonation on a target without warning. The latter would be devoid of meaning and purpose except for revenge and would bring down the inevitable wrath of the great powers atop the community of origin of those who delivered the attack, and is relatively easily deterred although given possible irrationality at play in the minds of non-state nuclear terrorists, never with certainty.[4] Almost certainly, the threat of retaliatory use of nuclear weapons would be disproportionate and not likely to be effective, if, as Sadli Tasleem points out, multiple mass attacks in recent history have been any indication.[5]

The former, the credible threat to use nuclear weapons, is much harder to deter against, and perhaps impossible to defend against. The main defense against such a wide ranging array of distributed targets is therefore to stop nuclear weapons falling into non-state hands in the first place.

Let's assume that the non-state actor concurs that this pathway is the most credible, but also the hardest to pull off, given the relatively tight controls on nuclear weapons. Such an actor might not give up attempting such a strategy, especially if one can apply blackmailing strategy using the resources of organized transnational criminal gangs that may have morphed into or converged with ideologically motivated non-state terrorist networks.[6] Stand-over tactics can be amazingly effective at cracking open the most secure facilities.

What's a nuclear terrorist to do? One could acquire radioactive materials from medical or industrial sources to make a radiological "weapon of mass disruption" as the newly formed Middle East Next Generation of Arms Control Specialists Network suggested recently.[7] This weapon could be focused on food, and be aimed at a fragile state where controls are weak, and response capacity even weaker.

To attack bigger, more secure states, the easiest may be to target already existing nuclear fuel cycle facilities that hold large quantities of radiological material in proximity to populations. This approach means no risk of moving nuclear weapons from source to target city with thousands of agents focused on finding you in a race against time. It means no risk from acquiring or moving radiological material around from source to target, as is required for a dirty bomb, that is, a radiological device.

As was noted at the time, Fukushima was a "wet run" at what could happen not only after a technological failure or malfunction, but as a result of a malevolent attack on a nuclear facility by a state or non-state actor, or as a result of terrorist diversion of spent fuel and its subsequent use to threaten or attack concentrated populations or military targets.[8]

Concern about nuclear facilities as radiological targets began with discussions of targeting these sites during the Cold War to "enhance" the effects of nuclear strikes. An early debate occurred over the risk of nuclear terrorism in light of Theodore Taylor's work on the topic.[9] The first public systematic treatment of the issues associated with targeting nuclear facilities by terrorists (by

Bennett Ramberg) included the targeting of spent fuel ponds and other ancillary facilities that support reactors, but concentrated on the risk of attacks by states on reactors and consequent radiological risks.[10]

In the United States, non-governmental researchers, especially scientists, have been at the forefront of research on the risks posed by poorly protected and badly designed spent fuel ponds in reactor containment buildings, putting pressure on the Nuclear Regulatory Commission to respond—to date with limited but significant success.[11] These experts have also raised the risk that of non-state actors could attack spent fuel ponds and casks at reactor sites. They have estimated quantitatively and qualitatively the truly immense, catastrophic possible releases that could result from successful attacks.[12] In some cases, simple repositioning of casks could reduce the risk and impacts of attacks substantially. Some redesign of storage casks could also greatly reduce the risks that a successful non-state actor could breach such spent fuel containers.

Post-Fukushima, many states with nuclear power fuel cycle facilities are confronting the full implications of Fukushima. One key imperative is to separate the spent fuel removed from reactor cores from proximity to reactor cores, so that they do not suffer from a common-mode failure. Another is to "de-densify" the racks of the spent fuel ponds themselves, many of which are now so chock-a-block with hot spent fuel that should the cooling water be lost, the spent fuel will melt with potentially catastrophic release of radioactive materials via a thermal plume.

States in the region have been dilatory in the extreme in addressing this risk. The Seoul Nuclear Security Summit in March 2012 called for coordination to make this connection between nuclear fuel cycle management, safety and security, noting, "We affirm that nuclear security and nuclear safety measures should be designed, implemented and managed in nuclear facilities in a coherent and synergistic manner… Noting that the security of nuclear and other radioactive materials also includes spent nuclear fuel and radioactive waste, we encourage States to consider establishing appropriate plans for the management of these materials."[13]

Although it called for action to address risks related to the management of spent fuel and wastes, the Summit focused on control of fissile material, did not have a panel on nuclear safety and security, and failed to offer any concrete recommendations for how nuclear facilities should be designed or secured so as to reduce the risk of accident or attack and the attendant radiological consequences of such events. Thus, it appears to have been left to civil society organizations in East Asia to tackle this question directly.[14] Fortunately, Nautilus Institute with partners in China, Japan, and South Korea have addressed exactly this issue in a combination of quantitative and qualitative analysis in the The Resilience and Security of Spent Fuel in East Asia project.[15] These analysts examine how alternative spent fuel storage locations, management strategies, and storage technologies—including deep borehole disposal of spent nuclear fuel and high-level wastes—can minimize the risk of radioactive releases caused by nuclear terrorism or by accidents. The early results of the projects second regional workshop have just been published: https://nautilus.org/projects/by-name/security-of-spent-nuc-ear-fuel/2013-working-group-meeting/papers-and-presentations/

The intractability and possible impossibility of controlling large number of diverse, self-organizing agents, especially individuals and ideologically motivated networks, with top-down control strategies orchestrated by states, suggests that fundamental issues of vulnerability arising from concentrations of population and critical infrastructure may drive designs of greater resilience to possibly inevitable nuclear threats and even attacks by non-state actors in the coming decades. The trend in major cities is exactly the opposite, that is, towards even bigger primary and secondary cities, with gigantic urban corridors emerging between these mega-cities. However, there is also an opposite trend of *in-situ* and networked urbanization known as "rurbanization" in India and *desakota* in China

and elsewhere in Asia which may prove less vulnerable to such attack, lending a networked resilience to these settlements.

After the risks of nuclear next-use between states in a universally nuclear-armed East Asia, especially attacks aimed at populations, the risk of nuclear next-use by non-state actors may be the second most important source of risk—not least because it could vastly complicate inter-state conflicts during times of high tension or even in the midst of war.

III. REFERENCES

[1] C. van Marrewijk et al. *International Economics*, Oxford University Press, 2006 (from data tables at http://www.oup.com/uk/orc/bin/9780199280988/01student/zipf

[2] J. Vernon Henderson and Hyoung Gun Wang, 'Urbanization and City Growth: The Role of Institutions', (2006).

[3] Data tables, Global Rural-Urban Mapping Project, SocioEconomic and Applications Data Center, Columbia University, accessed 6 February 2009**,** at: http://sedac.ciesin.org/gpw/global.jsp

[4] M. Kroenig, B. Pavel, "How to Deter Terrorism," *Washington Quarterly*, Spring 2012, pp. 21-36 at http://csis.org/files/publication/TWQ_12Spring_Kroenig_Pavel.pdf

[5] Sadia Tasleem, "Deterring nuclear terrorism: Reflections from Islamabad," *The Bulletin of the Atomic Scientists*, June 15, 2013, at: http://www.thebulletin.org/nuclear-deterrence-and-terrorism-implications-global-security

[6] John Rollins, Liana Sun Wyler, *Terrorism and Transnational Crime: Foreign Policy Issues for Congress*, Congressional Research Service, R41004, June 11, 2013, at: *fpc.state.gov/documents/organization/200053.pdf*

[7] Nilsu Goren, Aviv Melamud, Ibrahim Said Ibrahim, and Ariane Tabatabai, "Anger Management in the Middle East," August 8, 2013, at: http://guests.armscontrolwonk.com/archive/3932/anger-management-in-the-middle-east#more-3792

[8] As argued by C. Robichaud, "The consequence of a dirty bomb attack," April 11, 2011, at: http://thehill.com/blogs/congress-blog/homeland-security/155493-the-consequence-of-a-dirty-bomb-attack

[9] M. Willrich and T. Taylor, *Nuclear Theft: Risks and Safeguards: A Report to the Energy Policy Project of the Ford Foundation*, Ballinger, 1974; Taylor was profiled by John McPhee in *The Curve of* Binding Energy, Ballantine, 1974.

[10] B. Ramberg*, Nuclear power plants as weapons for the enemy: an unrecognized military peril, Nuclear power plants as weapons for the enemy,* University of California Press, 1984, pp. 55 et passim.

[11] J.Beyea, *et al*, "Damages from a Major Release of 137Cs into the Atmosphere of the United States," *Science and Global Security,* 12:125–136, 2004, pp. 125-136, at: www.princeton.edu/sgs/publications/sgs/pdf/12_beyea.pdf and R. Alvarez *et al*, "Reducing the

Hazards from Stored Spent Power-Reactor Fuel in the United States," *Science and Global Security,* 11:1–51, 2003, pp. 2-60, at; www.princeton.edu/sgs/publications/sgs/pdf/11_1Alvarez.pdf

[12] G. Thompson, Robust Storage of *Spent* Nuclear *Fuel*: A Neglected Issue of Homeland Security, Institute for Resource and Security Studies, January 2003, at: http://www.nirs.org/reactorwatch/security/sechossrpt012003.pdf

[13] "Seoul Communiqué at 2012 Nuclear Security Summit" at: http://www.cfr.org/proliferation/seoulcommuniqu-2012-nuclear-security-summit/p27735

[14] See the research published by Nautilus Institute's Security of Spent Nuclear Fuel project at: https://nautilus.org/projects/by-name/security-of-spent-nuclear-fuel/#axzz2STq2M8Ed

[15] See Nautilus Institute, The Resilience and Security of Spent Fuel in East Asia workshop, April 13-15, 2012, at: https://nautilus.org/projects/by-name/security-of-spent-nuclear-fuel/east-asi--spent-fuel/#ixzz2bzD2r72c

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IV. NAUTILUS INVITES YOUR RESPONSES

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