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## Submitter Information

**Name:** Matthew Bunn
**Address:**
BCSIA, 79 JFK Street
Cambridge, MA, 02138

## General Comment

See attached file(s)

## Attachments

Public Comment on NRC Material Categorization Proposal

Comment on Proposed Rule on Enhanced Security at Nuclear Fuel Cycle Facilities; Special Nuclear Material Transportation; Docket NRC-2014-0118

Matthew Bunn

Professor of Practice, Harvard Kennedy School

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I am writing in strong opposition to the Nuclear Regulatory Commission (NRC) staff's proposed rule change on categorization of nuclear material based on material attractiveness. The proposal (a) fails to provide adequate assurance against nuclear theft; (b) rests on findings that are contrary to decades of studies by groups ranging from the NRC itself to committees of the National Academy of Sciences; (c) would likely lead to reduced security for key nuclear materials in foreign countries; and (d) offers little benefit, as few regulated operations that would save substantial funds are likely to move forward in the United States for decades to come.

## Providing inadequate assurance against nuclear theft

The NRC staff proposes to reduce security requirements for material that contains less than 20 percent by weight special nuclear material (SNM), on the ground that this material would be unattractive for use in nuclear weapons.

It certainly makes sense to risk-inform security requirements, and to provide the highest levels of security for materials that would be easiest for terrorists to turn into a nuclear bomb. Material containing less than 20 percent by weight SNM would be more difficult to make an improvised nuclear explosive from than would pure material; terrorists would have to steal more material, would have to chemically process it to pure form, and would take time to do so. But as discussed below, decades of studies, including some sponsored by the NRC itself, have concluded that blending plutonium into forms such as those covered by the staff proposal would provide only a modest security benefit, as any state or group able to do the challenging job of making a nuclear bomb from pure plutonium would also be likely to be able to do the less challenging job of getting pure SNM from material containing less than 20 percent SNM by weight.

Given the very real possibilities of processing moderately dilute material for use in an improvised nuclear device, the staff proposal goes much too far in reducing security these materials, eliminating all requirements that these materials be protected against a design basis threat (DBT) and relying for security not on preventing thieves from removing the material but on the unproven and low-assurance strategy of hot pursuit and recovery after a theft has occurred. This simply does not provide high assurance of public health and safety or of the common defense and security, as required by law.

Reliance on hot pursuit is particularly problematic, for two principal reasons. First, empirical studies of police pursuits find a range of success rates in apprehending the suspects pursued ranging from 48 percent to 82 percent, with most studies having

results in the range of two-thirds to three-quarters of pursuits being successful.[1] That hardly constitutes high assurance suitable for the protection of potential nuclear bomb material. One might say that the pursuit will be more determined and have more resources in the case of chasing nuclear material thieves – but it is also likely that nuclear material thieves will have more weaponry and other means to interfere with pursuit than a typical suspect. What if a second team is assigned to block the road or stop the pursuers? What if directed fire from the thieves halts the pursuit? What if the thieves depart by helicopter, as is common in jailbreaks around the world?

Second, hot pursuit would be provided by local law enforcement. The NRC can require licensees to work out arrangements with local law enforcement for such pursuit, and to conduct exercises, but ultimately the NRC has no ability to regulate the effectiveness of pursuit by local responders. The NRC should not rely, for the fundamental basis of protection of Category I quantities of potential nuclear bomb material, on entities it cannot regulate.

A more moderate reduction in security requirements for moderately dilute material compared to pure material would make sense. The Department of Energy, for example, also uses material attractiveness criteria (with a shift at 10 percent by weight rather than 20 percent by weight), but the reduction in security requirements for moderately dilute material is far less extreme than what the NRC staff is proposing. Materials that are moderately dilute must still be protected against a DBT. There are many options for more moderate reductions in security requirements; NRC could require, for example, that moderately dilute material be protected against a somewhat smaller DBT than the one for pure material, or could permit licensees to provide modestly lower assurance that they could defeat the same DBT as for pure material. Alternatively, NRC could exempt moderately dilute material from some particular requirements that were judged to be burdensome (with appropriate analysis demonstrating that effective security would be maintained without those requirements) rather than from the whole requirement to protect against a DBT.

In short, permitting such a dramatic reduction in security for material that poses only a moderately reduced risk would put both the public health and safety and the common defense and security at undue risk.

## Contradicting decades of studies on nuclear material risks

The NRC staff argues that its conclusion that material containing less than 20 percent by weight nuclear material would be unattractive for use in a nuclear weapon is supported by a classified study from an expert at Los Alamos. The publicly available documentation does not even describe the general argument from this study that supports the staff proposal. Many studies over many decades, however, have come to the opposite conclusion:

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[1] See, for example, Geoffrey P. Alpert and Cynthia Lum, *Police Pursuit Driving: Policy and Research,* (New York: Springer, 2014, pp. 29-42). In some studies, pursuits using helicopters had higher success rates.

- A detailed review by a panel of the National Academy of Sciences panel rated the chemical barriers posed by mixed oxides and other compounds requiring dissolution and separation as a two on a scale of zero to four – where pure plutonium oxide rated one.[2] In other words, moderately dilute material was considered more difficult to make a bomb from than plutonium oxide, but not dramatically so. That panel also argued explicitly that "most potential proliferators with the technical expertise, personnel, and the organization required to produce an operable weapon from separated plutonium—a substantial task in itself—would also be able to extract plutonium chemically from a glass log not spiked with radioactivity. Having to do so would not substantially increase the overall time and cost of building a weapon."[3] The panel clearly had a similar view of the difficulty of separating plutonium from unirradiated plutonium-uranium mixed oxides, as it recommended that not only plutonium metal but even fabricated MOX fuel, until it was inserted into a reactor, be given security comparable to the security provided for nuclear weapons themselves.[4]
- Similarly, in 2000, a U.S. national laboratories team described the barriers to chemical separation of nuclear material from forms such as MOX fuel as "medium," but then added that "the range of difficulty implied by this classification [from insignificant to high] may be rather narrow. Most chemical processes involved in the separation, extraction, and refining of fissile materials are well known and available."[5]
- The Proliferation Vulnerability Red Team (a cross-laboratory group tasked with examining security issues in options for plutonium disposition) argued that the large size and mass of MOX assemblies made the threat of covert theft "non-credible" but would not be a major barrier to overt theft, and that while the chemical processing required was significantly more complex than for pure plutonium oxides, it would not be unduly difficult for adversaries to accomplish.[6]
- In a detailed government study on MOX security from the 1970s, the NRC staff categorized unirradiated MOX fuel as requiring "relatively modest facilities and effort" to recover the plutonium for use in a bomb.[7] Hence, "lowering the

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[2] U.S. National Academy of Sciences, Panel on Reactor-Related Options,, *Management and Disposition of Excess Weapons Plutonium: Reactor-Related Options* (Washington, D.C.: National Academy Press, 1995), http://www.nap.edu/catalog.php?record_id=4754, p. 67.

[3] U.S. National Academy of Sciences, *Management and Disposition of Excess Weapons Plutonium: Reactor-Related Options*, pp. 225-226.

[4] U.S. National Academy of Sciences, *Management and Disposition of Excess Weapons Plutonium: Reactor-Related Options*, p. 72.

[5] "Annex: Attributes of Proliferation Resistance for Civilian Nuclear Power Systems," *Technological Opportunities to Increase the Proliferation Resistance of Global Nuclear Power Systems (TOPS)* (Washington, D.C.: U.S. Department of Energy, Nuclear Energy Research Advisory Committee, 2000), http://www.ne.doe.gov/neac/neacPDFs/FinalTOPSRptAnnex.pdf, p. 12.

[6] J.P. Hinton et al., *Proliferation Vulnerability Red Team Report*, SAND97-8203 (Albuquerque, N.M.: Sandia National Laboratories, October, 1996), http://www.osti.gov/bridge/servlets/purl/437625-gCUCGr/webviewable/437625.pdf, pp. 4.6, 4.8, 4.13-14.14.

[7] Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission,, *Safeguarding a Domestic Mixed Oxide Industry Against a Hypothetical Subnational Threat*, NUREG-0414 (Washington, D.C.: NRC, May, 1978), p. 3.16.

concentration of plutonium through blending should not be used as a basis for reducing the level of safeguards protection."[8]

## Encouraging reduced security for nuclear material abroad

If the NRC staff proposal is accepted, it is likely to influence the way nuclear material is protected in other countries. Advocates argue that this could give countries incentives to store and transport plutonium in dilute form, reducing risks. But this could seriously *increase* risks if countries followed the proposed NRC approach and no longer required that this material be protected against a DBT and allowed operators to rely on a hot pursuit for recovery strategy rather than preventing theft in the first place. This could be particularly dangerous in countries that already have too-modest security measures in place, such as Japan.

## Failing to offer substantial benefits

In addition to posing these substantial risks, the NRC staff proposal offers few benefits to operations that are likely to be undertaken by NRC licensees in the next few decades. The two Category I fuel cycle licensees that presently exist handle pure HEU and will continue to require the highest levels of security; they would see little benefit. Research reactors do not ship their fuel in Category I quantities in any case. The proposed MOX plant would see a substantial benefit, but its more than $30 billion life-cycle cost is not likely to be sustainable. With the administration attempting to put the plant in cold standby while it looks for other alternatives, it appears unlikely that this plant will in fact operate and produce MOX. No commercial reprocessing plant is likely for decades in the United States, on cost grounds alone. Hence, except in the unlikely event that the MOX plant come to operation, there appears to be no obvious benefit from the NRC staff proposal.

In short, the NRC staff proposal calls for too extreme a reduction in security requirements for moderately dilute material. It does not provide the high assurance of protection required by law. And it offers few benefits for licensees. It should be rejected, and more moderate approaches to balancing risk and materials attractiveness should be pursued.[9]

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[8] Office of Nuclear Material Safety and Safeguards, *Safeguarding a Domestic MOX Industry*, pp. 6.8-6.9.

[9] For a further critique of the NRC staff approach and a discussion of an alternate approach, see Matthew Bunn, "What Types of Material Require What Levels of Security?" presentation, Institute for Nuclear Materials Management Workshop on Risk-Informing Security," February 11-12, 2014, http://belfercenter.ksg.harvard.edu/files/materials-attractiveness.pdf.