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February 13, 2007

Arms Control Today

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The Role of Nuclear Forensics in Preventing Nuclear Terrorism

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Nuclear terrorism, a nuclear weapon in the hands of a terrorist, is a picture that we'd rather not envision. The implications of just such a catastrophe demand we consider this scenario carefully and credibly. The role of nuclear forensics in counterterrorism has recently been highlighted in journals and the media (May et al., 2006; Smith and Dunlop, 2006; Ignatius, 2006; Allison, 2006). These public statements have focused on the role of nuclear forensics in the aftermath of a nuclear explosion, but they largely ignored the role of nuclear forensics prior to the mushroom cloud.

In the construct of a layered defense strategy of nuclear counterterrorism, nuclear forensics plays a significant role in both prevention and response. What we emphasize in this letter is that nuclear forensics can potentially help *prevent* the ultimate terrorist attack by enabling a response before the adversary can carry out their plan.

We posit that, for many scenarios, the most likely early warning of an adversary's planned nuclear attack will be their involvement in illicit transfer of nuclear materials. The availability of these materials to terrorists poses the most significant danger. Not only is illicit trafficking one of the more likely early warning signals, it may well be the only warning prior to detonation at the target. Whenever this type of warning arises, nuclear forensics should be utilized to fully exploit the evidence.

Nuclear forensics involves the analysis of nuclear materials and/or devices (and associated material) to identify the source of the materials or devices, the route of transit, and ultimately to contribute technical evidence for nuclear attribution, i.e. determining who was responsible (IAEA, 2006). Thus, a nuclear forensics investigation of interdicted nuclear material can potentially help to answer such questions as: Is there a leak in one of the known holdings of nuclear material? Where was legitimate control lost? Is this case connected to previous cases? How did the material come to be where we found it? And of course, ultimately, can we link this material to the perpetrators?

The point about linking the material to prior cases deserves emphasis. A case becomes more significant if it can be linked with other evidence that demonstrates a sustained effort to sell, or obtain, nuclear material. Enhanced awareness of the spectrum of nuclear forensics casework warrants heightened attention by government agencies. The example from law enforcement indicates that the combined evidence from two related cases enhances the probability of solving them both. For this reason, even some incidents that appear to be of a relatively low threat, e.g. low enriched uranium, ought to be investigated, because they may represent precursors of more serious threats. For example, the adversary may be attempting "trial runs" of their ability to transport nuclear material without being detected.

Nuclear forensics also helps us understand the history of the interdicted material. This role is especially valuable when we've accomplished the difficult task of detection and interdiction. Should we end the case by congratulating ourselves on the successful interdiction? Or should we instead exploit the interdiction as fully as possible by vigorously leveraging the material evidence. If the source of the leak can be identified, steps can be taken to close that leak. And it could well be that other attempts to detonate a nuclear bomb are being executed concurrently, just as in 9/11 when more than one airplane was hijacked and directed against multiple targets. Nuclear forensics can be the key to thwarting such a coordinated multi-pronged attack.

Ultimately nuclear forensics can prevent and deter only to the extent that it enables an effective response by governments. Deterrence works only when the adversary perceives that the purported response is credible and unacceptable. In the case of a nuclear detonation, the typical stated (or implied) response is commensurately severe. Some have questioned the government's willingness to launch a devastating counterattack, especially when the evidence against the adversary might not be compelling. When the episode involves intercepting nuclear materials at an earlier stage, the response will be less draconian and thereby viewed as more credible. By focusing more attention on nuclear forensics prior to a detonation, an earlier warning becomes more likely, and such an early warning enables a wider range of credible options for response by the government.

What steps could be taken to enhance the usefulness of nuclear forensics in preventing nuclear terrorism?:

First, seek to establish a new international norm that places far greater importance on conducting nuclear forensic investigations for interdictions of illicit nuclear materials. In a majority of past incidents, the investigation was conducted in the context of local government laws, often from the customs perspective that places a premium on the monetary values of the interdicted material, i.e. if you can't sell it for much, we don't care much. New policies are necessary that emphasize threats to international and national security from these incidents. All governments must be committed to pursuing these illegal acts to the fullest extent possible. The means of creating such an international norm is beyond the scope of this paper (and the competence of its authors), but it surely would greatly enhance the global ability to detect early warning sign of nuclear terrorist activity.

Second, greatly expand international cooperation in both developing nuclear forensics (as it is a newly emerging discipline) and conducting nuclear forensic investigations. Nuclear smuggling is an international problem; identified smuggling routes do not neatly coincide with state borders. An informal group, the Nuclear Smuggling International Technical Working Group (ITWG), has been working towards just that end since 1995 (Koch et al., 1999). The ITWG continues to make progress, but it would benefit greatly from new policies that would support a greater level of cooperation. Examples are: a) much more vigorous development of bi-lateral R&D projects, b) establishing relationships for working cases collaboratively, c) developing a global "knowledge base"

system that would draw upon subject matter experts and associated information in a way that also protects national interests, and d) expanded scope of participation in the ITWG by new member states and organizations affected by nuclear trafficking.

Third, the U.S. government should make greater investments in improving its nuclear forensics capability. The magnitude of the investment depends upon the extent to which policymakers agree upon the relative importance of nuclear forensics in a national strategy for counterterrorism and nonproliferation. We suggest that the current level of investment will only slowly move the U.S. from a fledgling capability to a mature one. If we are to embrace an international objective of true nuclear accountability, the appropriate technologies must enable the U.S. and its partner governments to trace illicit nuclear materials back to their points of origin and unauthorized diversion as well as help identify those responsible for these acts.

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This work was performed under the auspices of the U.S. Department of Energy by University of California, Lawrence Livermore National Laboratory under Contract W-7405-Eng-48.