

Thoughts on Promoting Best Practices for the Security of of Nuclear Materials and Facilities

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The events of 11 September 2001 underscore the urgency of assuring the highest attainable standards of safety and security for nuclear weapons, materials, and facilities. A once hypothetical threat has been made all too vivid and real. Osama bin Laden called the acquisition of weapons of mass destruction a “religious duty.” There is evidence that al Qaeda and Taliban agents tried to buy or steal nuclear weapons and nuclear materials, and tried to enlist the technical assistance of Russian and Pakistani nuclear weapon scientists and engineers. There is little doubt that bin Laden would have ordered the use of a nuclear weapon if he had succeeded in acquiring one. There also is evidence that al Qaeda had plans to disperse radioactive materials and to attack nuclear power reactors.

Eliminating al Qaeda (if that were possible) would not eliminate this threat. Aum Shinrikyo, which succeeded in manufacturing its own chemical agents, also sought nuclear materials. We can expect that other terrorist and criminal groups will continue this pattern of trying to reach the highest levels of violence. The problem is not limited to terrorists: there is evidence that agents of some states have tried to purchase nuclear weapons and materials and recruit nuclear experts.

A full response to this threat has many components. Most important are physical protection and personnel reliability. Nuclear materials and facilities must be protected against a coordinated terrorist attack, which may include the help of insiders, with a combination of physical barriers and armed guards. There must also be measures to ensure that the guards and all people responsible for handling nuclear materials and operating nuclear facilities are trustworthy, in order to minimize the possibility of insider conspiracy. Also important are material control and accountancy, to constantly monitor and accurately measure nuclear materials so that any theft could be detected in time to allow an effective response, and to provide assurance that no theft or significant loss of nuclear material has occurred.

An International Responsibility

To date, physical protection and personnel reliability have been almost exclusively a national responsibility. Standards, laws, and practices vary widely from country to country. Material control and accountancy are subject to IAEA audit only in non-nuclear weapon states. (The five nuclear weapon states have voluntary offers to submit some or all of their civilian facilities to inspection, but the IAEA does not have the resources to do this, and facilities in non-NPT states remain outside IAEA safeguards.)

There are strong reasons to believe that the physical protection of materials and facilities, personnel reliability, and material control and accounting should be subject to substantially greater levels of international cooperation, funding, and standard-setting:

- Limiting access to fissile materials is the principal barrier to the acquisition of nuclear materials. Almost any state can build a workable nuclear device if it has the fissile material in hand. Even a sophisticated terrorist group may be able to do so if they have access to high-enriched uranium or if they have enlisted the help of experienced nuclear weapon scientists.
- Nuclear weapons pose a threat to all nations. The UN Security Council has declared that the spread of these weapons is a threat to international peace and security. The international community has a legitimate and overwhelming interest in seeing that all nuclear weapons and fissile materials everywhere are secure and accounted for.
- Nuclear weapons are not the only threat. Attacks against nuclear facilities—particularly power reactors and nuclear waste storage facilities—could have devastating and transnational consequences. The dispersal of radioactivity in city centers could sow panic and have enormous economic impacts, even if it would result in few or no immediate deaths.
- No country is immune from terrorist threats. Al Qaeda had coordinated operations involving many agents in at least a dozen countries on four continents. Those seeking to steal nuclear materials or attack nuclear facilities will go where security is weakest; those seeking to buy nuclear materials will buy them wherever they are available. A chain is only as strong as its weakest link. All materials and facilities everywhere must be well protected.

Vulnerable Materials and Facilities

Fissile materials should receive the same degree of protection as nuclear weapons. Unfortunately, this is not the case today. The most acute and best known weaknesses are in the former Soviet Union, where the collapse of the state and the economy left vast quantities of nuclear materials inadequately protected. Between 1992 and 1994 there were five confirmed cases in which kilogram quantities of high-enriched uranium and plutonium were stolen from Russian facilities. This triggered the creation of a US program to purchase excess fissile materials from former Soviet states and to assist in improving the protection, control, and accounting of their nuclear materials by installing fences, alarms, portal monitors, and the like. As of last year, security upgrades had been completed at facilities containing 20 percent of Russia's stockpile of fissile material. Nevertheless, a report released this month by US National Intelligence Council concluded that undetected (but unquantifiable) smuggling has occurred. The report quotes a Minatom official saying that enough material for a bomb was stolen from a facility in 1998.

A key problem is that technical systems are only as reliable and effective as the people who operate them. Personnel reliability programs combined with a culture that values the highest levels of safety and security are absolutely vital. There are reports of employees at Russian facilities leaving doors unlocked and guards leaving their posts, turning off alarms, and allowing employees to bypassing portal detectors, simply to avoid the minor inconvenience imposed by the security measures.

These shortcomings are by no means confined to the former Soviet Union. There are anecdotal accounts of serious vulnerabilities at facilities in Europe. Visitors to the plutonium-handling area at a MOX fabrication plant were greeted by a single armed guard; when they left the area, the guard was gone. At another European facility, lightly irradiated HEU reactor fuel, cool enough to handle, is secured by a old chain-link fence and a single watchman. At another European facility, fresh HEU fuel is stored with even weaker security measures

The United States, which spends over \$800 million dollars a year on safeguards and security at Department of Energy sites, also has difficulty achieving high standards of physical protection. In recent exercises, federal agents posing as commandoes were able to breach security and gain access to fissile material more than half of the time; in most of these cases, facility officials had been notified of the exercise well in advance. This includes facilities such as Pantex, Rocky Flats, Los Alamos, and Savannah River. For example, there recent press reports describe exercises in which employees were able to remove fissile material from facilities without detection, and mock terrorist teams were able to penetrate facilities and remove material without suffering casualties. Although the results are dismaying, DOE should be applauded for conducting such exercises in order to identify vulnerabilities. More troubling is the fact that some countries that store fissile materials do not have such exercises and are not actively seeking to improve their security systems.

In short, today there are many facilities in many countries where a small but well-armed and well-trained terrorist group would have a good chance of stealing fissile materials. There are many more facilities where such a group would have a good chance of sabotage.

More Cooperation, Higher Standards

What can be done? In the short term, there should be an informal but well-funded and high-priority efforts to encourage international cooperation and peer review to improve material protection, control, and accounting around the world. In the medium term, there should be an effort to develop binding standards in this area, complete with international inspection to ensure that these standards are being met.

Greater International Cooperation

The highest priority is to improve the actual security of nuclear materials and facilities around the world. This cannot and need not wait for formal international agreements on higher standards.

The U.S.-Russian program to improve MPC&A is one activity that could serve as a model for bilateral and multilateral cooperation. Under this program, the U.S. has spent hundreds of millions of dollars to quickly improve safeguards and security at dozens of Russian facilities; it expects to spend a total of \$1.5 billion. Much of this money has been spent in Russia, stimulating the creation of a domestic industry in detectors, portal monitors, and other equipment for MPC&A. Japan and European countries have contributed to these activities in a relatively small way; they should be encouraged to do more, particularly at civilian facilities. Much work remains to be done.

Bilateral and multilateral cooperation to improve MPC&A should be extended to include any country that possesses high-enriched uranium or separated plutonium. All countries have incentives to ensure that their nuclear materials and facilities are accounted for, and are secure against theft and sabotage. Chinese experts have expressed interest in cooperating with US experts in modernizing MPC&A systems. It seems possible that such cooperation also could occur between the United States and India. This might begin with meetings in which experts for both sides discuss, in general terms, their procedures and systems. This might lead to visits to less-sensitive civilian facilities, in order to identify opportunities for improving security and accounting. The experience gained could then be applied to more sensitive facilities. Since physical protection is mostly concerned with assuring the integrity of the perimeter, this need not require access inside sensitive facilities.

A related activity is the IAEA's International Physical Protection Advisory Service (IPPAS), under which a member state can request an international expert peer review of its physical protection program, as well as financial assistance to upgrade physical protection if it is found wanting. This is analogous to the peer-review programs to improve the operational safety of nuclear power reactors that have been in place for some time. Unfortunately, because of inadequate funding the IAEA has been able to conduct peer reviews in only twelve countries.

Funding for IPPAS should be increased substantially. All IAEA member states with fissile materials should be encouraged to participate in this peer review program. Although there might be concern that such activities would reveal vulnerabilities, and that this information might leak to terrorists or other groups with hostile intent, the IAEA has a good track record of protecting confidential information, and careful selection of the peer review teams could minimize these concerns. It is, in any case, more important to identify and correct deficiencies than to try to keep them secret.

As noted above, physical protection systems are only as good as the people who run them. Thus, it is equally important that countries have effective programs to test the reliability and trustworthiness of personnel that have access to fissile material or help protect fissile material from theft. Bilateral cooperation or IPPAS peer reviews should include discussion of personnel reliability programs, with experts sharing their experience with techniques such as background and credit checks, regular physical and psychological tests, random drug screening, polygraph tests, two- and three-man rules for access to certain locations, and so forth.

Less urgent, but still important, are consistent standards and practices for nuclear material accounting. Today, only non-nuclear weapon states must regularly subject their national systems of material accounting to IAEA audit. It would be helpful if *all* civilian nuclear programs were subject to this same discipline. The possibility that India might voluntarily place its civilian nuclear facilities under IAEA safeguards has been discussed in the past. This would be a very useful, inasmuch as it would send the message that India values the principle of safeguards. It has also been suggested that this move might open the door to greater cooperation between the civilian nuclear programs of India and other states, particularly on the safety and reliability of power plants. The IAEA safeguards budget should be increased so that it can take full advantage of voluntary offers and actually apply safeguards in the nuclear weapon states. In addition to helping assure the international community that weapon states have high standards of material accounting, this would help pave the way for a fissile material cutoff treaty.

It makes sense to ban the production of fissile material outside of safeguards. Unfortunately, efforts to negotiate a formal convention have bogged down. An alternative would be for the nuclear weapon and non-NPT states to formally announce that they have ended the production of fissile materials for weapons purposes. This could be accompanied by confidence-building measures, such as voluntarily placing reprocessing and enrichment facilities under IAEA safeguards, or more informal “site visits” by expert teams to facilities to confirm that they are shut down or are processing only civilian materials.

Excellent material accounting and record keeping will be important over the longer term for the negotiation of deep and comprehensive reductions in nuclear forces are negotiated, and particularly for the prohibition of nuclear weapons. The case of South Africa is highly instructive in this regard. Although the IAEA was able to readily verify the *accuracy* of South Africa’s material declaration (i.e., that a certain amount of high-enriched uranium had been recovered from dismantled weapons and was stored in a vault), it had great difficulty confirming that this declaration was *complete* (i.e., no additional material had been produced and hidden from inspectors). A accurate material balance was impossible because of poor accounting practices (e.g., the enrichment tails were not assayed). In the end, the IAEA relied on interviews with personnel and inspection of original facility operating documents to gain confidence that the declaration was complete.

The accounting uncertainties are far greater in weapon states that have produced much more material. The inventory difference for US plutonium is nearly three tons. (It is hoped that this will be reduced as facilities such as Rocky Flats are decontaminated and dismantled.) Uncertainties in Russian inventories are undoubtedly higher, and the accounting uncertainties for HEU are higher still. It is important for weapon states to minimize these accounting uncertainties today, while the original records and facilities and people who operated them are still available. It should be possible for weapon states to share their experiences in this regard and offer technical assistance in producing the most accurate accounting possible.

Higher International Standards

The only binding international standard for the physical protection is the Convention on the Physical Protection of Nuclear Material, of which India is, I believe, the most recent member. Unfortunately, the Convention's provisions are very general and cover only civilian material in international transport, and it contains no provisions for verification or enforcement (even voluntary reporting or peer review). Nevertheless, we should encourage universal participation. Today, only 74 countries are parties, including only 36 of the 44 countries listed in Annex 2 of the CTBT.

The IAEA has issued a far more detailed and comprehensive set of recommendations on the Physical Protection of Nuclear Material and Nuclear Facilities, known as INFCIRC/225, which was updated most recently in 1999. These guidelines now recommend that states develop "design basis" threats for theft and sabotage of facilities, and recommend personnel reliability programs. Unfortunately, these guidelines are purely advisory.

The United States has proposed that the Convention on Physical Protection be amended to extend its coverage to all civilian nuclear materials, and require that states provide levels of protection comparable to INFCIRC/225, and to require that states provide reports on their physical protection programs to the IAEA every five years. Although a subsequent experts meeting endorsed the idea of extending coverage to domestic civilian materials, it appears that some states remain opposed to binding international standards for physical protection and any verification that standards are being met. This should be reconsidered in the wake of 11 September, and India could play an important role here.

Amending the Convention is a long-term proposition. In the near term, states could voluntarily pledge to observe the INFCIRC/225 recommendations, and to welcome international peer review teams to assume that these standards are being met.

Conclusion

Theft of nuclear materials and sabotage of nuclear facilities pose grave threats to international security. Every nation with fissile materials or significant nuclear facilities should urgently reassess its security and accounting practices and standards in light of the threat demonstrated on 11 September, and upgrade them where necessary. States should cooperate to the maximum extent possible, either bilaterally or through IAEA. Over the longer term, states should agree to binding standards for the protection of nuclear material.

This paper has touched on only part of a broader agenda, that would include international coordination on export controls, border security and law enforcement cooperation to combat nuclear smuggling, and complementarily domestic legislation. All these topics, and more, should be open to international cooperation.