Nuclear Threat Reduction CAMPAIGN

A program of Vietnam Veterans of America Foundation and The Justice Project

INTERNATIONAL NUCLEAR SECURITY STANDARDS

I: The Issue

Despite increasing concerns about nuclear terrorism, nuclear weapons and fissile materials -- the key ingredients for making nuclear weapons -- remain vulnerable to theft around the globe. The lack of a universal and verifiable agreement concerning security standards allows for wide variation in levels of security at facilities that house nuclear weapons and materials. Because of the destructive capacity of a single nuclear weapon, insecure material in one country places the entire international community in danger. Charles Curtis, president of the Nuclear Threat Initiative, stated the issue succinctly: "The worldwide system of security for nuclear materials is no stronger than the system at the weakest, worst-defended site."[1]

The global stockpile of fissile material is estimated at roughly 443 tons of plutonium and 1,665 tons of highly enriched uranium (HEU), including material in close to 32,000 nuclear warheads.[2] The United States and Russia maintain 93% of the world's military plutonium and 96% of its HEU, but they account for only 35(18%) of the 195 tons of civilian controlled plutonium.

To manufacture a nuclear weapon, a terrorist need only acquire about 4-5 kilograms of plutonium (about the size of baseball) or 12-15 kilograms of HEU (about the size of a softball).[3]

Despite the obvious need to prevent even a small amount of nuclear material from falling into the wrong hands, the security of fissile materials and weapons ranges from virtually impervious to almost nonexistent. The inconsistent physical security for fissile material is the result of three general factors.

- **Variation in Resources:** Often, a lack of adequate funding precludes sufficient physical security. Some nations, like the United States, can incorporate cutting edge technology and significant manpower to prevent theft; some other nations rely on as little as a chain-link fence, a lone guard, and a padlock.[4]
- **Inadequate Global Governance:** There are no universal, comprehensive, and verifiable security standards regarding nuclear weapons and fissile material. The Nuclear Non-Proliferation Treaty (NPT) "safeguards" system is designed to verify that states do not divert nuclear materials and technology from peaceful applications to weapons use, but it does not address the threat from individuals, terrorists, or other non-state actors. The only international agreement that addresses physical security issues, the Convention on the Physical Protection of Nuclear Material (CPPNM),[5] outlines security requirements for civilian nuclear material in international transit only. Civilian fissile material in use, storage, or domestic transit and all military fissile material (99% of the global stockpile at any given time) are unregulated.

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- **Insufficient Cooperation and Information Sharing:** There is no international organization specifically charged with monitoring security, compiling best practices, or sharing potential threat information regarding nuclear materials. In recent years, the International Atomic Energy Agency (IAEA) has facilitated some cooperation among state parties but such programs are voluntary and often under-funded. The lack of official cooperation precludes the international community from effectively identifying the points of weakness, diagnosing the problems, and taking appropriate and expedient action to secure vulnerable weapons or materials.[6]

The Evolution of Physical Security Standards

Historical efforts to establish security standards for nuclear weapons and fissile materials have been narrowly focused, with deliberately vague recommendations so as to "protect" the sovereign interests of the participants. During the Cold War, states were viewed as the main threats to nuclear proliferation. Hence, the NPT and related agreements focused on the theft or diversion of nuclear materials and technologies by other states. Individuals and other non-state actors were not addressed.

In 1971, the IAEA convened an advisory group to assess the problem of physical protection and submit recommendations on how to improve security measures worldwide. A year later, the group released voluntary guidelines, entitled *Recommendations for the Physical Protection of Nuclear Materials*, widely known as the "Grey Book." At the first NPT review conference in 1975, the IAEA amended and published these recommendations as a benchmark for securing nuclear materials, though there remained no obligation on the part of any member state to institute the suggestions.[7]

With the release of the Grey-Book guidelines, the 1975 NPT review conference also called for more "concrete recommendations for the physical protection of nuclear material in use, storage and transit, including principles relating to the responsibility of States, with a view to ensuring a uniform, minimum level of effective protection for such material."[8] This appeal inspired the negotiation of the Convention on the Physical Protection of Nuclear Material (CPPNM) by the end of decade. Endorsed by the United States, the convention was submitted for signature in October 1979. The Senate gave its advice and consent to the ratification of the convention in 1981, and the treaty came into force in 1987.[9] Upon signing the implementing legislation, President Reagan declared: "This step symbolizes our firm commitment both to preventing the spread of nuclear explosives and to fighting the scourge of terrorism."[10]

As noted above, however, the CPPNM presents a very narrow view of the physical security problem, applying only to civilian nuclear materials in international transit—typically less than one percent of the world's nuclear materials.[11] Moreover, the treaty stipulates very vague standards with no certification procedures, bringing into question its utility even in the narrow arena in which it applies.[12] The CPPNM, however, does require that its parties legislate against civilian fissile material theft and settle issues of jurisdiction, prosecution, and extradition for such crimes. Without adequate security measures, however, such laws can do little to prevent theft by determined individuals.

Outside the CPPNM

Periodically, the IAEA revises and updates the Grey Book guidelines though they remain strictly advisory. In the fourth and latest Grey Book update in 1998,[13] the IAEA added recommendations on preventing sabotage and suggested that each state develop a "design basis threat" (DBT), *i.e.*, a physical security specification focused on descriptions of the kinds of threats that a facility must be able to defeat, not just requirements as to protective barriers, equipment, and personnel.[14] The amendments, however, did not specify a global minimum threat, allowing each state to decide what threats are relevant within their jurisdiction.[15]

In order to facilitate the implementation of its Grey Book guidelines, the IAEA began to extend training assistance, perform advisory inspections when requested, and organize international conferences for interested nations in 1995. The training courses cover not only the techniques and policies of physical protection but also the creation and assessment of a DBT. Countries outside of the CPPNM, including Iran and Egypt, have participated in these training courses.[16]

The IAEA's International Physical Protection Advisory Service (IPPAS) performs onsite advisory inspections at the request of individual states. These evaluations review physical protection systems, assess whether they meet international standards, and submit recommendations for improvement if necessary. IPPAS inspections have been performed throughout Central and Eastern Europe, South America, and Africa.[17] As IPPAS is granted access to a country's highly sensitive facilities, its reports and recommendations are strictly confidential and made available only to the inspected state, and the international community does not know what reforms were suggested or completed. Furthermore, there is no UN assistance program to support the implementation of the IPPAS recommendations, and, if adequate funding is attained, no verification procedure to confirm that they have been effectively carried out. Thus, an IPPAS inspection does not necessarily mean that needed reforms are made and sustained.[18]

In 1997, the IAEA convened its first Conference on Physical Protection, providing an important forum for the international community to discuss designing and implementing physical protection systems. At the conference, the participants were surveyed about various aspects of domestic physical protection policy. Analysis of the survey results revealed several factors that contributed to the widespread differences in protection policies other than the absence of international standards. These included variations in the perceived threat from country to country, a wide range of abilities to finance updated security measures, differences in legal and regulatory authority, and the diversity of cultural attitudes regarding key security issues such as arming guards and performing background investigations.[19] Subsequent conferences on these issues, such as the International Seminar on Material Security in 2000, have sought to build among the participants a consensus regarding the physical security problem.

The Nuclear Suppliers Group (NSG) has also wrestled with the issue of physical protection. The NSG requires that all recipients of nuclear exports adhere to a minimum set of security standards, albeit similar to the vague guidelines enumerated in the CPPNM.[20] In other instances, states have agreed to assist in improving another nation's security measures, often implementing the IAEA guidelines. Examples of this bilateral cooperation include the U.S.

Materials, Protection, Control, and Accounting (MPC&A) program in the former Soviet Union, and the G-8 Programme for Prevention and Combating Illicit Trafficking.[21]

As part of the broader international effort against terrorism, Russia proposed the International Convention for the Suppression of Nuclear Terrorism in 1996. The ensuing draft convention would require states to provide physical protection for nuclear materials using the IAEA recommendations as a guideline.[22] However, some developing countries have balked at the definition of "nuclear terrorism," insisting that the convention should prohibit any use of nuclear weapons, even by nuclear weapon states—a development that Russia and United States resist. [23] Thus, the Ad Hoc committee charged with preparing a broadly supported draft convention has made little progress.

Amending the CPPNM

In 1998, Secretary of State Madeline Albright proposed a draft revision of the CPPNM that would enumerate additional standards for the domestic use, storage, and transport of civilian nuclear material. The proposal also suggested that the latest IAEA guidelines be used as a minimum benchmark for physical security and included a new reporting process on each party's security status every five years. The U.S. revision, however, did not call for IAEA inspections or other mandatory verification measures; it allowed for member states to refuse to release information on national security grounds; and it ignored military nuclear material altogether.[24]

In response, experts from over 40 countries convened in Vienna in 1999 and 2000 to discuss the U.S. proposal. In addition to the changes put forward by Secretary Albright, the meetings outlined three additional areas of concern; illicit trafficking, the privatization of the nuclear industry, and the increasing amount of nuclear material outside of weapons due to warhead dismantlement in the United States and Russian Federation.[25] Five EU countries, Belgium, France, Germany, Sweden, and the United Kingdom (all in possession of significant amounts of civilian plutonium), expressed reluctance to change the CPPNM and proposed further study of the likelihood of illicit trafficking and the effects of the existing regulations. At the close of the meetings, the experts voted for further study in lieu of the U.S. proposal.[26]

The expert committee met again in May 2001 and ultimately recommended amending the CPPNM. The committee's advice included extending the scope of the CPPNM to the domestic use, storage, and transport of civilian material, requiring state parties to protect against sabotage and theft, and calling for state parties to establish an independent regulatory framework for the physical protection of nuclear material.[27] The experts did not call for any additional standards (or make any reference to the IAEA guidelines), or any system of verification or peer review (including reporting by the state's themselves). Furthermore, all military material was excluded from coverage.[28]

Confronting the Terrorist Threat:

The 2001 attacks on the World Trade Center and Pentagon underscored the need for increased international attention to the possibility of nuclear weapons or fissile materials falling into the hands of terrorists or rogue states. Osama Bin Ladin has expressed his desire to acquire and use nuclear weapons against the United States and its allies and, with enough material, Al Qaeda could manufacture a crude but effective nuclear weapon rather easily.[29] Furthermore, the

vast black market network formerly overseen by Pakistani scientist A.Q. Khan makes this threat more tangible and imminent as more facts come to light.[30] In the new strategic reality of smaller and elusive non-state threats, the CPPNM and voluntary IAEA guidelines are devastatingly inadequate.

The state parties to the CPPNM are continuing to move forward with the amendments suggested by the expert committee in May 2001 but the suggestions remain essentially unchanged, even in light of the September 11th attacks,[31] and are thus very unlikely to result in a sufficiently strong agreement.[32] Also, although the CPPNM has 103 parties as of April 2004, significant states remain outside of its framework, notably Iran and North Korea.[33]

Some experts point to the new awareness of non-state threats as the ultimate justification for more comprehensive security requirements for the world's nuclear stockpile and recommend a new U.S. effort. Thus, a recent article in *Foreign Affairs* by Graham Allison, director of the Belfer Center for Science and International Affairs at Harvard University, urges:

> "The centerpiece of a serious campaign to prevent nuclear terrorism…should be denying terrorists access to weapons and their components. After all, no nuclear weapon or material means no nuclear terrorism; it's that simple."[34]

Allison goes on to suggest the development and implementation of an International Security Standard, an initiative to be led by the two largest nuclear powers, the United States and Russia. With these two powers in agreement, he recommends that they approach other nations and "make it clear that [implementing the standard] is not a negotiable demand."[35]

Matthew Bunn, an expert at Harvard's Project on Managing the Atom, supports the negotiation by a larger number of countries, ideally including Russia, of a treaty that would cover both military and civilian nuclear materials, incorporate stringent standards, allow for peer review and verification, and provide assistance to interested states to join the agreement. Bunn suggests that the agreed-upon standards should be "performance-based" rather than "rule-based"—in other words, the focus should be upon the size and nature of the threat that defenses must be able to defeat rather than the thickness of a wall or height of a fence.[36]

II. Recent Legislation

N/A

III. Obstacles

- Not every nation that possesses fissile material can afford to dedicate the funding and manpower necessary to sufficiently secure its stockpile.

- While there is a broad consensus that fissile materials and nuclear weapons need to be safeguarded, there is disagreement regarding the size and nature of the threats that need to be thwarted.
- Citing national security and state sovereignty concerns, states have traditionally resisted efforts to dictate security standards for nuclear weapons arsenals and military fissile

material stockpiles, even though these categories encompass 91% of the fissile material in the world.[37]

- As more Cold War era weapons are destroyed and the nuclear industry is increasingly privatized, larger amounts of nuclear material will be under civilian and/or private control. The material will no longer be protected by the military and will not fall under the CPPNM regulations most of the time.
- The international community does not have an organization in charge of monitoring security, gathering and promulgating the latest technologies and techniques, and sharing identified threats regarding nuclear materials.

IV. Q & A

Q: Why amend the CPPNM or otherwise mandate new standards? No nuclear material has been stolen successfully.
A: While there are no official reports of significant amounts of fissile material having been stolen,[38] this does not mean that the existing security measures are sufficient to thwart terrorist or criminal attempts to steal nuclear weapons or materials. International agreements regarding the physical security of fissile material were written specifically with states in mind and are inadequate to confront the threat from terrorist, insider, or other "non-state" threats. The environment has changed dramatically; it is time for the regulatory regimes to change as well.

Q: Why should the United States do more when it already supplies massive amounts of security assistance to Russia and the other states of the former Soviet Union?
A: As the unquestioned leader in the international arena, no international agreement regarding fissile materials would go anywhere without U.S. involvement. While U.S. assistance to Russia and the former Soviet Union has achieved a great deal, loose fissile material is a problem of truly international proportions and a threat to U.S. national security. Those seeking to steal nuclear weapons or their raw materials will naturally go to the place with the weakest security. It is in the U.S. interest to ensure that nuclear weapons and fissile material anywhere in the world are adequately protected from theft.

Q: Even if terrorists acquire sufficient fissile material to make a nuclear weapon, could they really construct a working device?
A: The biggest obstacle for a terrorist group that seeks to have a nuclear weapon is acquiring the fissile material for the chain reaction, as HEU and Pu do not occur in nature. The design of a gun-type nuclear device (Hiroshima-type bomb) is simple enough that a group such as al Qaeda could easily acquire the technical expertise needed to build one.

V. Talking Points

- The fact is, however surprising or hard to believe, there are no international standards for the security of nuclear weapons and material.

- The 1987 Convention on the Physical Protection of Nuclear Materials (CPPNM) only applies to civilian nuclear material while in international transport, less than one percent of the world's nuclear stockpile at any given time.

- IAEA guidelines for protecting nuclear materials, which are periodically updated to confront emerging threats, remain strictly voluntary.
- Revisions to the CPPNM, though a step forward, would still likely (1) fail to safeguard military fissile materials; (2) not include any verification mechanism, and (3) present overly vague guidelines for the member states. Thus, current international efforts are unlikely to develop meaningful, enforceable standards.
- The United States should take the lead in enlisting a number of nuclear powers in an effort to produce a new international agreement that covers both military and civilian nuclear materials, incorporates stringent standards, provides for peer review and verification, and provides assistance to interested states to join the agreement.

VI. Factoids

- The global stockpile of nuclear materials contains over 2,100 tons of highly enriched uranium (HEU) and plutonium, including over 32,000 nuclear warheads. Only 13 trillionths of a percent (.000013%) are necessary to build a nuclear weapon.
- There are 195 tons of plutonium, enough for approximately 48,000 nuclear weapons, in the global civilian nuclear stockpile. Russia and the United States only account for 35 tons (18%) of this amount.
- As little as 4-6 kilograms of plutonium, about the size of a baseball, or 12-15 kilograms of HEU, about the size of a softball, could be used to manufacture a weapon about as powerful as the one that destroyed Hiroshima.

VII. Applicable Treaties, Legislation, and Other International Agreements

- The Convention on the Physical Protection of Nuclear Materials[39]
- *The Physical Protection of Nuclear Materials*, International Atomic Energy Agency "Grey Book" – INFCIRC 225 (Rev. 4), 1999[40]

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[1] Charles B. Curtis, "Reducing the Nuclear Threat in the 21st Century," *Symposium on International Safeguards, Verification and Nuclear Material Security: International Atomic Energy Agency,* October 29, 2001, accessed at: http://www.nti.org/c_press/c1_speeches.html.

[2] Global military and civilian stockpile estimates are taken from the Institute for Science and International Security website. For military fissile material estimates see: http://www.isis-online.org/mapproject/supplements.html; for excess military fissile material estimates see: http://www.isis-online.org/publications/puwatch/excessmil.html; for civilian plutonium estimates, see David Albright and Mark Gorwitz, **"**Tracking Civil Plutonium Inventories: End of 1999," accessed at: http://www.isis-online.org/publications/puwatch/sepputable.html.

[3] The amount of fissile material necessary for a nuclear explosion depends on the level of enrichment and design of the nuclear weapon. For the purposes of this paper, we will use 4-5 kilograms of plutonium and 12-15 kilograms of highly enriched uranium taken from: Matthew Bunn, Anthony Weir, and John Holdren, *Controlling Nuclear Warheads and Materials: A Report Card and Action Plan* (Washington D.C.: Nuclear Threat Initiative and the Project on Managing the Atom, Harvard University, March 2003), p. 13.

[4] Matthew Bunn, *The Next Wave: Urgently Needed New Steps to Control Warheads and Fissile Material*, (co-published by the Carnegie Endowment for International Peace and the Harvard Project on Managing the Atom) March 2000. pp. 9-19, accessed at: http://bcsia.ksg.harvard.edu/BCSIA_content/documents/FullNextWave.pdf.

[5] The text of the convention can be accessed at: http://www.state.gov/www/global/arms/treaties/nucmate1.html.

[6] Matthew Bunn, "Securing Nuclear Warheads and Materials: Global Nuclear Security Standards," Nuclear Threat Initiative, January 29, 2003, accessed at: http://www.nti.org/e_research/cnwm/securing/standards.asp.

[7] Emily Bailey, Richard Guthrie, Darryl Howlett, and John Simpson, *Programme for Promoting Nuclear Nonproliferation (PPNN) Briefing Book, Volume I: The Evolution of the Nuclear Nonproliferation Regime*, PPNN 2000, p. 40, accessed at: http://www.ppnn.soton.ac.uk/bb1table.htm.

[8] "Treaty on the Nonproliferation of Nuclear Weapons: Final Declaration of the First NPT Review Conference," Center for Nonproliferation Studies, accessed at: http://cnsdl.miis.edu/npt/dec1/dec1.htm#I%20AND%20II.
[9] "Convention on the Physical Protection of Nuclear Material," United States Department of State, accessed at: http://www.state.gov/www/global/arms/treaties/nucmate1.html.
[10] "Statement on Signing the Convention on the Physical Protection of Nuclear Material Implementation Act of 1982," Ronald Reagan Presidential Library, accessed at: http://www.reagan.utexas.edu/resource/speeches/1982/101982a.htm.
[11] Matthew Bunn, *op. cit.*, note 6.
[12] *Ibid.*
[13] International Atomic Energy Agency, *The Physical Protection of Nuclear Material, INFCIRC 225* (Rev. 4) (Vienna, Austria: 1999).
[14] Anita B. Nilsson, "Physical Protection: Strengthening the Security of Nuclear Material," *IAEA Bulletin*, 41:4 1999, p. 35.
[15] Matthew Bunn, *op. cit.*, note 6.
[16] International Atomic Energy Agency, *Annual Report 2002*, p. 73.
[17] Anita B. Nilsson, *op. cit*., note 14; and, *Ibid.*
[18] Matthew Bunn, "Securing Nuclear Warheads and Materials: International Nuclear Material Security Upgrades," Nuclear Threat Initiative, October 29, 2002, accessed at: http://nti.org/e_research/cnwm/securing/secure.asp.
[19] George Bunn, "Raising International Standards for Protecting Nuclear Materials from Theft and Sabotage," *Nonproliferation Review*, Summer 2000, p. 148.
[20] Matthew Bunn, *op. cit.*, note 6.
[21] Bonnie D. Jenkins, "Viewpoint: Establishing International Standards for Physical Protection of Nuclear Material," *Nonproliferation Review*, Spring-Summer 1998, p. 102, accessed at: http://cns.miis.edu/pubs/npr/vol05/53/jenkin53.pdf; and, Matthew Bunn, *op. cit.*, note 6.
[22] Matthew Bunn, *op. cit.*, note 6.
[23] George Bunn, *op. cit.*, note 19, p. 153.
[24] *Ibid*, p. 152.
[25] *Ibid.*
[26] *Ibid*, p. 153.
[27] Matthew Bunn, *op. cit.*, note 6.
[28] *Ibid.*
[29] Mike Boettcher and Ingrid Arnesen, "Al Qaeda Documents Outline Serious Weapons Program: Terrorist Group Placed Heavy Emphasis on Developing Nuclear Device," *CNN*, January 25, 2002, accessed at: http://www.cnn.com/2002/US/01/24/inv.al.qaeda.documents/.
[30] Pakistan is party to the CPPNM but with a reservation that exempts it from any obligations regarding "nuclear material used for peaceful purposes while in domestic use, storage, or transport." While the CPPNM does not directly regulate those categories of materials, they represent "an essential part of the object and purpose of the convention." Euroatom, the nuclear regulatory body of the European Union, formerly protested the reservation in October 2001. For more information see: Hughes Belin, "EU, Euroatom Object to Pakistan's Reserve on Physical Protection Text," *Nuclear Fuel*, October 29, 2001, accessed at: www.nexis.com.
[31] Daniel Horner, "Group Revising Physical Protection Now Targets November for Agreement," *Nucleonics Week*, October 3, 2002, accessed at: www.nexis.com.
[32] Matthew Bunn, *op.cit.*, note 6.
[33] For a complete list of members to the CPPNM, see: International Atomic Energy Agency, "Convention on the Physical Protection of Nuclear Material," accessed at: http://www.iaea.org/Publications/Documents/Conventions/cppn_status.pdf.
[34] Graham Allison, "How to Stop Nuclear Terror," *Foreign Affairs*, January-February 2004, accessed at: http://www.foreignaffairs.org/20040101faessay83107/graham-allison/how-to-stop-nuclear-terror.html.
[35] *Ibid.*
[36] Matthew Bunn, *op. cit.*, note 6.
[37] The global fissile material stockpile is 2108 tons (1,665 HEU and 443 Pu). The military portion of that is 1913 tons or 90.7 %. (Stockpile Estimates taken from www.isis-online.org)
[38] CDI Russia Weekly #231, Item #6, November 14, 2002, Center for Defense Information website, accessed at: http://www.cdi.org/russia/231-6.cfm.
[39] The text can be accessed at: http://www.state.gov/www/global/arms/treaties/nucmate1.html.
[40] IAEA, *op. cit.*, note 13.