

International Efforts to Improve Security for Nuclear Materials Since September 11

By George Bunn and Lyudmila Zaitseva

1. Introduction

International efforts to improve the security of nuclear material and facilities from theft and sabotage were intensified by the attacks of September 11. But the magnitude of the changes that are needed to protect against terrorist attacks like those of September 11 has not yet been widely appreciated, perhaps in part because of beliefs in some countries that what happened in the US on September 11 “can’t happen here.” This report will discuss the relevant features of the September 11 attacks, the recent illicit trafficking in nuclear and radioactive materials that might benefit terrorists, and the international efforts to improve physical protection after September 11.

2. Do the September 11 attacks suggest threats to nuclear facilities?

The attacks suggest a larger threat than many countries contemplated when their nuclear facilities were built. Moreover, since there is no treaty requiring physical protection for nuclear material used or stored for domestic purposes within a country, variations from country to country on how to protect nuclear material may be inevitable.¹ Reports about Russia suggest that protection practices vary considerably there.² IAEA experts who helped 10 smaller countries, mostly in Eastern Europe, strengthen their physical protection practices said that the protections they found varied from country to country: “Differences in culture, perceived threat, financial and technical resources and national laws are some of the reasons for variations.”³ A Stanford survey of 1997 physical protection practices showed that only 11 of 19 respondent countries reported that their security was designed to deal with terrorists or saboteurs.⁴ Year 2001 responses from six countries to a Stanford questionnaire showed that none of them had planned protection against a truck bomb attack “which spreads radioactive material over and beyond the protected area [e.g., the fenced-in area around a power reactor].”⁵

We know that Al Qaeda and Osama bin Laden had sought weapons-usable material and nuclear weapons.⁶ But, could they, would they attack nuclear power reactors using aircraft or truck bombs in order to spread radioactivity over a city? The September 11 terrorists were

- Four separate but coordinated teams, each made up of four or five highly-trained, intelligent and well-financed men.
- All teams had the same mission; participants had been told that suicide would take them to heaven and that killing “prisoners of war” (in this case, the occupants of the buildings) was directed by God.⁷
- Their means of destruction were ingenious and more powerful than nuclear facility designers have prepared for.

¹ The only multilateral treaty providing any standards for physical protection is the Convention on Physical Protection of Nuclear Material of 1980, International Atomic Energy Agency document INFCIRC/274/Rev.1. It does so only for civilian nuclear material while in international transport, or in storage pending or after international transport, not for any material in *domestic* use, storage and transport.

² See, e.g., Bunn, M., “A Detailed Analysis of the Urgently Needed New Steps to Control Warheads and Fissile Material,” in Cirincione, J., ed., *Repairing the Regime*, pp. 74-77 (Routledge: New York, 2000), pp. 74-75.

³ Soo Hoo, M., Ek, D., Hageman, A., Jenkin, T., Price, C., Weiss, B., “International Physical Protection Advisory Service: Observations and Recommendations for Improvement,” Proceedings of the 40th Annual Meeting of the Institute for Nuclear Material Management (2000).

⁴ Harrington, K., “Physical Protection of Civilian Fissile Material: National Comparisons,” (Sandia National Laboratories in cooperation with Stanford: Livermore, CA., 1999), p. 18.

⁵ Bunn, M., and Bunn, G., “Nuclear Theft and Sabotage,” *IAEA Bulletin* vol. 43, no.1 (Dec. 2001), pp. 8-9.

⁶ See, e.g., “U.S. Indictment: ‘Detonated an Explosive Device,’” *New York Times*, November 5, 1998, p.A-9; Weiser, B., “U.S. Says Bin Laden Aide Tried to Get Nuclear Weapons,” *New York Times*, September 26, 1998, p.A-3; “Responsibility for the Terrorist Atrocities in the United States,” 11 September 2001, *New York Times*, October 5, 2001, p. B-4.

⁷ “Instructions to Kill: Excerpts from Notes Found After Hijackings,” *New York Times*, Sept. 29, 2001, p. A-3.

What does this say about possible goals of terrorists like Al Qaeda in the nuclear field? Acquiring weapons-usable material anywhere to make nuclear weapons, and causing terror through the spread of radioactive materials, seem possible goals. In addition to nuclear facilities where weapons-usable materials are stored or used, targets could include power reactors, other nuclear operations and spent fuel in storage ponds or in transport. The IAEA reported in November that its “past efforts have focused largely on diversion of nuclear material by States for non-peaceful purposes, without the same degree of focus on malicious activities by sub-national groups.” Thus, its estimate of the extent of the damage to a nuclear facility from the intentional crash of a “large, fully fueled jetliner” was “still a matter for analysis. Nuclear facilities vary from country to country, so studies will have to take specific plant designs into account.”⁸ As the IAEA Director General said:

“After September 11, we realized that nuclear facilities – like dams, refineries, chemical production facilities or skyscrapers – have their vulnerabilities. There is no sanctuary anymore, no safety zone.”⁹

In addition, IAEA experts “are concerned that terrorists could develop a crude radiological device using radioactive sources commonly used in every day life.”¹⁰ This could mean using radioactive materials to make “dirty bombs” with conventional explosives to disperse the radioactivity.¹¹

3. Recent data on illicit trafficking

A report in the 2001 SIPRI Yearbook contains a summary of illicit trafficking in nuclear and other radioactive material through March 2001 based upon the International Atomic Energy Agency (IAEA) Illicit Trafficking Database.¹² All conclusions of this summary are confirmed and strengthened by the Stanford University’s analysis of its Database on Nuclear Smuggling, Theft and Orphan Radiation Sources (DSTO).¹³ However, DSTO, which includes open source reports and the data for the years 1991 and 1992 (not part of the IAEA database), provides a deeper insight into the problem of illicit trafficking over the past ten years.¹⁴

Analysis of both the state-confirmed incidents in the IAEA database and the data in DSTO indicates that there was a noticeable increase in the number of incidents between 1998 and 2000, following a sharp peak in 1993 and 1994 and a subsequent decline from 1995 to 1997 (see Fig. 1). Preliminary data shows that the number of incidents has gone down in 2001.

⁸ “IAEA Outlines Measures to Enhance Protection Against Nuclear Terrorism,” IAEA Press Release, 30 Nov. 2001, p.1; “Calculating the New Global Nuclear Terrorism Threat,” IAEA Press Release, 1 Nov. 2001, p. 3.

⁹ “Calculating the New Global Nuclear Terrorism Threat,” p. 3.

¹⁰ “Calculating the New Global Nuclear Terrorism Threat,” p.3.

¹¹ “Calculating the New Global Nuclear Terrorism Threat,” p. 5.

¹² SIPRI Yearbook 2001, Zarimpas, N., Appendix 6C. *The illicit traffic in nuclear and radioactive materials*, p. 503.

¹³ DSTO relies upon the state-confirmed international data presented in the IAEA Illicit Trafficking Database and the abstracts on all reported instances of trafficking in nuclear and radioactive materials in the Newly Independent States collected by the Monterey’s Center for Nonproliferation Studies in its Nuclear Trafficking Database. In addition, DSTO collects all relevant reports from open information sources, such as books, publications, international media and the Internet.

¹⁴ A special parameter – reliability factor – was devised by the Stanford DSTO to define the degree of reliability of information presented in each particular case: high, medium and low. “High” - high credibility of data (confirmed by IAEA and/or confirmed by competent national authorities), “medium” - reasonable credibility of data (not confirmed to the IAEA, but confirmed by local authorities directly involved in the incidents, as referenced in mass media reports), and “low” - less credible or conflicting data. It should be noted that over 75% of the incidents recorded in DSTO have high or medium reliability of data.

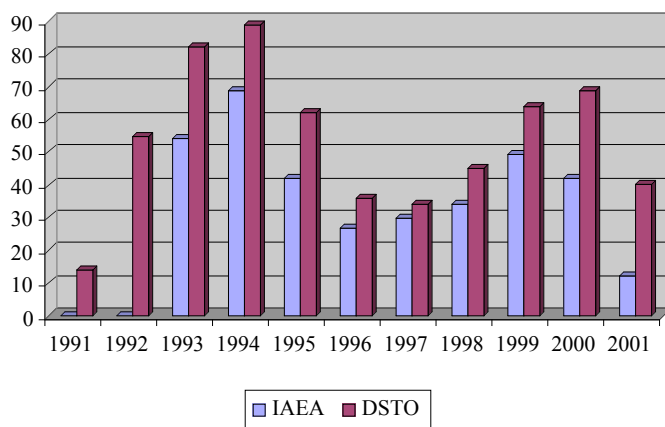


Fig. 1: Comparison of the number of illicit trafficking incidents confirmed by states to the IAEA between January 1993 and March 2001 (post-March 2001 data is unavailable) and recorded in the Stanford database for the period January 1991 to December 2001, including those with medium and low reliability.

The current number of incidents involving thefts and seizures of nuclear material is considerably lower than in the early 1990s. From 1991 to 1996, nuclear material was seized or stolen more frequently than other radioactive material (See Fig. 2).¹⁵ This trend started to change in 1997 and there have been fewer cases of illicit trafficking involving nuclear material over the past five years as compared to incidents involving other radiation sources. Over the period 1998 through 2001, the incidents involving nuclear material have accounted for less than a third of the total number of illicit trafficking cases.

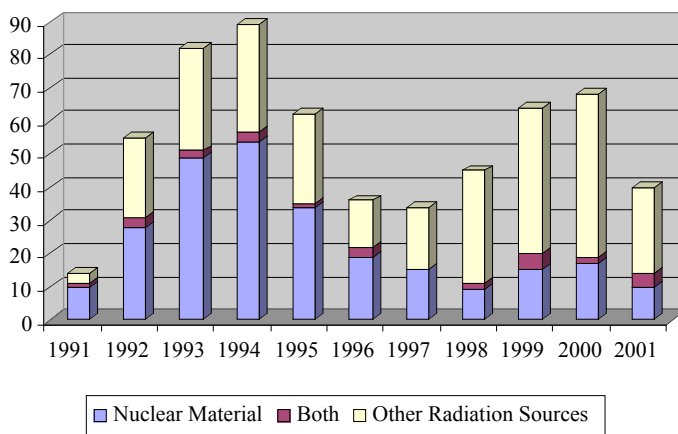


Fig. 2: Comparison of the number of illicit trafficking incidents involving nuclear material, other radiation sources and both of them for the period 1991 through 2001 based on the Stanford DSTO. Orphan radiation sources are not included in this chart. For the purpose of the Stanford database, orphan sources are considered to be outside the illicit trafficking problem, because there is no known underlying criminal intent to sell them to third parties or use them with malicious intent.

Out of 645 illicit trafficking cases recorded in DSTO for the period January 1991 to December 2001, more than a third (286) involved thefts and seizures of nuclear material. Of these, 122 incidents (43%) were of no proliferation concern (e.g. natural uranium, depleted uranium, “yellow cake”), 118 (41%) of low proliferation concern (e.g. low-enriched uranium (LEU), miniscule amounts of plutonium, including those in radiation sources), and 46 (16%) of high proliferation concern (e.g. highly-enriched uranium (HEU),

¹⁵ For the purposes of the DSTO, nuclear material is defined as uranium, plutonium, thorium or a compound containing any of these elements, and irradiated nuclear reactor fuel. Although nuclear material is radioactive, the term “other radioactive materials” refers primarily to ionizing radiation sources (e.g. americium, cesium, cobalt, strontium, radium, etc.). See also the definition given in note 31.

plutonium).¹⁶ However, the majority of proliferation significant incidents took place in the period 1991 to 1995, suggesting that the efforts to improve the physical security of weapons-usable nuclear material in Russia and other former Soviet republics have started to bear fruit.

According to the IAEA database, the total amount of stolen and seized weapons-usable material is approximately 10.820 kg. However, DSTO shows this figure could be as high as 37.158 kg, if other credible proliferation-significant cases – unconfirmed by states to the IAEA – were to be included. If these 37 kg represent 10 to 30 percent of the material actually smuggled, as is the case with drug trafficking in the US, the actual situation in countries with border control and law-enforcement less efficient than in the US may be reason for serious concern.¹⁷ Although all of this material originated in the former Soviet Union (FSU), there has been at least one known theft of enriched uranium from a country other than FSU. In 1998, members of a smuggling ring were arrested in Italy in possession of US-supplied 19.9% enriched uranium (20% is defined as weapons-usable) stolen from a research reactor in the Congo, where security was described as appalling.¹⁸

In general, research reactors around the world have been a reason for concern with regard to theft of weapons-usable nuclear material. Despite the ongoing US effort to convert research reactors using HEU to LEU and take back the originally supplied HEU, many countries in the world, including 28 developing countries, still operate on HEU.¹⁹ Some of them are reportedly not well guarded, presenting a potential target for theft, especially in times of political crises. For example, the Vinca research reactor in Yugoslavia, holding some 50 kg of Soviet-produced 80% enriched fresh HEU and 10 kg of low-irradiated HEU, was of great concern during the hostilities in the late 1990s between Yugoslavia and NATO, and remains so today due to questionable physical security.²⁰ About 2 kg of 90% enriched HEU went missing from another research reactor in Sukhumi, Georgia, during the political unrest between 1992 and 1997.²¹ Russia, which has supplied HEU for research reactors in these and many other countries, is only at the planning stage for an effort similar to the US conversion program.²²

The regional trends of illicit trafficking have changed over the past 10 years. After the highest peak in 1993 and 1994, Western Europe witnessed a sharp decline in illicit trafficking between 1995 and 1997, and the number of incidents has remained relatively low since. By comparison, the decline recorded in mid-1990s in Eastern Europe was less pronounced than in Western Europe and the number of incidents increased again significantly in 1999 and 2000. Due to the improvement of the border control and policing for radioactive materials in Eastern Europe, it may now serve as a barrier for the trafficking flow from the former Soviet Union, allowing less material to reach the Western Europe frontiers.

A new peak in illicit trafficking has also been observed in Russia between 1998 and 2001. However, during the period January 1998 to March 2001, only 3 incidents were confirmed by the Russian Government to the IAEA, whereas the Stanford's DSTO contains 37 incidents reported in open sources over the same period of time. The actual number of illicit trafficking cases may be higher still. For example, 61 events of radiation detection were recorded at the Sheremetyevo international airport in Moscow in 1999, after a radiation monitoring system had been installed, whereas in 1997, before the system's installation, only 2 such events were detected.²³

¹⁶ For comparison, the IAEA database contains 168 incidents involving nuclear material over the period January 1993 to March 2001. Of them, 89 incidents (53%) were of no proliferation concern, 65 (38%) of low proliferation concern and 15 (9%) of high proliferation concern.

¹⁷ At best, law-enforcement seizes only 10 percent to 30 percent of the illegal drugs smuggled into the United States each year. See Sterling, E., The Untold Drug Bust, *Washington Times*, September 3, 1999, p. A17.

¹⁸ See More Wreck Than Reactor, *Financial Times*, 21 August 1999, p. 8.

¹⁹ IAEA, *Nuclear Research Reactors in the World*, Reference Data Series No. 3, September 2000.

²⁰ Potter, W., Miljanic, D, and Slaus, I., Tito's Nuclear Legacy, *The Bulletin of the Atomic Scientists*, March/April 2000, p.69.

²¹ Center for Nonproliferation Studies, CSN Reports: *Confirmed Proliferation-Significant Incidents of Fissile Material Trafficking in the Newly Independent States (NIS), 1991-2001*, November 30, 2001, <http://cns.miiis.edu/pubs/reports/traff.htm>.

²² Research reactors in 12 countries still use Russian/Soviet supplied HEU. See IAEA, *Nuclear Research Reactors in the World*.

²³ Ukhlinov, L, Bojko, V., Organization of Customs Control of Fissionable and Other Radioactive Materials, Proc. IAEA International Conference "Security of Nuclear Material: Measures to Prevent, Intercept and Respond to Illicit Uses of Nuclear Material and Radioactive Sources", Stockholm, 7-11 May 2001, p. 80.

Whatever the reasons are for Russia not reporting all of its illicit trafficking cases to the IAEA, they may be shared by some other countries. For example, as of March 2001, the United States has not reported a single case to the IAEA database. However, according to the Nuclear Regulatory Commission, on average, about 200 licensed radiation sources are lost, abandoned or stolen in the US each year and mass media occasionally report thefts of radiation sources.²⁴

Of special concern is the increased illicit trafficking from Russia and other former Soviet Republics through the Southern Tier.²⁵ Between 1992 and 1998, the number of incidents detected in this region remained low (on the average, 4 cases per year) and then sharply increased in 1999 and 2000 (14 and 12). Seven incidents have been reported in 2001. Although these incidents represent only a fraction of the number of cases intercepted in Eastern Europe or Russia, the proliferation potential of the material smuggled through the Southern Tier is noticeably higher, which may indicate that more professional smugglers are using this route. For example, out of 56 trafficking incidents that took place in Eastern Europe from 1999 to 2001, 16 involved nuclear material, including two seizures of miniscule amounts of plutonium in radiation sources and one seizure of LEU. A total of 33 incidents were reported to have taken place in the Southern Tier over the same period, of which 18 involved nuclear material, including 3 confirmed and 2 unconfirmed seizures of HEU and plutonium and 9 seizures of LEU.

The above evidence suggests that smuggling rings may be using the southern routes more than before. The borders of the region are still not up to the challenge. Of the 18 seizures of nuclear material that took place in the Southern Tier over the past three years, 15 were reported to have resulted from police or intelligence operations and one was intercepted at a border by a US-trained official.²⁶ Of the 15 seizures of radioactive material, 6 took place at border crossings, two of which used the detection equipment provided by the US Customs Service.²⁷ Despite these successes of the US assistance programs, more remains to be done to have a significant impact on curbing illicit trafficking in the region, particularly in Turkey, where only two of the existing 120 border posts are reportedly equipped with radiation detection systems, both donated by the United States.²⁸

Despite the general increase in the number of illicit trafficking incidents in late 1990s, the number of cases involving nuclear material remains low as compared to the early 1990s. Few proliferation significant incidents have been recorded since 1995, suggesting that the security of these materials in Russia and other former Soviet republics has improved, probably due to the collaborative efforts of the US and Russian Governments. However, more has to be done to strengthen the security of weapons-usable nuclear material not only in the former Soviet Union, but in other countries possessing such material. Given the increased nuclear traffic through the Southern Tier over the past three years, efforts to improve the border control and law enforcement infrastructure in Central Asia, Caucasus and Turkey need to be continued.

4. International efforts after September 11 to improve security of nuclear and other radioactive materials against terrorists

Is the protection against September 11-like suicide attacks by several large fuel-laden jet airliners beyond what is financially feasible to guard nuclear power reactors against through strengthened physical protection? As seen by the IAEA, these reactors are “industrial facilities and as such are not hardened to withstand acts of war.”²⁹ Better security for commercial airliners, their passengers and their airports may be the most likely way of dealing with this threat -- unless anti-aircraft weapons are to be installed at reactors. The diving of smaller, medium-sized rental aircraft loaded with high explosives and fuel on a reactor site could not be controlled by better public airport and airline security and might cause a major

²⁴ Dicus, G., USA Perspectives: Safety and Security of Radioactive Sources *IAEA Bull.*, 41/3/1999.

²⁵ For the purposes of the DSTO database, the Southern Tier also includes Central Asia, Caucasus and Turkey.

²⁶ Since 1998, there have been eight significant seizures by foreign customs or police agencies attributed to U.S. Customs non-proliferation training. See U.S. Customs Service “U.S. Customs Kicks Off Training To Help Former Soviet Republics Combat Spread Of Weapons Of Mass Destruction, Washington, D.C., Tuesday, August 21, 2001 at <http://usinfo.state.gov/topical/pol/arms/stories/01082203.htm>.

²⁷ Ibid. See also Department Of Defense, Federal Bureau of Investigation and United States Customs Service Counterproliferation Program: Success Stories at http://www.dtra.mil/os/fbi-uscs/os_successstor.html

²⁸ See D. Frank, Nuclear Booty: More Smugglers Use Asia Route, *New York Times*, September 11, 2001.

²⁹ “Calculating the New Global Nuclear Terrorism Threat,” IAEA Press Release, 1 Nov. 2001.

release of radioactivity. The same concern holds for several trucks loaded with high explosives attacking the reactor or its spent fuel pond.

Other nuclear facilities may also not be hardened enough to withstand acts of extreme violence like this.³⁰ We will discuss, first, international efforts to protect reactors and other facilities containing uranium and plutonium -- “nuclear” materials within the IAEA definition.³¹ Then we will describe efforts to control other radioactive materials.

Nuclear Material: IAEA Physical Protection Services and International Standards. A November 2001 IAEA report said that IAEA activities for the protection of nuclear material had been severely limited by lack of funds.³² One of the most important IAEA programs to strengthen physical protection was the International Physical Protection Advisory Service (IPPAS) which sends teams of experts to requesting countries to provide advice on the adequacy of their security systems. When the experts advised strengthening, the country could usually gain financial help to do so from European Union and other industrial countries just as Russia has been receiving such help from the U.S. and others to strengthen nuclear security for its many nuclear facilities. However, because of lack of resources, the IAEA has been able to conduct IPPAS missions in only 12 countries since the initiation of the program in 1995.³³ Other important IAEA physical protection services include training, guidance publications, and information exchange. But, for example, reviews and tests of emergency responses to sabotage and terrorism had not been conducted because of the inadequate budget. The physical protection program had received less than a million dollars in the regular IAEA budget plus somewhat less in non-budgetary voluntary contributions from the U.S. and some other industrialized countries. But, this was far from enough to provide adequate assistance to IAEA member states for their physical protection efforts.³⁴

Lack of information on important security practices also hindered the IAEA from finding out what was necessary for improvement, emphasizing its urgent need “... to identify the most vulnerable locations and see that they get the necessary security upgrades.”³⁵ IAEA member states have long regarded information on their own physical protection practices as confidential because to disclose such information might reveal weaknesses to potential thieves or saboteurs. As indicated above, what IAEA information exists on this, suggests major variations in protection of similar facilities from country to country.³⁶ Yet thieves and terrorists desiring to steal weapons-usable material are likely to seek out the places where it is least well guarded based upon what they can see from the outside or learn from cooperative insiders. The IAEA hopes to make an immediate attempt to gain more information about what the actual physical protection practices of states are insofar as they are willing to report that confidentially.

The IAEA November 2001 report describes threats ranging from terrorist acquisition of nuclear material (to make a nuclear weapon), to attacks on facilities containing nuclear materials (reactors; fuel enrichment, fabrication, and reprocessing plants; and waste management facilities). For some time, the IAEA has urged

³⁰ “Summary of Report on Protection Against Nuclear Terrorism,” IAEA Press Release PR 2001/26 30 Nov. 2001, p.2; “Calculating the New Global Nuclear Terrorism Threat,” p. 3.

³¹ The IAEA is the depositary for the Convention on the Physical Protection of Nuclear Material (CPPNM) which defines “nuclear material” as “plutonium except that with isotopic concentration exceeding 80% in plutonium-238; uranium –233; uranium enriched in the isotope 235 or 233; uranium containing the mixture of isotopes as occurring in nature other than in the form of ore or ore-residue; any material containing one of the foregoing.” Art.1 (a).

³² “IAEA Outlines Measures to Enhance Protection Against Nuclear Terrorism,” IAEA Press Release, PR 2001\26, 30 Nov. 2001.

³³ “Summary of Report”; IAEA Working Group of the Informal Open-Ended Meeting to Discuss Whether there is a Need to Revise the Convention on the Physical Protection of Nuclear Material, “Final Report of the Working Group” (Feb. 2, 2001), p.5. (This final report is to be distinguished from the final report which reflects the final consensus on amending the Convention on Physical Protection of Nuclear Material, “Final Report” of May 23, 2001 which invited the IAEA Director General to convene an open-ended group of legal and technical experts to prepare a draft amendment to the Convention. It was based upon the February 2 “Final Report of the Working Group” which contains information on many issues besides whether to amend the Convention). Two reports of the IAEA Secretariat to the Working Group describe IAEA and country assistance programs for physical protection: Secretariat Paper No.9,

“IAEA International Physical Protection Advisory Service (IPPAS) Programme” (June 2000), and Secretariat Paper No.15, “Bilateral Physical Protection Support—Compilation of Input from Member States” (Nov. 2000).

³⁴ “IAEA Outlines Measures to Enhance Protection”; “Summary of Report”.

³⁵ “IAEA Outlines Measures to Enhance Protection.”

³⁶ See Bunn, M. and Bunn,G, “Nuclear Theft and Sabotage: Priorities for Reducing Threats,” *IAEA Bulletin*, v. 43, no. 4 (Dec. 2001), pp.8-9; Soo Hoo, M., Ek, D., et al., “International Physical Protection Advisory Service.”

its members to strengthen international standards for physical protection of nuclear material. The IAEA Director General convened an experts' group in 1998 to consider strengthening the one treaty that deals with physical protection, the Convention on Physical Protection of Nuclear Material (CPPNM) of 1970. The most important reason for doing so was that the CPPNM's protection requirements only apply to nuclear material in international transport--not to that in domestic use, storage and transport.³⁷ In May of 2001, the experts' group reported a consensus on amending the treaty to apply to nuclear material within a country that was not in international transport.³⁸ Among the reasons for amendment, the report said, was that none of the illicit trafficking reports received by the IAEA described theft of nuclear materials from international transport; they all appeared to involve trafficking from domestic storage and use of material for which the CPPNM provided no standards.³⁹

While the experts' consensus would extend the CPPNM to domestic nuclear materials, it contained no agreement on *required standards* for protection except that protection should be offered against sabotage of nuclear facilities as well as theft of nuclear material. The consensus did contain some "fundamental principles" for physical protection which have since been approved by the IAEA conference of member states and by its board of governors.⁴⁰

The CPPNM now contains general requirements for the protection of weapons-usable material when it is stored temporarily awaiting international transport. The CPPNM says, for example, that more than two kilograms of unirradiated plutonium or more than five kilograms of HEU must be stored in a "protected area" with access restricted to "persons whose trustworthiness has been determined," and with surveillance of this material by guards in communication with response forces.⁴¹ The experts' consensus report does not say whether this requirement would continue in an amended treaty. Except for the general principles, the consensus report does not suggest any specific requirements for protection of such facilities as nuclear storage buildings or reactors; nuclear separation, fuel fabrication or reprocessing plants; or spent fuel or waste disposal facilities.

One of the general principles approved by the IAEA board of governors says that a state should base physical protection "on a graded approach, taking into account the current evaluation of the threat, the relative attractiveness, the nature of the material and the potential consequences associated with the unauthorized removal of nuclear material and with the sabotage against nuclear facilities or nuclear material."⁴² Under this principle, if country officials decided that terrorists are not a threat to their country though they might be to the US, they could choose to provide no protection against terrorists' attacks. These countries could become weak points from which terrorists could steal weapons useable material. The consensus report on amending the CPPNM also rejects all forms of international oversight--from IAEA inspection to peer group review to periodic reports or periodic meetings of the parties to discuss practices.⁴³

The IAEA publishes recommended rules for protection of nuclear material and facilities from theft and sabotage.⁴⁴ Though many bilateral nuclear assistance agreements suggest application of these rules by the country receiving assistance, there are still major variations in physical protection by these countries.⁴⁵ Yet the experts' consensus opposed any requirement in the CPPNM that countries follow these recommendations or even that they be given "due consideration."⁴⁶

³⁷ Bunn, G., "Raising International Standards for Protecting Nuclear Materials from Theft and Sabotage," *Nonproliferation Review*, vol. 7, no. 2 (Summer 2000), p.152-53.

³⁸ Informal Open-Ended Expert Meeting, "Final Report" (May 23, 2001).

³⁹ Informal Open-Ended Expert Meeting, "Final Report of the Working Group" (Feb. 2, 2001), p.2

⁴⁰ IAEA General Conference, "Measures to Improve the Security of Nuclear Materials and Other Radioactive Materials," GC(45)/INF/14 (14 Sept. 2001); "IAEA General Conference Adopts Resolution on the Physical Protection of Nuclear Material and Nuclear Facilities; Agency to Redouble Efforts to Combat Nuclear Terrorism," IAEA Press Release 2001/21, 21 Sept. 2001.

⁴¹ CPPNM, Annex 1.

⁴² Working Group of the Informal Open-Ended Meeting, "Final Report of the Working Group" (2 Feb. 2001), Attachment 4, "Secretariat Paper No.13, Physical Protection Objectives and Fundamental Principles," Principle H, p. 3.

⁴³ Informal Open-Ended Expert Meeting, "Final Report," (May 23, 2001), p.3.

⁴⁴ IAEA Information Circular 224, Rev. 4 (1999).

⁴⁵ See Bunn, M., and Bunn, G., *Nuclear Theft and Sabotage*, p.8.

⁴⁶ Informal Open-Ended Expert Meeting, "Final Report" (23 May 2001), p.3.

The November 2001 IAEA report called for a revision of the IAEA recommended standards after the CPPNM amendment is agreed upon. But that will probably not happen for awhile. The amendment discussions are going slowly because, despite September 11, most participants have not been prepared to go beyond the pre-September 11 consensus described above though encouraged by the IAEA to do so.

Other Radioactive Material: IAEA Services and International Standards.

“Other radioactive material” in IAEA regulations and policies means radioactive sources that are not uranium or plutonium but are used for industrial, medical and other uses not involving fission. The November 2001 IAEA report described the dangers of terrorist acquisition of such radioactive material.⁴⁷ These materials are often so poorly guarded that they become “orphaned” from control by the original users or those responsible for disposing of them as waste after their creation or use. They are not used for making nuclear weapons but can be combined with conventional high explosives to make “dirty bombs” that scatter radioactivity over a populated area. To scare Moscovites, Chechen militants buried one in Moscow’s Izmailovsky Park in 1995 and then told the press where it was.⁴⁸ Dirty bombs of this sort are much less dangerous than nuclear weapons but easier to make.⁴⁹ They could cause panic if they dispersed radioactivity over a populated area.

The November 2001 IAEA report urged better security for this radioactive material stating that security was lax in some places.⁵⁰ The most important of the treaties that are relevant to this problem is the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. This treaty requires parties to maintain a national regulatory framework to govern radioactive waste management.⁵¹ The IAEA, in cooperation with other international organizations and interested states, has adopted International Basic Safety Standards and a Code of Conduct for protection against ionizing radiation and for the safety of radioactive sources. These and related safety standards contain recommended rules for states to adopt in their national regulations or legislation to improve the security of radiation sources.⁵²

The IAEA had provided some assistance to states to strengthen practices for maintaining control over radioactive material of this sort. In general, this assistance was not designed to address the use of these materials for malicious purposes such as for a “dirty bomb.” The IAEA November 2001 report proposed a new peer review program to evaluate state regulatory structures, to assess the new threats relating to malicious acts involving radioactive waste, to find ways to help states regain control over large orphan sources, to review the existing standards in the Code of Conduct and the actual implementation of the Basic Safety Standards, and to consider what new norms might be needed.⁵³ This will also require a major increase in the IAEA budget which members have been unwilling to provide in the past.⁵⁴

⁴⁷ “Summary of Report on Protection Against Nuclear Terrorism.”

⁴⁸ See Orlov, V. and Khlopov, A., “Super-Terrorism: An Immediate Threat to the World,” PIR Center Nonproliferation and Arms Control Hotline, Sept. 13, 2001, p. 7. www.pircenter.org/Super-Terrorism-An-Immediate-Threat-to-the-World-e.doc; Albright, D., O’Neill, K. and Hinderstein, C., “Nuclear Terrorism: The Unthinkable Nightmare,” Sept. 13, 2001, (Institute for Science and International Security Issue Brief --unpublished except on ISIS web site).

⁴⁹ Albright, O’Neill and Hinderstein, “Nuclear Terrorism”; O’Neill, “The Nuclear Terrorist Threat,” Aug. 1997 (Institute for Science and International Security Issue Brief—unpublished except on ISIS web site), pp. 6-8. Following the June 1996 attack on U.S. troops stationed in Saudi Arabia, then Secretary of Defense William Perry warned that U.S. military personnel had to prepare for a possible attack by terrorist groups using radiological weapons. Department of Defense News Briefing, Wed. July 17, 1996, 9:45 AM (EDT).

⁵⁰ “Summary of Report on Protection Against Nuclear Terrorism.”

⁵¹ See Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management of 1997. For example, when a party proposes to establish a new spent fuel management facility or radioactive waste management facility, it must consult other parties in the vicinity of the proposed facility and provide them, upon their request, with data enabling them to evaluate the likely safety impact of the facility on their territory. Art. 6.1(iv) and 13.1(iv). The party siting such a new facility must take “appropriate steps to ensure that such facilities shall not have unacceptable effects” on other parties by siting the facility in compliance with the general safety requirements of the Convention. Art. 6.2 and 13.12.

⁵² See IAEA Safety Series No. 115 and IAEA GOV/2000/34. The Basic Safety Standards were accepted by other international organizations having some regulatory responsibility for radioactive materials, for example. These include the UN Food and Agriculture Organization, the World Health Organization, and several other international organizations. The Standards are described in IAEA, *Legal and Governmental Infrastructure for Nuclear, Radiation, Radioactive Waste and Transport Safety*, IAEA Safety Standard Series No. GS-R-1 (2000).

⁵³ See Calculating the New Global Nuclear Terrorism Threat, pp. 5-7; “Summary of Report on Protection of Nuclear Terrorism,” p. 2.

⁵⁴ “IAEA Outlines Measures to Enhance Protection Against Nuclear Terrorism.”

5. Conclusions

The post-September 11 threat of nuclear terrorism requires urgent review of security practices for nuclear and other radioactive material. The most dangerous threat, of course, is terrorist acquisition of nuclear weapons. More likely but less dangerous are terrorist attacks on nuclear facilities with truck bombs or aircraft laden with fuel and high explosives. Still more likely but still less dangerous are terrorist attacks on populated areas with “dirty bombs.”

IAEA initiated programs are needed to evaluate and propose reforms in existing protections against all of these threats. But this is likely to require more change and more expense than many member states have so far been willing to agree to.