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Securing Nuclear Warheads and Materials: Seven Steps for Immediate Action

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Abstract

In the last decade, substantial progress has been made in improving security and accounting for nuclear weapons and weapons-usable nuclear material worldwide, both by states' own domestic actions and through international cooperation. Thousands of nuclear warheads and hundreds of tons of nuclear material are demonstrably more secure than they were before, and through programs such as the U.S.-Russian Highly Enriched Uranium (HEU) Purchase Agreement, enough potentially vulnerable bomb material for thousands of nuclear weapons has been verifiably destroyed. Since the attacks of September 11, 2001, the international community has attempted to expand and accelerate these efforts.

But much more remains to be done. This paper summarizes a recent report from Harvard University, which recommended seven further steps for immediate action in U.S.-Russian and international cooperation. It covers two recommendations that may be of particular interest to this audience, in detail. The first is a proposed program to remove nuclear material entirely from many of the most vulnerable sites around the world (by offering incentives targeted to the needs of each facility to give up the material at that site). The second is a suggestion that participants in the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, announced at the June 2002 Group of Eight summit make a political commitment to meet stringent security standards for nuclear materials on their territories, and urge (and assist) other states to do likewise.

The attacks of September 11, 2001 demonstrated that the threat of terrorist groups with global reach, bent on causing mass destruction, is not hypothetical but real. Al Qaeda has been actively attempting to get a nuclear weapon capability based on stolen nuclear material or nuclear weapons.¹⁾ Nothing could be more central to the security of every nation therefore, than ensuring that nuclear weapons and their essential ingredients are secure and accounted for, wherever they may be: insecure nuclear material anywhere is a threat to everyone, everywhere.

In the last decade, substantial progress has been made in improving security and accounting for nuclear weapons and weapons-usable nuclear material worldwide, both by states' own domestic actions and through international cooperation. Thousands of nuclear warheads and hundreds of tons of nuclear material are demonstrably more secure than they were before, and through programs such as the U.S.-Russian Highly Enriched Uranium (HEU) Purchase Agreement, enough potentially vulnerable bomb

material for thousands of nuclear weapons has been verifiably destroyed.²⁾ Since the attacks of September 11, 2001, the international community has attempted to expand and accelerate these efforts. In particular, following the September 11 attacks, the U.S. Congress added hundreds of millions of dollars to U.S. cooperative threat reduction programs, and the Bush administration then reversed its earlier efforts to cut budgets for these programs. For the fiscal year 2003, the Bush administration has proposed, in effect, a "steady as you go" threat reduction budget (approximately 1 bio. USD in total, roughly the same as the last budget President Clinton proposed, long before the September 11 attacks).³⁾ As a result, the speed and effectiveness of the main U.S. efforts in these areas are no longer primarily limited by money, but rather by policy and leadership issues.

Despite these efforts, much, much more remains to be done than has been done so far. To date, U.S.-Russian cooperative programs have accomplished only initial "rapid upgrades" - such as bricking up windows or piling heavy blocks on top of material - of only 40% of the weapons-usable nuclear material in Russia and comprehensive security and accounting upgrades of only half of that.⁴⁾ Less than one-seventh of Russia's stockpile of HEU (and still less of the U.S. stockpile) has been destroyed, and virtually none of the weapons plutonium in either country has yet been eliminated. While salaries and conditions for nuclear workers and guards in the former Soviet Union have notably improved, Russia plans to lay off tens of thousands of nuclear weapons scientists and workers in the next few years, and the infrastructure to provide jobs for these people has not yet been created. HEU-fueled research reactors in countries around the world remain dangerously insecure. Other nations are contributing far less to resolving these problems than is the United States (though that may change, if the recent G-8 summit commitments are fulfilled, as discussed below). The International Atomic Energy Agency's Action Plan to prevent nuclear terrorism remains dangerously underfunded (as does the Agency's global safeguards system).⁵⁾

Recommended Actions

In a report published in May, 2002, two co-authors and I recommended seven further steps for immediate action in U.S.-Russian and international cooperation:⁶⁾

Forging a Global Coalition to Secure Weapons of Mass Destruction

Stockpiles of weapons of mass destruction (WMD) - not just nuclear weapons but chemical and biological weapons as well - and their essential ingredients exist in dozens of countries throughout the world in both the military and civilian sectors. Hence, this is a problem that can only be solved through cooperation on a global scale. We recommended that the U.S. and Russian presidents, along with their colleagues from other leading states, should seek to forge a global coalition to secure stockpiles of weapons of mass destruction (WMD) and their essential ingredients everywhere. Participants would pledge to secure and account for their own stockpiles to stringent standards, cooperate to interdict WMD theft and smuggling, share critical intelligence on these threats, and prepare to respond to WMD threats and attacks. The initial step toward forging such a coalition was taken with the June 2002 G-8 agreement on a "Global Partnership Against the Spread of Weapons and Materials of Mass Destruction."⁷⁾ Very high priority should be placed on transforming this first step into an effectively functioning international partnership to secure these stockpiles as rapidly as practicable.

Appointing One U.S. and One Russian Official to Lead the Respective Countries' Efforts to Secure Nuclear Weapons and Materials

Today, there is no senior official anywhere in the U.S. government with full-time responsibility for leading and coordinating the entire panoply of efforts related to securing nuclear weapons and materials - setting priorities, eliminating overlaps, seizing opportunities for synergy - and keeping the mission of moving these programs forward on the front burner, at the senior levels of the White House, as Governor Ridge does for homeland security.⁸⁾ The lack of such a senior leader leads inevitably to an uncoordinated and increasingly bureaucratized effort.⁹⁾ We recommended that President Bush appoint a senior official in the White House, reporting directly to him, who has no other mission but this - someone tasked to wake up every morning thinking, "What can I do today to keep nuclear weapons out of the hands of terrorists?" This senior leader should be given the authority and resources needed to do such a job effectively, and should be tasked with preparing an overall integrated plan tying the many efforts together. Surely, unless we are going to have an entire Department of Homeland Security, we should have at least one senior person in charge of keeping the most devastating weapons out of terrorist hands, in the first place. Russian President Putin should make a similar appointment of a single leader; the need for improved coordination and leadership of such efforts is, if anything, even more urgent in Russia.

Accelerating and Strengthening Security Upgrades for Warheads and Materials in Russia:

Every effort should be made to ensure, that all nuclear warheads and materials in the United States and Russia are secured and accounted for, to standards adequate to meet the likely threats as rapidly as possible - and that they are secured in a way that will last for the long haul. We recommended that the United States and Russia jointly develop and implement a strategic plan to accomplish all "rapid upgrades" of security and accounting for warheads and materials, within two years and comprehensive upgrades within four years, and take a series of steps to build an accelerated partnership to achieve that goal.¹⁰⁾ We also outlined a number of steps to improve sustainability of the upgrades and ensure that they were designed to be effective against post-September 11 threats. The United States and Russia have been taking modest steps in these directions, but there is much more to be done; without significant changes in approach, there seems little hope of completing these upgrades for many years to come.

Launching a "Global Cleanout and Secure" Effort to Eliminate or Secure Stockpiles of Weapons-Usable Nuclear Material Worldwide

Currently there are hundreds of facilities in scores of countries, that have plutonium or HEU, anywhere from kilograms to tons. Removing all of the weapons-usable material from the most vulnerable and impoverished of these facilities, where it is least likely that effective security can be sustained for the long haul, should be of high priority. Higher levels of security could be sustained at lower cost, if the number of facilities were substantially reduced. For example, there are an estimated 140 research reactors in countries throughout the world, still operating with HEU, and more research reactors with HEU that are shut down but still have HEU on-site.¹¹⁾ This number can and should be greatly reduced, with

an approach that balances the continuing scientific needs, the proliferation risks, the safety hazards, and economic costs:

For shut-down research reactors and other facilities with no continuing need for their HEU, arrangements should be made to ship their fresh and spent HEU elsewhere for secure storage or processing. This would address the proliferation concern over HEU widely dispersed at vulnerable facilities, the safety concerns over the spent HEU, and the reactor operators' concerns over spent fuel management. (After September 11, when considering terrorists for whom death is part of the plan, HEU in relatively lightly irradiated and long-cooled spent research reactor fuel may also pose a significant risk of theft and use in nuclear explosives.¹²⁾ It should be recalled that Iraq's "crash program" to build a bomb, after the invasion of Kuwait, called for making use of, both fresh and irradiated HEU, from its research reactors.)

For research reactors that are currently operational, but whose benefits no longer justify their costs and risks, shut-down assistance and incentives - including research grants for work that no longer requires the research reactor - should be provided. Arrangements should be made to accept fresh and spent HEU fuel from these facilities as well. As physical protection regulatory requirements increase for facilities using HEU or plutonium, facilities whose spent fuel may be usable in a dirty bomb, and facilities whose location in urban areas increases the risk, if sabotaged - a significant fraction of research reactors - may no longer be able to afford continued operation. It may be desirable to work out regional sharing arrangements for fewer, but more capable facilities, as has been done with particle accelerators.

For research reactors for which there is a continuing need, an expanded and accelerated effort should be made to assist in conversion to LEU fuel. Recent development of 16 g/cc U-moly fuel should make it technically possible to convert every research reactor in the world, once development is complete.¹³⁾ Here, too, take-back arrangements should be made for fresh and spent HEU fuel. Efforts to remove HEU from potentially vulnerable sites should *not* be limited to the largest research reactors of over 1 megawatt thermal power.

International cooperation to upgrade security and accounting arrangements at those vulnerable facilities where HEU or separated plutonium will remain should be substantially expanded.

The recent success of "Project Vinca", the removal of roughly three bombs' worth of HEU from a vulnerable facility in Yugoslavia, demonstrates the need of what still has to be done for many more facilities throughout the world. But for many facilities, the HEU at their sites is a substantial part of the reason for them to continue to exist and receive funds, as there are understandable concerns about the future of those facilities and the people who work there, if the material is removed. Hence, providing *incentives*, tailored to the needs of each facility, will be a fundamental element of success in any effort to remove the material from the most vulnerable sites around the world. The history of Project Vinca and its predecessor Project Sapphire (which airlifted nearly 600 kilograms of HEU to the United States from a vulnerable site in Kazakhstan in 1994) demonstrates this reality: in both cases, incentives that ended up costing millions of dollars had to be offered to the relevant facilities and institutions, to gain agreement for the material to be removed. (In Yugoslavia's case, this included help with managing the spent fuel and radioactive contamination at the site; in Kazakhstan's case, the incentives included a variety of threat reduction projects at the specific facility and elsewhere, which provided work for a significant number of relevant experts and workers.)

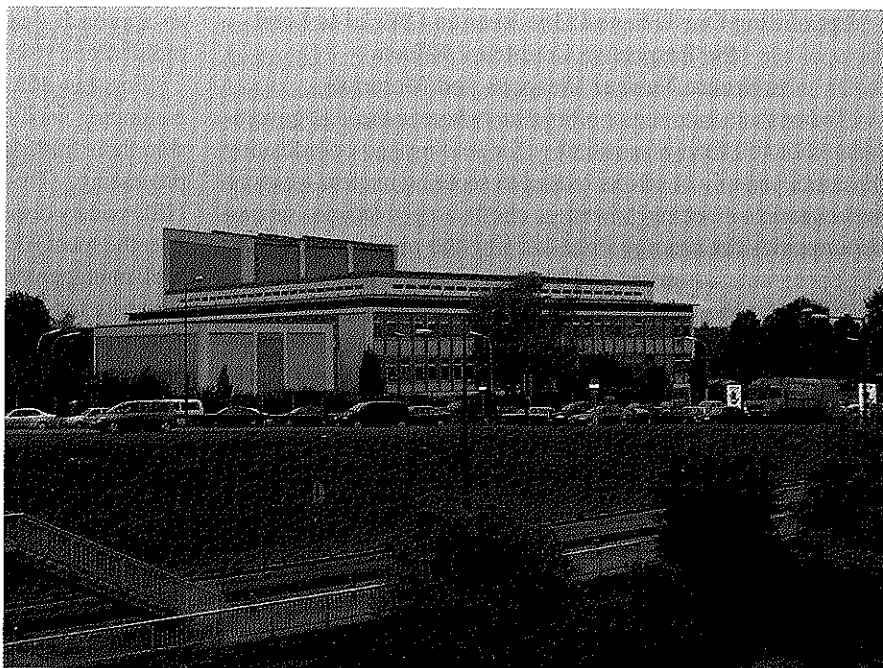
Both Project Vinca and Project Sapphire, required well over a year of secret interagency and international negotiations, to be implemented. Project Vinca ultimately required the Nuclear Threat Initiative, a private U.S. non-governmental organization, to provide 5 mio. USD, because none of the U.S. government agencies involved had authority to spend their funds cleaning up another country's spent fuel. After September 11, the world can no longer afford such delays or such reliance on private generosity.

Hence, we recommended that a flexible new program be established, funded at approximately \$50 million per year for several years, which would (a) provide a range of targeted incentives to facilities around the world to give up their highly enriched uranium or plutonium, and (b) implement rapid security upgrades at facilities where these materials would remain. In combination with the ongoing effort to upgrade security and accounting for nuclear material in the former Soviet Union (and consolidate such material at fewer facilities), such an effort could eliminate the most urgent risks worldwide, within a few years. Building the necessary sensitive security partnerships with countries around the world will be a difficult but essential task that will have to be approached one country at a time.

Important parts of this mission are already underway. The Reduced Enrichment for Research and Test Reactors (RERTR) program has been highly successful in converting reactors to use low-enriched fuels, and a very large fraction of the U.S.-supplied facilities with HEU are eligible for the U.S. take-back offer (over 100 facilities around the world are on the U.S. eligible list). The United States, Russia, and the IAEA are now working in a tripartite initiative to undertake a similar take-back effort for Soviet-supplied facilities with HEU, which, if successful, will address some of the most worrisome facilities. What is needed on the U.S. end, is a single program that integrates such efforts, and puts expertise, legal authority, and money to do what it takes to get these vulnerable stockpiles removed in a single set of hands.

Leading Toward Stringent Global Nuclear Security Standards

Terrorists and hostile states will steal nuclear material from wherever it is easiest to get, and buy it from anyone willing to sell. Hence, vulnerable nuclear material anywhere is a threat to everyone, everywhere - and the international community has an overwhelming interest in ensuring that each state with weapons-usable nuclear material carries out its responsibility to secure that material. Yet today, there are no binding international standards for the security of weapons-usable nuclear material, and national practices vary enormously. It is difficult to argue, for example, that there is a country in the world, for which an attack by a small group of well-armed and well-trained terrorists, possibly in collusion with an insider, is not a realistic threat - yet many security systems for nuclear materials around the world



Austrian University research reactor, Prater, Vienna

would not be able to handle such a threat. While there is near-unanimity among senior political officials and military officers that potential bomb material everywhere must be protected according to stringent standards, at the expert level, where such negotiations are carried out, concerns over national sovereignty, protection of secrets, and potential costs to nuclear facilities have so far stymied efforts to agree on stringent international standards. Current negotiations to amend the Convention on Physical Protection of Nuclear Material to expand its coverage, ranging from in-transit materials to domestic materials, for example, now appear highly unlikely to result in an agreement on any internationally accepted standard for nuclear material security.¹⁴⁾

An alternative to formal treaty negotiation at expert level would be high-level joint political commitments of a group of interested states, to protect their own nuclear materials to stringent standards - including at least a common minimum design-basis threat, which each participant would be free to exceed, and a number of other key principles, and subsequently encourage (and assist) other states to do likewise. The recent G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, which agreed that all participants would provide "appropriate" and "effective" security for their nuclear materials and help other states to do the same, could form the nucleus of such an effort. In particular, a further statement from the G-8, that they would each protect their weapons-usable nuclear materials to at least an agreed minimum design-basis threat and be prepared to discuss assistance to other states willing to join them in making that commitment, could provide (a) a strong incentive for states to join an agreement on a stringent standard, (b) develop a mechanism for targeting physical protection assistance where it may be most needed, and (c) allow for substantial flexibility of each state in how precisely to meet the agreed standard. The prospect of such a political-level initiative leading to rapid action in improving security for nuclear material where it is most needed, seems far better than the prospect of formal treaty negotiations to that effect.

Accelerating the Blend-Down of Highly Enriched Uranium

We urged the Bush Administration to begin negotiations with Russia on an accelerated approach to destroying Russia's excess bomb uranium, in which tens of tons of additional material would be blended and stored each year, for later sale. We called on Congress to appropriate approximately 50 mio. USD to fund the first year's accelerated blending. President Bush and President Putin, at their May summit, established a working group to explore expanded blend-down. The U.S. Senate's version of the defense authorization bill would authorize the Department of Energy to redirect 40 mio. USD from other appropriated funds for such a program.

Creating New Revenue Stream for Nuclear Security

We recommended that new revenue streams be developed to supplement on-going government expenditures for securing nuclear weapons and materials in the former Soviet Union, such as a "debt for nonproliferation" swap, or a set-aside of revenues from spent fuel imports, if an acceptable approach to such imports moves forward. The G-8 summit in June, 2002, pledged \$20 billion for such efforts over 10 years, some of it potentially in the form of debt for nonproliferation swaps, which were explicitly authorized as part of the package in the summit agreements.¹⁵

Conclusions

The time for action is now. Immediate further steps are needed to ensure that all of the tens of thousands of nuclear weapons and hundreds of tons of weapons-usable nuclear materials around the world are secure and accounted for. Accomplishing this as rapidly as possible, must be a top security objective of the entire international community. After September 11, "business as usual" is simply not good enough.

The leaders of the major states in the international system should be asking themselves, "On the day after a terrorist nuclear attack, what actions would we wish, we had taken to prevent it?" - and start taking those steps before disaster strikes.¹⁶ The steps outlined in this paper could be at least the beginning of such an agenda.

ENDNOTES:

1) See, for example, David Albright, Kathryn Buehler, and Holly Higgins, "Bin Laden and the Bomb," *Bulletin of Atomic Scientists*, Jan.-Feb. 2002 (available as of September 19, 2002 at <http://www.isis-online.org/publications/terrorism/binladenandbomb.pdf>); Mike Boetcher and Ingrid Arnesen, "Al Qaeda Documents Outline Serious Weapons Program," *CNN*, January 25, 2002 (available as of September 19, 2002 at <http://www.isis-online.org/publications/terrorism/cnnstory.html>); Gavin Cameron, "Multi-Track Microproliferation: Lessons from Aum Shinrikyo and Al Qaeda," *Studies in Conflict and Terrorism*, Vol. 22, No. 4, 1999; and Kimberly McCloud and Matthew Osborne, "WMD Terrorism and Usama bin Laden," Monterey Institute for International Studies, Center for Nonproliferation Studies (available as of September 19, 2002 at <http://cns.miis.edu/pubs/reports/binladen.htm>).

2) See, for example, Matthew Bunn, John P. Holdren, and Anthony Wier, *Securing Nuclear Weapons and Materials: Seven Steps for Immediate Action* (Cambridge, MA: Harvard University Managing the Atom Project and Nuclear Threat Initiative, May 2002, available as of September 19, 2002 at http://www.nti.org/e_research/securing_nuclear_weapons_and_materials_May2002.pdf).

3) Bunn, Holdren, and Wier, *Securing Nuclear Weapons and Materials*, op. cit.

4) DOE estimates that 42% of the weapons-usable nuclear material will have rapid upgrades installed by the end of FY 2002, with 18% having comprehensive upgrades installed by that time. See U.S. Department of Energy, *FY 2003 Budget*

Request: Detailed Budget Justifications-Defense Nuclear Nonproliferation (Washington, DC: DOE, February 2002, available as of September 19, 2002, at <http://www.cfo.doe.gov/budget/03budget/content/defn/nucinonp.pdf>), p. 24.

5) As of August, 2002, for example, the entire amount pledged to the agency's nuclear security fund by all countries other than the United States combined was about the same as the \$1.2 million that a U.S. non-government organization, the Nuclear Threat Initiative, had contributed. No contribution from any other country made it over \$400,000 - level that can only be described as pathetic. See "Nuclear Security: Progress on Measures to Protect Against Nuclear Terrorism," GOV/INF/2002/11-GC(46)/14 (Vienna, Austria: IAEA, August 12, 2002, available as of September 19, 2002, at <http://www.iaea.org/worldatom/About/Policy/GC/GC46/Documents/gc46-14.pdf>). At the IAEA General Conference in early September, Secretary of Energy Spencer Abraham pledged an additional U.S. contribution of \$3 million.

6) Bunn, Holdren, and Wier, *Securing Nuclear Weapons and Materials*, op. cit.

7) For a description of this initiative, see Cristina Chuen, Michael Jasinski, and Tim Meyer, "The 10 Plus 10 Over 10 Initiative: A Promising Start, But Little Substance So Far," (no date), available as of September 19, 2002, at <http://cns.miis.edu/pubs/week/020812.htm>. The text of the G-8 commitment was available as of September 19, 2002, at http://www.g8.gc.ca/kan_docs/globpart-e.asp. Former Senator Sam Nunn and Senator Richard Lugar have taken the lead in making the case for such a global coalition; see, for example, their statement from the Moscow conference on the topic sponsored by the Nuclear Threat Initiative in May, 2002, available as of September 19, 2002 at http://www.nti.org/c_press/c_index.html.

8) While there is a highly capable individual several tiers down on National Security Council staff tasked with coordinating most of these efforts, that does not remotely compare to someone on the model of Governor Ridge, which I believe is roughly what is required.

9) For a useful (though depressing) recent account of one element of this picture (in this case programs intended to prevent nuclear smuggling), see U.S. General Accounting Office, *Nuclear Nonproliferation: U.S. Assistance Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning*, GAO-02-426 (Washington, DC: General Accounting Office, May 2002, available as of September 19, 2002 at <http://www.gao.gov/new.items/d02426.pdf>).

10) For more detailed recommendations on these points, see Bunn, Holdren, and Wier, *Securing Nuclear Weapons and Materials*, op. cit.; Hecker, testimony to the Senate Foreign Relations Committee, op. cit.; and Oleg Bukharin, Matthew Bunn, and Kenneth N. Luongo, *Renewing the Partnership: Recommendations for Accelerated Action to Secure Nuclear Material in the Former Soviet Union* (Washington DC: Russian American Nuclear Security Advisory Council, 2000, available as of September 19, 2000 at <http://ksgnotes1.harvard.edu/BCSIA/Library.nsf/pubs/ransacreport>).

11) James Matos, Argonne National Laboratory, personal communication, September 2002, based on updates to International Atomic Energy Agency, *Nuclear Research Reactors in the World*, IAEA-RDS-3 (Vienna, Austria: September 2000.)

12) It is time, in particular, to reconsider whether the international standard of 100 rem/hr at 1 meter as "self-protecting" against theft is still appropriate.

13) Armando Travelli, Argonne National Laboratory, personal communication, April 2002.

14) Patricia Comella, presentation at NUMAT conference, Salzburg, Austria, September 9-12, 2002.

15) For a description of this initiative, see Cristina Chuen, Michael Jasinski, and Tim Meyer, "The 10 Plus 10 Over 10 Initiative: A Promising Start, But Little Substance So Far," (no date), available as of September 19, 2002, at <http://cns.miis.edu/pubs/week/020812.htm>. The text of the G-8 commitment was available as of September 19, 2002, at http://www.g8.gc.ca/kan_docs/globpart-e.asp. Former Senator Sam Nunn and Senator Richard Lugar have taken the lead in making the case for such a global coalition; see, for example, their statement from the Moscow conference on the topic sponsored by the Nuclear Threat Initiative in May, 2002, available as of September 19, 2002 at http://www.nti.org/c_press/c_index.html.

16) This way of posing the question was first proposed by Graham T. Allison, Owen R. Coté, Richard A. Falkenrath, and Steven E. Miller, *Avoiding Nuclear Anarchy: Containing the Threat of Loose Russian Nuclear Weapons and Fissile Material* (Cambridge, MA: MIT Press, 1995), p. 17.