10. Securing Nuclear Warheads and Materials

"Global Cleanout"

Currently there are hundreds of facilities in scores of countries that have from kilograms to tons of plutonium or highly enriched uranium (HEU). As we recommended in our previous report, removing all of the weapons-usable material from the most vulnerable and impoverished of these facilities, where it is least likely to be possible to sustain effective security for the long haul, should be a top priority.[1] The argument for removing material from the most vulnerable sites, rather than trying to upgrade security in place, rests on several points:

- Some vulnerable sites have little revenue or prospect of future revenue, and are not likely to be able to afford the substantial cost of effective security into the future (including paying significant guard forces), even if given initial assistance to put a modern security system in place.

- Some facilities are in locations that are inherently difficult to secure – for example research reactors on university campuses, where a substantial armed guard force and a large fenced-off area might be quite difficult to create.

- At some sites, there may be a real danger of threats bigger than any reasonable security system could handle – if there is a danger of state failure or civil war in the area, for example, or a possibility that top officials of the facility itself would decide to sell off the material.

- Finally, constant vigilance is needed, but is very difficult to maintain, for security systems designed to protect against attacks that never occur: any security system only reduces the risk of theft. Only by ensuring that there's nothing there to steal can the threat of theft be entirely eliminated.

Hence, the United States, working with Russia and other countries as appropriate, should as part of the G-8 Global Partnership establish a "global cleanout" program intended to remove the nuclear material entirely from the world's most vulnerable nuclear sites as rapidly as possible. Interim security upgrades would also have to be provided for the period until the material could be removed. The program would offer a range of incentives, targeted to the needs of each facility, for facilities to give up the weapons-usable nuclear material at their site – and would arrange for safe and secure transport to secure facilities elsewhere.

If such an effort were implemented efficiently, funding of approximately $50 million per year for several years should be sufficient – when combined with an accelerated effort to upgrade security and accounting for nuclear material in the former Soviet Union and consolidate such material at fewer facilities – to eliminate the most urgent risks worldwide within a few years.

The "Project Vinca" operation carried out in August 2002 provides a good example of what needs to be done for many more facilities throughout the world. In that highly publicized operation, 48 kilograms of 80% enriched HEU – enough for one gun-type bomb or 2–3 implosion-type bombs – were removed from a vulnerable site in Yugoslavia to safer storage in Russia.[2]

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[1] Matthew Bunn, John P. Holdren, and Anthony Wier, *Securing Nuclear Warheads and Materials: Seven Steps for Immediate Action* (Washington, D.C.: Nuclear Threat Initiative and Project on Managing the Atom, Harvard University, May 2002; available at http://www.nti.org/e_research/securing_nuclear_weapons_and_ materials_May2002.pdf as of February 25, 2003), pp. 45–55.

[2] For discussion, see Matthew Bunn, "Removing Material From Vulnerable Sites," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/securing/vulnerable.asp as of March 12, 2003).

However, Project Vinca – just like two similar operations that preceded it –required well over a year of secret interagency and international negotiations to implement. What is more, Project Vinca ultimately required the Nuclear Threat Initiative, a private U.S. non-government organization, to provide $5 million, because, in the State Department's words, "the U.S. government lacks the authority" to spend funds cleaning up another country's spent fuel[3] – and cleaning up the spent fuel was Yugoslavia's core demand in return for allowing the HEU to be removed. After September 11, the world can no longer afford such delays or such reliance on private generosity. Instead, a single, flexible program should be established that collects the needed expertise, authority, and resources to negotiate removals of nuclear material from facilities around the world in a single set of hands.

For example, there are estimated to be over 140 research reactors in countries around the world still operating with HEU, and more research reactors with HEU that are shut down but still have HEU on-site.[4] This number can and should be greatly reduced, with an approach that balances the continuing scientific needs, the proliferation risks, the safety hazards, and the economic costs:

- For shutdown 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 research reactor spent research reactor fuel may also pose a significant risk of theft and use in a nuclear explosive.[5] It should also 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, assistance and incentives to shut down the reactor – 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, for facilities whose spent fuel may be usable in a dirty bomb, and for facilities whose location in urban areas increases the risk if they are sabotaged, a significant fraction of research reactor operators may no longer be able to afford continued operations. Such increased regulatory requirements for security represent a negative incentive that may help to convince facility operators that it is no longer in their interest to maintain HEU at their facility, especially when combined with positive incentives to give it up. The United States and other leading nuclear countries should work with other countries to ensure that security regulations appropriate to addressing post–September 11 global threats are in fact put in place. At the same time, it may be desirable to work out regional sharing

[3] Office of the Spokesman, "Project Vinca" (Washington, D.C.: U.S. Department of State, August 23, 2002). There has been some dispute over whether, if there had been a higher-level push to do so, it would have been possible to find interpretations of the legal mandates of the Departments of State, Energy, and Defense that would have authorized expenditure of funds on this purpose. The mere fact that the government felt compelled to reach out to NTI, however, demonstrates the desirability of providing clear and indisputable legal authority to do what needs to be done to address such risks to U.S. security.

[4] 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: IAEA, September 2000).

[5] 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. See Edwin Lyman and Alan Kuperman, "A Re-Evaluation of Physical Protection Standards for Irradiated HEU Fuel" (paper presented at the 24th International Meeting on Reduced Enrichment for Research and Test Reactors, Bariloche, Argentina, November 5, 2002).

arrangements for fewer, but more capable, research reactor 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 uranium-molybdenum fuels with a density of 16 grams per cubic centimeter should make it technically possible to convert every research reactor in the world, once development is complete.[6] 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.

Providing incentives tailored to the needs of each facility will be a fundamental element of success in any effort to remove nuclear material from the most vulnerable sites around the world. For many facilities, the HEU at their site is a substantial part of the site's reason for existing and receiving funds. Thus, there are understandable concerns about the future of the facility and those who work there if the material is removed. 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, as already noted, the key incentive was help with managing the spent fuel 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 the relevant experts and workers.)

Important parts of such a "global cleanout" effort 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 a U.S. offer to take back their HEU if they convert to LEU (over 100 facilities around the world are on the U.S. eligible list).[7] The United States, Russia, and the International Atomic Energy Agency (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.

Each of these efforts, however, addresses only part of the problem, and brings to bear only a limited set of tools. The RERTR effort, for example, can help research reactors convert to LEU – but has only limited incentives it can offer them to do so, and no mandate to encourage reactors that are no longer needed to shut down. Similarly, the U.S. efforts focused on ensuring that materials supplied by the United States are adequately secured have no mandate to offer facilities incentives to remove the material entirely, rather than securing it in place. The U.S. and Russian HEU take-back efforts are focused on removing material from vulnerable sites, but have not been designed with broad authority to offer the tailored packages of incentives to each site that in many cases will be crucial to success. This is why, in each case like Project Vinca and Project Sapphire, a new approach has had to be developed from scratch, and a new interagency negotiation undertaken over who will pay for which parts of the package. As a result, progress in efforts to remove the vulnerable stockpiles from Soviet-supplied facilities has been painfully slow, with one facility cleaned out in 1994, another in 1998, and a third in 2002.

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[6] Armando Travelli, "Status and Progress of the RERTR Program in 2002" (paper presented at "RERTR 2002: The 24th International Meeting on Reduced Enrichment for Research and Test Reactors," San Carlos do Bariloche, Argentina, November 3–8, 2002).

[7] See Matthew Bunn, "Converting Research Reactors," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/securing/convert.asp as of March 12, 2003).

A drastic acceleration and expansion of efforts to remove vulnerable nuclear materials is needed. The goal should be to address several sites a year, dealing with all of the 24 facilities the State Department has identified as candidates for future operations similar to Project Vinca within 5–6 years, if not sooner.[8] To accomplish that, the United States needs to put in place 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.

Logically, such an effort should be located at the Department of Energy (DOE), where most of the relevant expertise resides. The Department should establish a new office, with a fast-moving "tiger team" approach, drawing key personnel and expertise from across the department. This office should have the capability to draw on other agencies when needed, but should be structured so that in most cases extensive interagency negotiation will not be required. Initially, the office should be targeted for a budget of approximately $50 million per year, but this figure should be adjusted as experience clarifies the needs.

The United States should be willing to accept both fresh and irradiated HEU itself when necessary to address urgent proliferation risks (as it has for U.S.-supplied HEU under the RERTR fuel take-back program), and should work with Russia and other states to ensure that when facilities are willing to give up their weapons-usable nuclear material, there are states with secure facilities ready to take it.

Recommendation: ***Establish a focused program to remove all nuclear material from the most vulnerable sites worldwide, with authority to provide tailored incentives to facilities to convince them to give up their material.***

An Accelerated U.S.-Russian Nuclear Security Partnership

As described earlier in this report, since September 11, the Bush administration has endeavored to accelerate U.S.-Russian cooperation focused on improving security and accounting for nuclear material in Russia. President Bush and President Putin have agreed that the matter deserves "urgent attention,"[9] Secretary of Energy Spencer Abraham and Minister of Atomic Energy Rumiantsev have directed their staffs to accelerate the effort and report to them on their progress,[10] and the Material Protection, Control, and Accounting (MPC&A) program itself, working with its Russian counterparts, has launched a number of initiatives to attempt to speed the effort.[11] The reality, however, is that the actual rate at which security and accounting upgrades are being implemented remains unacceptably slow (with rapid upgrades accomplished for only an additional 5% of Russia's potentially vulnerable nuclear material, and comprehensive upgrades on only 2%, in the year after the September 11 attacks, as discussed above).

A dramatic acceleration of this effort is clearly needed. At the same time, it is equally crucial that the levels of security reached by these upgrades be sufficient to defend against post–September 11 threats – and that improved security, once achieved, be sustained into the future. Achieving these three goals – accelerated progress, strengthened upgrades, and long-term sustainability – will

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[8] Robert Schlesinger, "24 Sites Eyed for Uranium Seizure," *Boston Globe*, August 24, 2002.

[9] The White House, Office of the Press Secretary, "Joint Statement on New U.S.-Russian Relationship: Joint Statement by President George W. Bush and President Vladimir V. Putin on a New Relationship Between the United States and Russia" (Washington, D.C., press release, November 14, 2001; available at http://www.whitehouse.gov/news/releases/2001/11/20011114-3.html as of January 9, 2003).

[10] U.S. Department of Energy, "U.S. and Russia Agree to Strengthen Nuclear Material Protection" (Washington, D.C.: DOE, November 29, 2001; available at http://www.energy.gov/HQPress/releases01/novpr/pr01200_v.htm as of January 9, 2003).

[11] Jack Caravelli, Kenneth Sheely, and Brian Waud, "MPC&A Program Overview: Initiatives for Acceleration and Expansion," in *Proceedings of the 43rd Annual Meeting of the Institute for Nuclear Materials Management, Orlando, Florida, June 23–27, 2002* (Northbrook, Illinois: INMM, 2002).

require a new approach, based on real partnership, integrating Russian officials and experts into all stages of the planning, design, and implementation of the effort. Today, with President Putin firmly committed to U.S.-Russian partnership in fighting terrorism, there is a real – and possibly fleeting – opportunity to build an accelerated nuclear security partnership as well.

Such a partnership approach is crucial to success. The needed work at highly sensitive nuclear facilities in Russia will simply not get done quickly without genuine enthusiasm for moving it forward on the part of Russian government officials, military leadership, and site managers – which is only likely to be forthcoming if the work is implementing approaches that they understand and had a hand in designing. Sustaining security over time will also require that Russian officials and experts, from the President and Prime Minister down to the guards and workers using the security and accounting systems every day, "buy in" to the need for the new approach to security and accounting of nuclear weapons and nuclear material. And however much U.S. experts have learned through cooperation, Russian experts understand their materials, facilities, and bureaucracy far better than U.S. experts ever will. Past "made in America" approaches in which strategic plans have been developed, security standards set, and progress reviewed without Russian input need to be drastically overhauled.[12]

To succeed in getting these stockpiles as secure as possible as fast as possible, the United States and Russia will have to (a) set an agreed deadline, for which officials can be held accountable; (b) forge a new partnership approach that can sustain broad Russian support; (c) jointly develop a strategic plan to meet the deadline; (d) resolve the access issues; (e) provide the resources necessary to implement the plan; and (f) overcome the many bureaucratic obstacles that have slowed progress in recent years.[13] Toward those ends:

- The U.S. and Russian Presidents should direct their governments to take whatever steps are necessary to complete "rapid upgrades" of security for *all* nuclear warheads and weapons-usable nuclear materials within two years, and comprehensive security and accounting upgrades for these stockpiles within four years. (Discussions with a substantial number of U.S. and Russian participants in the MPC&A program suggest that these goals could be accomplished, *if* there were sufficient high-level authority and focus applied to eliminating the many constraints and obstacles on both sides.) They should make it clear that they will hold the relevant officials accountable for meeting these goals.

- The two Presidents should commit themselves to a genuinely partnership-based approach to this mission, with efforts funded with U.S. and Russian resources fully integrated into an overall plan,[14] and U.S. and Russian experts involved in the planning, design, implementation, and review of the entire effort.

- The two Presidents should direct their governments to develop a truly *joint* strategic plan for accomplishing these accelerated goals. The plan should include measurable milestones for progress along the way; a clear strategy for transitioning from U.S. funding and technical assistance toward full Russian responsibility for sustaining security and accounting measures; *jointly* developed guidelines and criteria for the types of

[12] See discussion in Bunn, Holdren, and Wier, *Securing Nuclear Warheads and Materials*, op. cit., pp. 35–43; Matthew Bunn, Oleg Bukharin, and Kenneth N. Luongo, *Renewing the Partnership: Recommendations for Accelerated Action to Secure Nuclear Material in the Former Soviet Union* (Princeton, N.J.: Russian American Nuclear Security Advisory Council, August 2000; available at http://ksgnotes1.harvard.edu/BCSIA/Library.nsf/pubs/ransacreport as of January 13, 2003); Siegfried S. Hecker, "Thoughts About an Integrated Strategy for Nuclear Cooperation With Russia," *The Nonproliferation Review* 8, no. 2 (Summer 2001; available at http://cns.miis.edu/pubs/npr/vol08/82/heck82.htm as of January 13, 2003). For a Russian perspective, see Gennadi Pshakin, Vladimir Samsonov, and Victor Erastov, *U.S.-Russian Collaboration on Nuclear Materials Protection, Control, and Accounting* (Obninsk, Russia: Institute for Physics and Power Engineering, Analytical Center for Nonproliferation, April 2002).

[13] For an earlier discussion of these points, see Bunn, Holdren, and Wier, *Securing Nuclear Warheads and Materials*, op. cit., pp. 35–43.

security and accounting systems to be installed under the cooperative effort, and the level of insider and outsider threats they should be designed to defeat; and an approach to integrating Russia's own ongoing security and accounting efforts with U.S.-funded efforts and those funded by other international participants.

- President Putin should give his personal imprimatur to opening key nuclear facilities to limited access to facilitate this cooperation.[15] The two Presidents should direct their governments to complete an agreed approach to access at all sensitive nuclear sites (or non-access assurances that money is being spent appropriately and work being accomplished to agreed standards)[16] for their approval within 60 days, and should make clear that they will not tolerate failure to reach this objective. For every type of facility where the United States demands direct on-site access by U.S. personnel, it should offer limited reciprocal access to comparable U.S. facilities.

- The two Presidents should commit to providing whatever financial and personnel resources are necessary to ensure that all nuclear warheads and materials are secured by the agreed deadline – and should then each instruct their budget personnel and departments charged with nuclear warhead and material security to ensure that sufficient funds are allocated so that nuclear security progress is not constrained by lack of money.

- As recommended above, each President should appoint a full-time senior official personally accountable to them for accomplishing these goals, with the authority and resources needed to monitor progress and ovecome obstacles as they arise. Bureaucratic delays, often lasting for months or even years at a time, have been endemic to this effort, on both sides of the Atlantic: no one in Moscow was ever fired for saying "no," and no one in Washington was ever fired for saying "let's hang tough until the Russians agree." Both Presidents, along with the key ministers of their governments, need to personally put in the sustained leadership needed to resolve bureaucratic obstacles and keep this effort moving forward as quickly as possible, rather than allowing problems to fester. Three of the biggest factors slowing progress at present are the Russian inability to process and implement contracts quickly in sensitive areas, DOE's demands for detailed review and repeated modifications of each proposed laboratory contracting action, and the still extended U.S. process for travel approvals. These are the kinds of issues that can absorb inordinate amounts of the time of the experts implementing programs, if senior officials do not put in the effort to resolve them.

- The United States and Russia should jointly develop at least a minimum agreed standard for the threats against which nuclear facilities should be secured – taking into account the

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[14] Where U.S. and Russian views of what security upgrades are worthwhile to invest in continue to differ even after the two sides have talked through the reasons for their views, it would make sense to allocate U.S. resources to those upgrades identified as most important by U.S. experts, and Russian resources to the additional upgrades Russian experts believe are also important. (Russian resources might contribute to upgrades at outer perimeter fences, for example, which U.S. experts argue are less important.) Similarly, if there are particular areas where it proves impossible to work out access or assurance arrangements satisfactory to both sides, Russian resources should be used to do the needed upgrades, with U.S. participants providing only technical input Russian experts may request.

[15] While there is now a U.S.-Russian agreement on access for the MPC&A program, which has eased the access problem significantly, it remains true that there are large facilities with huge quantities of nuclear material – including all of the warhead assembly and disassembly facilities, and parts of some other nuclear weapons complex facilities – where no agreed approach to access or non-access assurances has been worked out, and therefore few if any cooperative nuclear security upgrades have been accomplished. Clear direction from President Putin himself is likely to be required to give officials within the Russian system the political cover they need to move forward on even limited access to the most sensitive facilities.

[16] For an extended discussion of the access issue, including possible approaches to ensuring that cooperative upgrades are performed appropriately without direct access by U.S. personnel, see Bukharin, Bunn, and Luongo, *Renewing the Partnership,* op. cit.

scale of the September 11 attacks (four independent and well-coordinated teams of 4–5 well-trained, suicidal terrorists each), the scale of the Moscow theater attack (some 40 heavily armed and suicidal terrorists), and the possibility of substantial insider threats (which might arise not only from corrupt or greedy insiders, but also from insiders being subjected to blackmail – such as if terrorists kidnapped a member of a key nuclear guard's family).

- The United States and Russia should work together to put in place a regular system of performance testing that would help assess how much progress was being made in actually meeting the agreed standard – by demonstrating that some facilities were in fact capable of defeating the specified threats, while identifying weaknesses requiring correction at others.[17] In addition, the two sides should cooperate to expand use of systems to monitor actual security operations at key locations, providing another check on the day-to-day performance of the systems being put in place. [18]

- The accelerated partnership should place very high priority on ensuring that effective security and accounting will be sustained for the long haul. The effort should be designed around an exit strategy focused on ensuring an effective transition from dependence on U.S. funding to sustainable security based on Russia's own resources.

- President Bush should seek a clear commitment from President Putin to provide the Russian government resources needed to sustain and improve the security and accounting systems now being put in place once U.S. assistance phases out.

- As in the rest of the world, the United States and Russia should work together to ensure that nuclear material is removed entirely from the most vulnerable facilities in their two countries as rapidly as possible, and the overall number of buildings and sites where nuclear weapons and weapons-usable nuclear materials reside is substantially reduced. Reducing the number of buildings and sites to be protected will allow higher security to be achieved more quickly, and sustained at lower cost.

- The United States and Russia should focus intensely on building up strong nuclear security and accounting regulation in Russia, to ensure that nuclear facilities will only be allowed to continue to operate if they have effective security and accounting in place for their nuclear warheads and weapons-usable nuclear materials.

- The United States should send the message that high standards of security and accounting for nuclear material are part of the "price of admission" for any facility to get lucrative contracts from the United States – and work to convince other leading nuclear states to do the same.

This is a large and complex agenda. At the same time, this accelerated partnership in securing nuclear warheads and materials within Russia should be framed as one part of U.S.-Russian leadership in the G-8 Global Partnership, as described before. Working together to address security hazards in other countries will help the shift from a donor-recipient relationship to a genuine partnership.

A number of the other initiatives described below – to secure and dismantle the most dangerous nuclear weapons, to strengthen capabilities to interdict nuclear smuggling, to reform efforts to reemploy nuclear experts and shrink nuclear complexes, to reduce the size of these dangerous nuclear stockpiles, and to put agreed declarations and monitoring in place – should also be seen as central elements of such a renewed U.S.-Russian

[17] For a discussion of the importance of performance testing and approaches the United States might use to help Russia establish a regular and effective performance testing program in Russia, see Bukharin, Bunn, and Luongo, *Renewing the Partnership,* op. cit.

[18] Office of International Material Protection and Cooperation, *MPC&A Operations Monitoring (MOM) Project* (Washington, D.C.: U.S. Department of Energy, February 2002).

nuclear security partnership. Indeed, there are other areas we do not address in detail in this report – such as joint research and development on advanced nuclear power systems and fuel cycles – that are less urgent in and of themselves (though valuable), but can help strengthen and deepen the nuclear security partnership between U.S. and Russian experts.

Success in building an accelerated U.S.-Russian nuclear security partnership is likely to be limited as long as U.S. concerns over Russia's sensitive nuclear exports, particularly to Iran, remain unresolved. The United States and Russia need to focus intensively on finding a solution to this issue, including a clear and authoritative Russian commitment that there will be no transfers of technologies related to uranium enrichment or plutonium production and separation, along with in-depth cooperation in strengthening export controls and pursuing individual cases of illicit cooperation. The United States is likely to have to compromise as well, as the first nuclear power plant at Bushehr is now nearing completion, and it is not realistic to expect that it can now be canceled.[19]

The scope of work to be done is large, but finite. This effort is fundamental to the security of Russia, the United States, and the world. Hence, these efforts must be placed at the very top of the U.S.-Russian security agenda. The United States should press forward on this agenda at every level, on every occasion, until the problem is adequately addressed (as is now done with issues such as cooperation with Iran, to take one example). The United States should also work to convince other leading nuclear powers to take a similar approach. While there is much to do, with sustained high-level leadership in both Washington and Moscow focused on building a new partnership to get this job done, it should be possible to secure all of these stockpiles to an initial, interim level within two years, and complete comprehensive upgrades within four years. That would be an outstanding security legacy for President Bush and President Putin.

Recommendation: *Accelerate and strengthen nuclear security and accounting upgrades in Russia, with a partnership-based approach.*

Forging Sensitive Nuclear Security Partnerships

The next step of a prioritized effort would be to move beyond Russia and attempt to apply the tool of cooperative partnerships to upgrade security for nuclear warheads and materials in other key nuclear states around the world. Because of the extraordinary secrecy and deep sensitivities surrounding the nuclear weapons activities of smaller nuclear powers (such as China) states outside the Non-Proliferation Treaty (NPT) regime (such as Pakistan and India) and states whose nuclear weapons efforts remain unacknowledged (such as Israel, which also remains outside the NPT), extending the Nunn-Lugar concept to these quite different situations will not be easy.

This is especially true when it comes to cooperative efforts to improve security for nuclear warheads and materials. For certain kinds of cooperation, the issue of access to sensitive sites will be even more difficult than it has been in the Russian case. Indeed, in the cases of Pakistan, India, and China, in particular, there have already been discussions of possible cooperation in upgrading nuclear security – but as of yet only modest success in overcoming the myriad sensitivities standing in the way. Nevertheless, there are clearly types of cooperation that can be imagined that would serve the international interest in preventing nuclear weapons and materials from falling into hostile hands while serving these countries' interests as well – all in ways entirely permissible under the NPT.[20]

Each of these countries poses a different situation, requiring a different approach, so simply copying exactly the approaches taken in Russia would surely fail. Each will have to be approached with extreme care, to maximize the prospects of success. Such cooperation will be more appealing politically and will be more likely to succeed if it is

[19] For an excellent analysis of U.S. concerns over this issue and possible approaches to resolving the problem, see Robert J. Einhorn and Gary Samore, "Ending Russian Assistance to Iran's Nuclear Bomb," *Survival* 44, no. 2 (Summer 2002).

seen to be one part of the participation of these states, with the world's leading powers, in the Global Partnership focused on keeping weapons of mass destruction out of terrorist hands. Success will require overcoming a wide range of barriers – some of which cannot even be clearly foreseen – and will inevitably require sustained political leadership from the highest levels. But given the stakes at hand, it is crucial to try.

In short, the Bush administration should substantially increase the political level and intensity of its efforts to forge sensitive nuclear security partnerships with key countries beyond the former Soviet Union. Below, we briefly address the issues related to several of these countries.

Pakistan

Pakistan and India, two nuclear-armed neighbors still disputing the territory between them, which have fought repeated wars with each other and have had two crises that nearly came to war since their nuclear tests in 1998, pose perhaps the world's most dangerous nuclear flashpoint. Measures to reduce nuclear tensions on the South Asian peninsula and convince these states that it is not in their interest to move toward full deployment of hair-trigger nuclear arsenals are a key challenge for world security.

Pakistan's nuclear stockpiles also pose particularly urgent concerns over possible nuclear theft – not because security is low (it is not, as far as can be determined from public sources), but because the threat is so high. The potential insider threat arises from the widespread sympathy extreme anti-American causes in Pakistani society (including within its nuclear establishment), and the continuing operation of large and heavily armed remnants of al Qaeda within the country. The Pakistani government has said repeatedly that its nuclear arsenals are highly secure and should not be a concern to anyone, and from what little is known about Pakistani security practices, it does seem that serious attention – and significant numbers of armed guards – are devoted to securing the nuclear stockpile. It appears, however, that the Pakistani security approach, like that of the old Soviet Union, is heavily dependent on "guards, guns, and gates." Pakistan may not have extensively implemented modern safeguards and security technologies such as electronic intrusion sensors, tamper-resistant seals, detectors to set off an alarm if an insider attempts to smuggle nuclear material out of a facility, and security cameras in the areas where nuclear weapons and materials are stored and handled.[21]

There are four key concerns about the security of Pakistan's nuclear weapons and materials: insider theft threats, threats of insiders leaking nuclear expertise, outsider theft threats, and regime change.

Insider theft threats. A significant segment of Pakistani society holds extreme Islamic views and is sympathetic to the Taliban and al Qaeda. This includes some insiders within Pakistan's nuclear weapons program, as demonstrated by the case of Sultan Bashiruddin Mahmood, a former head of Pakistan's plutonium production who, with a colleague from the nuclear program, strongly supported the Taliban, established an Islamic charity in Afghanistan, met with Osama bin Laden there, had extensive discussions in which bin Laden asked for technical information on nuclear, chemical, and biological weapons, and was placed under house arrest for a time on suspicion of passing nuclear secrets to al Qaeda.[22] The possibility that

[20] Each state that is a party to the NPT pledges "not in any way to assist, encourage, or induce any non-nuclear-weapon State to manufacture or otherwise acquire nuclear weapons or other nuclear explosive devices, or control over such weapons or explosive devices" (Article I; full text of *The Treaty on the Non-Proliferation of Nuclear Weapons* available at http://disarmament.un.org/wmd/npt/npttext.html as of January 13, 2003). This would very likely prohibit, for example, helping Pakistan and India design warheads incorporating modern electronic lock technologies to prevent unauthorized use (though it would not prohibit providing unclassified information on the concepts behind such technologies, and discussing their benefits). This NPT provision, however, would pose essentially no constraint on wide-ranging cooperation to upgrade security and accounting measures designed to prevent theft of warheads and materials.

[21] The sparse information that is publicly available is summarized in Nathan Busch, *Assessing the Optimism-Pessimism Debate: Nuclear Proliferation, Nuclear Risks, and Theories of State Action* (Ph.D. dissertation, University of Toronto, 2001).

insiders would attempt to steal a nuclear weapon or nuclear material to make one – or help outsiders, by leaving locks open, disabling alarms, providing information on the security system, and the like – is real. Hence, effective measures to address insider threats must be put in place at Pakistani nuclear weapons and nuclear material facilities. Given that the Mahmood case involved a very senior figure in Pakistan's nuclear weapons program, working together with another scientist from the program, security systems for Pakistan's facilities should be designed to be able to block theft attempts by at least two insiders in any position, working together.

Threats of insiders leaking nuclear expertise. The Mahmood case did not involve any accusation of an attempt to actually steal nuclear weapons or materials; the issue, rather, is whether Mahmood and his colleague may have shared secrets about how to build a bomb. While help from a nuclear weapons expert might not be essential for al Qaeda to be able to construct a crude nuclear explosive, it would certainly be enormously useful to them. Here, too, Pakistan has provided public assurances that its security system to protect nuclear secrets is already sufficient to the task. But there are multiple reasons to believe that there is more work to do in strengthening Pakistan's protection against leakage of nuclear secrets: the Mahmood case; the documents found in Iraq that indicate that A.Q. Khan, the father of Pakistan's nuclear weapons program, offered centrifuge technology to Iraq;[23] reports that Khan has traveled both to North Korea (as part of Pakistan's reported deal with North Korea trading centrifuge technology for missiles) and to Iran;[24] and Khan's ouster from his leading role in Pakistan's nuclear program.[25] Of course, the United States itself does not have a flawless record in protecting nuclear secrets. Nevertheless, it is clear that there are types of U.S.-Pakistani cooperation that could be helpful, such as training, equipment, and assistance in putting in place effective procedures for personnel screening. The commander of Russia's force in charge of guarding nuclear weapons has publicly said that such cooperation has had significant benefit in improving the security of Russia's nuclear arsenal.[26]

Outsider theft threats. Pakistan clearly has an enormous domestic problem with Islamic terrorism, and the possibility of an attempt to break into a Pakistani nuclear facility by a large, well-armed, well-trained, al Qaeda-linked group cannot be ruled out. As in the insider case, the threat that must be defended against may be a substantial one: if Chechen rebels can successfully carry out an operation involving 40 suicidal terrorists armed with automatic weapons and explosives in the middle of Moscow, it seems very likely that al Qaeda could mount an operation of comparable or even larger scale within Pakistan. Ensuring that facilities are secure against a threat of that magnitude (possibly attacking with the help of insiders within the facility) requires substantial armed response forces – as well as appropriate security technologies, from intrusion detectors to means for the guards to communicate with each other, travel to the point of the attack, and fight from armored positions where they cannot be easily shot. These are all areas where cooperation between the United States and Pakistan – as well as cooperation with other potential partners in a global effort to secure warheads

[22] See, for example, Kamran Khan and Molly Moore, "2 Nuclear Experts Briefed Bin Laden, Pakistanis Say," *Washington Post*, December 12, 2001; Kaman Khan, "Pakistan Releases Nuclear Scientists for Ramadan's End," *Washington Post*, December 16, 2001; and Peter Baker, "Pakistani Scientist Who Met Bin Laden Failed Polygraphs, Renewing Suspicions," *Washington Post,* March 3, 2002.

[23] See, for example, David Albright and Khidir Hamza, "Iraq's Reconstitution of Its Nuclear Weapons Program," *Arms Control Today* (October 1998; available at http://www.armscontrol.org/act/1998_10/daoc98.asp as of January 13, 2003).

[24] See, for example, Maggie Farley and Bob Drogin, "The Evil Behind the Axis?" *Los Angeles Times*, January 5, 2003.

[25] For a discussion similarly arguing that Pakistan's controls over nuclear secrets need to be tightened, see David Albright, "Secrets? What Secrets?" *Scientific American,* December 2001.

[26] See Matthew Bunn, "Warhead Security," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/securing/warhead.asp as of March 12, 2003).

and materials, such as China (discussed below) – could make a substantial difference in improving security.

Regime change. Another concern is that the current Pakistani government led by General Pervez Musharraf might someday fall and be replaced by a Taliban-like government – which would then be in possession of all of Pakistan's nuclear weapons, materials, and expertise. Should such a change in government occur, no security systems installed now would be of much help. Indeed, this eventuality would leave the United States and other concerned governments with few options.

The United States is already attempting to start cooperation with Pakistan to improve security for nuclear warheads and materials, [27] and some initial cooperation appears to be moving forward.[28] As of late 2002, however, Pakistan had not yet responded to a DOE proposal for substantial cooperation on security upgrades.[29] There is much more that can and should be done to work with Pakistan to improve nuclear security.[30]

Initially, at least, workshops on issues such as designing, evaluating, and testing nuclear security systems, and the capabilities of types of equipment that are commercially available – designed to help Pakistani experts carry out substantial security improvements themselves – are likely to be more successful than cooperation based on U.S. experts actually visiting and helping with upgrades at the key sites where Pakistan's nuclear stockpiles are stored. Having been isolated from the world nuclear community for many years because of weapons-related sanctions, Pakistan's nuclear community might well be eager to explore what could be done to improve security with the most modern technologies available. The Bush administration should quietly but firmly intensify its efforts with Pakistan, making it clear to the Musharraf government that providing real confidence that Pakistan's nuclear stockpiles and secrets are secure – even against the severe threats that exist in Pakistan – is a must, not an option. To increase the chances of success, this cooperation should be pursued in the political context of joint efforts to improve Pakistan's domestic security, rather than as yet another U.S. nonproliferation demand. This should be seen as an absolutely central element of ongoing U.S.-Pakistani cooperation in battling al Qaeda and related groups.

India

India must be treated as a quite different case from Pakistan. India's overall nuclear program is larger and more sophisticated, and India is much less dependent on the United States, reducing potential U.S. leverage that could be used to encourage cooperation. India's nuclear establishment regards the cutoff of nuclear cooperation imposed after India's 1974 nuclear test, and the sanctions imposed after the 1998 tests, as tantamount to colonialism, and deeply distrusts U.S. motives with respect to nuclear cooperation.[31] Moreover, while India also has a large Muslim pop-

[27] Interviews with U.S. Department of Energy and IAEA officials, September 2002. See also Douglas Frantz, "U.S. and Pakistan Discuss Nuclear Security," *The New York Times*, October 1, 2001, and Alex Wagner, "U.S. Denies Talks With Pakistan on Nuclear Security," *Arms Control Today*, November 2001 (available at http://www.armscontrol.org/act/2001_11/paknucnov01.asp as of January 20, 2003).

[28] Interviews with U.S. officials, November 2002.

[29] Interviews with Department of Energy (DOE) officials, October 2002.

[30] See, for example, Lee Feinstein, James C. Clad, Lewis A. Dunn, and David Albright, *A New Equation: U.S. Policy Toward India and Pakistan After September 11* (Washington, D.C.: Carnegie Endowment for International Peace, May 2002; available at http://www.ceip.org/files/pdf/wp27.pdf as of January 13, 2003), especially the chapters by Albright and Dunn; and Rose Gottemoeller and Rebecca Longsworth, *Enhancing Nuclear Security in the Counter-Terrorism Struggle: India and Pakistan as a New Region for Cooperation* (Washington, D.C.: Carnegie Endowment for International Peace, August 2002; available at http://www.ceip.org/files/pdf/wp29.pdf as of January 13, 2003).

[31] The United States continues to reject some relatively innocuous nuclear safety cooperation that India has proposed – such as comparing the results of U.S. and Indian computer codes designed to simulate the progression of certain types of nuclear accidents (without exchanging any of the codes). This has further exacerbated Indian suspicion of U.S. motives with respect to India's nuclear program.

ulation, some of whom are participants in its nuclear weapons program, there is much less sympathy for extreme Islamic causes among India's Muslims, and the overall level of theft threats to India's nuclear facilities is likely to be substantially lower than in Pakistan.[32] Nevertheless, there is surely a substantial terrorist threat in India, and Prime Minister Indira Gandhi's assassination by members of her personal guard highlights the very real possibility of an insider threat.

In India's case, as in Pakistan's, little information is publicly available about procedures for securing and accounting for nuclear weapons and materials.[33] Both are believed to be located in a small number of facilities under heavy guard. A special security force guards both nuclear installations and other especially dangerous or sensitive industrial facilities. Indian experts report that detailed nuclear material accounting measurements, including assessments of material unaccounted for, are taken regularly, and that all facilities with weapons-usable nuclear material are equipped with portal monitors to detect any unauthorized removals. Indian intelligence services reportedly closely monitor personnel at nuclear facilities.[34] Nevertheless, India, like Pakistan, has been isolated from the world nuclear community for decades as a result of weapons-related sanctions (though Indian experts have regularly participated in international courses and meetings on security for nuclear facilities). Thus, it may not have implemented all the best approaches that have been developed around the world for securing nuclear facilities and materials.

Hence, here, too, as U.S.-Indian counter-terror cooperation expands, the United States should place significant priority on establishing nuclear security cooperation. This cooperation would cover protection against theft of nuclear weapons or materials, leakage of nuclear expertise, and also improved protection of India's nuclear facilities against sabotage (a potentially important concern, given the increasingly extreme attacks that Islamic terrorist groups have carried out, such as the attack on the Indian Parliament in 2001). In India, even more than in Pakistan, cooperation is more likely to succeed under the rubric of joint cooperation against terrorist threats to India's domestic security than in the political context of another U.S. nonproliferation demand. As in the Pakistani case, at least initially cooperation is likely to be more successful if it focuses on workshops and other measures designed to help Indian experts upgrade security themselves than if the United States seeks information on (or visits to) sensitive Indian nuclear facilities. Indeed, an initial focus on protecting civilian facilities against sabotage may involve fewer sensitivities, while allowing many of the same concepts that would be used to secure warheads and materials to be discussed. Other participants in the Global Partnership to secure weapons and materials – particularly Russia, which has established a close relationship with India's nuclear program (in some cases violating or skirting the edge of its nonproliferation obligations) – could also play key roles in working with India to provide expertise on modern security and accounting systems. The United States should encourage them to do so.

China

Unlike India and Pakistan, China is a nuclear-weapon-state party to the NPT. Nevertheless, U.S.-Chinese cooperation related to nuclear matters is extraordinarily sensitive – particularly in the aftermath of the accusations of Chinese nuclear espionage in the United States in the late 1990s. In general, China is believed to have a system for security and accounting for its nuclear warheads and materials that is similar to the old Soviet system – heavily dependent on "guards, guns, and gates," with relatively little application of modern safeguards technologies that may be needed if insider theft becomes a serious concern (as it may, with China's increasingly market-oriented and increasingly corrupt society).[35] Outside terrorist attack may some-

[32] The most prominent example is APJ Abdul Kalam, now India's President, long the key leader of its missile programs and a prominent figure in its nuclear weapons efforts.

[33] For a summary of available public information, see Busch, *Assessing the Optimism-Pessimism Debate,* op. cit.

[34] Interview with former senior Indian nuclear weapons and military science official, April 2002.

day also be an issue: China does have a continuing problem with terrorist groups, including groups based in China's Islamic minority, which the Chinese government believes are linked to al Qaeda.

The United States and China initiated a lab-to-lab cooperation program on technologies for securing and accounting for nuclear materials in the late 1990s. This effort ultimately included the installation of a demonstration facility for modern safeguards and security technology at the China Institute of Atomic Energy in Beijing, which U.S. participants hoped would create a new standard for securing and accounting for nuclear materials in China.[36] This cooperation has been frozen since the scandal over allegations of Chinese nuclear espionage in the United States – though U.S. physical protection experts have traveled to China to give lectures and have discussions on approaches to securing nuclear material under IAEA auspices since then.[37] Here, too, the United States should press forward more intensively in attempting to establish cooperation to improve security and accounting for nuclear material – and to enlist China as a key participant in an expanded Global Partnership to secure nuclear weapons and materials around the world.

Israel

Israel's nuclear stockpile is believed to exist at a very small number of sites, under heavy guard, but virtually no details of security arrangements for this unacknowledged stockpile are publicly available. Israel has long experience in battling terrorist threats and a reputation for taking harsh measures against those involved in security breaches (as in the case of former nuclear weapons worker Mordechai Vannunu). Given the extraordinary secrecy that surrounds Israel's nuclear weapons program, international cooperation on actual upgrades for security and accounting arrangements at Israeli facilities is not likely to be possible in the near term. Nevertheless, given the close U.S.-Israeli counter-terror relationship, there may be opportunities for at least workshops to discuss approaches to nuclear security and accounting. And Israel should be asked to commit itself to meet stringent, agreed standards for security as an extension of the G-8 global coalition to secure WMD and related materials.

France and Britain

France and Britain are already members of the G-8 Global Partnership, and hence can and should be expected to play key roles in a global effort to ensure that all nuclear weapons and materials are secure and accounted for – both in achieving stringent standards for their own stockpiles, and in helping other states to do the same. Both are believed to maintain stringent standards of security and accounting for their nuclear weapons and materials (though in these cases, too, as in the United States, there are well-informed critics who suggest that more should be done).[38] As NATO members, both countries already have very extensive security cooperation with the United States underway. Both, however, are extremely sensitive to any U.S. criticism in this area, in part because of their disagreements with the United States over plutonium reprocessing.

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[35] For a summary of physical protection practices in China, see Tang Dan, Yin Xiangdong, Fang Ni, and Guo Cao, "Physical Protection System and Vulnerability Analysis Program in China" (paper presented to the International Seminar on Disarmament and the Resolution of Conflict (ISODARCO), Beijing, China, October 2002). (It is notable that the authors begin with a review of recent changes in Chinese society, with the conclusion that these changes increase the criminal threat and decrease the ability to rely solely on the loyalty of insider personnel.) Here again, the sparse information that is publicly available on China's practices is summarized in Busch, *Assessing the Optimism-Pessimism Debate,* op. cit; see also Nathan Busch, "China's Fissile Material Protection, Control, and Accounting," *Nonproliferation Review* 9, no. 3 (Fall/Winter 2002); and Center for Nonproliferation Studies, "China's Attitude Toward Nuclear Material Protection, Control, and Accounting" (Monterey, Cal.: CNS, June 1998; available at http://www.nti.org/db/china/mpcapos.htm as of January 13, 2003).

[36] See Nancy Prindle, "The U.S.-China Lab-to-Lab Technical Exchange Program," *Nonproliferation Review* 5, no. 3 (Spring-Summer 1998; available at http://cns.miis.edu/pubs/npr/vol05/53/prindl53.pdf as of January 13, 2003).

[37] The most recent IAEA-sponsored workshop on physical protection held in China – with U.S. experts giving most of the talks, and with participants from China, India, Pakistan, and both Koreas participating – occurred in December 2002. Interviews with IAEA and Sandia National Laboratory experts, September 2002 and December 2002.

The plutonium powers

Several European states, Japan, Russia, and India reprocess their civilian spent fuel to separate the plutonium for use as new fuel. (China plans to do so as well, but has not yet begun civilian reprocessing on any substantial scale.) As a result, tens of tons of separated, weapons-usable plutonium are processed and shipped from place to place every year – and only a few kilograms are needed for a bomb.[39] In Britain, France, and non-nuclear-weapon states such as Japan and Germany, this material is under international safeguards, and is therefore accounted for to international standards – but these safeguards are designed only to detect whether the host state might be diverting civilian material for military purposes, not to prevent theft. Most of this material is well secured, but standards vary widely from one country to the next. In Japan, for example, armed guards were not required for plutonium facilities until after the attacks of September 11. Because reprocessing of plutonium has outpaced its use as fuel, over 200 tons of civilian separated weapons-usable plutonium are in storage – an amount that increases by many tons each year, and will soon surpass the total of all the plutonium in all the world's nuclear weapons arsenals.

In the aftermath of September 11, the risk-benefit balance for reprocessing has tilted further against the practice: whatever safeguards and security measures are in place, a world in which tens of tons of plutonium are being separated, processed, fabricated, and shipped to dozens of locations around the world every year is a world that poses significant risks above and beyond those of a world in which that is not occurring. Hence, we believe that there should be a phased-in moratorium on current approaches to reprocessing and recycling plutonium. Nuclear power's future will be best assured by making it as cheap, as safe, as secure, as proliferation-resistant, as simple, and as uncontroversial as possible – and current reprocessing and recycling technologies point in the wrong direction on every count.[40] We are under no illusions, however, that such a moratorium is likely, given the very large commercial investments and interests in continuing on the present course.

Whatever approach is taken to reprocessing, it would make sense for all the relevant states to cooperate to ensure that all stocks of separated plutonium are secured and accounted for to stringent standards.[41] This should be a central component of the Global Partnership to secure nuclear weapons and materials around the world. Nevertheless, this effort, too, will be politically sensitive and challenging, even though nearly all of the relevant players are close allies of the United States, because many of these states see U.S. concerns over security and accounting for separated plutonium as a thinly veiled attack on their reprocessing policies.

Recommendation: *Forge nuclear security partnerships with other key nuclear states, including Pakistan, India, and China.*

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[38] See, for example, Xavier Coeytaux, Yacine Faid, Yves Marignac and Mycle Schneider, *La Hague Particularly Exposed to Plane Crash Risk* (Paris: WISE-Paris, September 26, 2001; available at http://www.wise-paris.org/english/ourbriefings_pdf/010926BriefNRA1v4.pdf as of January 13, 2003).

[39] While this plutonium is largely "reactor-grade," all separated plutonium (except plutonium with 80% or more of the isotope Pu-238) is weapons-usable. Terrorists or unsophisticated states could make a crude bomb from reactor-grade plutonium, using technology no more sophisticated than that of the Nagasaki bomb, which would have an assured, reliable yield in the kiloton range (and therefore a radius of destruction roughly one-third that of the Hiroshima bomb), and a probable yield significantly higher than that; sophisticated states could make weapons with reactor-grade plutonium that would have similar yield, weight, and reliability to those made from weapon-grade plutonium. For an authoritative unclassified discussion, see U.S. Department of Energy (DOE), Office of Arms Control and Nonproliferation, *Final Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives,* DOE/NN-0007 (Washington, D.C.: DOE, January 1997), pp. 37–39.

[40] For a discussion, see, for example, John P. Holdren, "Improving U.S. Energy Security and Reducing Greenhouse-Gas Emissions: The Role of Nuclear Energy," testimony to the U.S. House of Representatives, Committee on Science, Subcommittee on Energy and Environment, 106th Congress, 2nd Session, Washington, D.C., July 25, 2000.

[41] See "Building Effective Global Nuclear Security Standards," below.

Building Effective 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. With attacks in New York, Washington, Kenya, Tanzania, Moscow, Bali, and elsewhere, terrorists have amply demonstrated their global reach, and their ability to seek out and strike weak points on a global basis. Vulnerable nuclear material anywhere is a threat to everyone, everywhere. The international community therefore has an overwhelming interest in ensuring that each state with weapons-usable nuclear material carries out its responsibility to secure that material. Shortly after the September 11 attacks, IAEA Director General Mohammed ElBaradei summed up the situation well:

> An unconventional threat requires an unconventional response, and the whole world needs to join together and take responsibility for the security of nuclear material…. Security is as good as its weakest link and loose nuclear material in any country is a threat to the entire world…. Countries must demonstrate, not only to their own populations, but to their neighbors and the world that strong security systems are in place.[42]

Yet today, there are no binding international standards for security of weapons-usable nuclear material, and national practices vary enormously.

There is probably no country in the world where attack by a small group of well-armed and well-trained terrorists, possibly in collusion with one insider, is not a realistic threat. But the security systems for nuclear material in many countries would not be able to defeat such a threat. There is near-unanimity among senior political officials and military officers that potential bomb material everywhere must be protected to stringent standards. But 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 an international requirement for such standards.

Unfortunately, the world's response to the implications of September 11 for nuclear threats has been entirely conventional, not the unconventional new thinking called for by the head of the IAEA. Negotiations to amend the Convention on Physical Protection of Nuclear Material to expand its coverage from material in international transport to domestic material, begun well before the September 11 attacks, have been stymied in attempting to reach any accord that would actually create any internationally accepted standard for nuclear material security. Even the extraordinarily vague requirements the existing convention imposes on nuclear material in international transport will not be extended to nuclear material in domestic use.[43] Similarly, despite occasional calls from senior political leaders, there has been no significant movement toward breaking the years-long deadlock at the United Nations on a proposed international convention on nuclear terrorism – which in any case currently has only brief and general provisions related to securing nuclear material. There is no prospect whatever that the route of formal treaty negotiation will soon lead to a standard meeting ElBaradei's sensible goals – one that would ensure "strong" security in every state where nuclear weapons and weapons-usable nuclear materials exist, in a way demonstrable to every state's neighbors and to the rest of the world. One is reminded of Albert Einstein's famous remark that the invention of nuclear weapons "changed everything save our modes of thinking and we thus drift toward unparalleled catastrophe."[44]

Efforts to amend the Convention on Physical Protection, draft a Nuclear Terrorism Convention, and update the IAEA's nuclear security recommendations should be continued: each has its own value. But these efforts should not be relied on to provide the effective global nuclear security stan-

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[42] International Atomic Energy Agency (IAEA), "Calculating the New Global Nuclear Terrorism Threat" (Vienna, Austria: IAEA, November 1, 2001; available at http://www.iaea.org/worldatom/Press/P_release/2001/nt_pressrelease.shtml as of January 20, 2003).

[43] Interviews with U.S. and Austrian negotiators and IAEA officials, September 2002.

dard that is urgently needed.[45] To build such a standard, a new approach is necessary, which would incorporate four essential elements:

- Focus on a political commitment rather than a negotiated treaty, to avoid years of negotiation;
- Negotiation at the political level, allowing national security concerns to be balanced against bureaucratic opposition;
- Commitments phrased in terms specific enough to be effective, but general enough to allow each state substantial flexibility to take its own approach to meeting them; and
- Incentives for states to join in the commitment.

The best available approach to building such a global standard is to build from the commitments already made in the G-8 Global Partnership accord of June 2002. In that statement, the participants each commit themselves to develop and maintain "appropriate" and "effective" security and accounting for all the nuclear weapons and materials, and the other WMD-related stockpiles, under their control – and to assist other states to do likewise. At the same time, the G-8 members called "on all countries to join them" in making these commitments.[46] Moreover, while the G-8 leaders emphasized that the initial focus of the $20 billion in pledged expenditures would be Russia, they made clear in their statement that they are willing to negotiate with "any other recipient countries" prepared to commit to the partnership's principles.

To transform the G-8 statement's very general principles into a political commitment to a strong nuclear security standard, essentially all that has to be done is to negotiate an additional statement specifying what was meant by "appropriate" and "effective" nuclear security and accounting measures. The G-8 partners should then also repeat, and make even more explicit, their offer of assistance to any country willing to make a commitment to reach this agreed standard but unable to muster the financial or technical resources to do so. Such statements could be worked out by the "Senior Officials Group" of the G-8, for adoption at the next G-8 summit in June 2003 in France.

To preserve the flexibility for Britain to continue to implement nuclear security with a British approach, France with a French approach, the United States with an American approach, and so on, the statement spelling out what was meant by "appropriate" and "effective" should *not* get bogged down in specifying how high fences should be or what types of locks should be placed on vaults. Rather, it should be performance-based, focusing on what such security systems should be able to accomplish – regardless of the specific means chosen to reach that end. It should be possible to specify the commitment adequately in a page or two.

In particular, it should specify a particular design-basis threat – for example, an insider in any position, two independent but coordinated teams of 4–5 well-armed and well-trained outside attackers each, or both insiders and outsiders working together – that any site where nuclear weapons or weapons-usable nuclear materials are located should be able to defeat reliably.[47] This should be expressed as a *minimum* standard, leaving each state free to provide *more* protection if it believes plausible threats are higher within its country, and leaving terrorists uncertain as to what level of defense they will find at any particular facility.

Incentives to participate will be a key to the success or failure of any such attempt to forge an effective global nuclear security standard. A critical reason why no binding international standards exist today is that the costs of agreeing to comply with any particular standard that might have been proposed are immediate, specific, and borne directly

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[44] Albert Einstein, "Telegram to prominent Americans, May 24, 1946," quoted in *New York Times,* May 25, 1946.

[45] For an earlier discussion, see Bunn, Holdren, and Wier, *Securing Nuclear Warheads and Materials*, op. cit. pp. 57–63.

[46] Group of Eight, "Statement by G8 Leaders: The G8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction" (Kananaskis, Canada, June 27, 2002; available at http://www.g8.gc.ca/kananaskis/globpart-en.asp as of February 26, 2003).

by the institutions to whom the negotiators reported, while the benefits in reduced risk of nuclear theft and terrorism have been seen as diffuse, uncertain, and mainly accruing to other countries or institutions. For the wealthy members of the G-8, the primary incentives to participate in a new standard will have to be its security value and the potential political embarrassment (and impact on political relations with the United States) of opting out. For many other states, however, an explicit offer of assistance to countries willing to commit to the standard will reverse the direction of the incentive – from a strong incentive *not* to agree to any standard, so as to avoid the potential costs of doing so, to a strong incentive to agree, in order to be seen to be taking part and to receive the benefits of doing so. As time goes on, other incentives to join the standard should be offered. For example, the members of the Nuclear Suppliers Group have agreed for years to require countries they supply to meet rather vague minimum nuclear security standards – and these could and should be upgraded to reflect the new agreed standard, if one is reached as part of the G-8 partnership. Ultimately, effective security and accounting for weapons-usable nuclear material should become part of the "price of admission" for doing business in the international nuclear market.

At the same time, a new statement designed to be the foundation of a new nuclear security standard should include either agreement on particular measures to provide confidence that the commitment is being met, or at least a commitment to develop agreed measures toward that end as rapidly as practicable. International expert peer reviews of security arrangements should eventually become a commonplace part of doing business in the nuclear area, just as international safety peer reviews have become. The sensitivities surrounding security for nuclear material are very high, however. One promising approach, in cases where permitting international experts to review security arrangements was considered too sensitive, would be for countries to report to other participants in the Global Partnership (perhaps confidentially) on the results of realistic performance tests at their facilities against the agreed design-basis threat, along with other regulatory performance assessments, and measures being taken to correct any weaknesses that had been identified.

In short, the United States should vigorously push for a further statement from the G-8 that each member country would protect its weapons-usable nuclear materials to at least an agreed minimum design-basis threat, and would be prepared to assist any state willing to join them in making that commitment but unable to afford to do so. Such a statement could provide (a) a strong incentive for states to join in agreeing to a stringent standard, (b) a mechanism for targeting physical protection assistance where it may be most needed, (c) a foundation for building confidence that states were in fact meeting their obligations to effectively secure their nuclear weapons and materials, and (d) a substantial degree of flexibility for each state in how precisely to meet the agreed standard.

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[47] An alternative approach would be to specify what has been called the "stored weapon standard" – the notion that, because acquiring the nuclear material is most of the job of getting a nuclear bomb, to the extent possible weapons-usable nuclear material should be secured and accounted for to the same stringent standards that nuclear weapons themselves are. See U.S. National Academy of Sciences, Committee on International Security and Arms Control, *Management and Disposition of Excess Weapons Plutonium* (Washington, D.C.: National Academy Press, 1994. This would be the most effective standard, if it could be agreed and implemented, and should be the goal for the long term. Moreover, the basic concept of this approach is quite easy to explain to senior political leaders. But it represents a standard substantially higher than that now usually applied even at the more secure civilian facilities handling weapons-usable nuclear material (such as plutonium processing facilities), and since it would involve increased costs at such facilities, it might be quite difficult to reach agreement on, even among the participants in the G-8 Global Partnership. Moreover, it would have the disadvantage of leaving it unclear exactly what was being committed to, since different countries protect their nuclear weapons differently, and the specific standards for protection of nuclear weapons in each country are generally secret. (For an attempt to explicate at an unclassified level what such a commitment to the stored weapon standard would mean, see George Bunn, "U.S. Standards for Protecting Weapons-Usable Nuclear Material Compared to International Standards," *Nonproliferation Review* 6, no. 1 (Fall 1998; available at http://cns.miis.edu/pubs/ npr/vol06/ 61/bunn61.pdf as of January 13, 2003)

Recommendation: ***Gain G-8 political commitment, as part of the Global Partnership, on an effective common standard for nuclear security, and on an offer of assistance to any state willing to commit to meet the standard but unable to afford to do so.***

Securing, Monitoring, and Dismantling the Most Dangerous Warheads

The Strategic Offensive Reductions Treaty signed by President Bush and President Putin in May 2002, while valuable, represents a missed opportunity to reduce threats of nuclear terrorism.[48] It does not require that the reduced warheads be dismantled, or their security improved, and it does not address tactical nuclear warheads at all.

Tactical warheads have not been addressed by any arms reduction treaties. Both the United States and the Soviet Union committed in 1991–1992 to unilateral reductions of their tactical nuclear warheads, but no verification was included in those commitments, and there are concerns over how completely they are being carried out. Despite those unilateral reductions, tactical nuclear weapons have been the subject of increasing international concern.[49]

Indeed, none of the arms reduction agreements to date have imposed any controls at all on what happens to any types of nuclear warheads after they are removed from their delivery platforms.[50] It is a remarkable fact that neither the United States nor Russia has ever verified the dismantlement of a single nuclear warhead by the other country, and that not a penny of threat reduction assistance has gone directly for Russian warhead dismantlement.

To address the danger of nuclear terrorism, in addition to improving security at all nuclear warhead storage facilities as rapidly as practicable, the time has come for a new initiative focused on a fast-paced program to secure, monitor, and dismantle thousands of nuclear weapons in both Russia and the United States – including in particular all of the most dangerous weapons, namely, those not equipped with modern safeguards against unauthorized use.

In principle, the nuclear weapons that pose the greatest nuclear terrorism danger are those that are:

- Located at poorly secured facilities, especially dispersed, forward-deployed facilities (which would likely be more vulnerable to terrorist attack than large central storage facilities);
- Small and relatively easy to transport;[51] and
- Not equipped with modern electronic locks and related devices intended to prevent unauthorized use.

Tactical nuclear weapons are believed to have all of these properties more frequently than do strategic nuclear weapons, and Russia in particular is believed to have a tactical nuclear weapons stockpile several times the size of the U.S. stockpile. But with respect to the risk of nuclear terrorism, the most important distinction in the weapons themselves is not whether they are strategic or tactical – indeed, in some cases, the same weapon design is used for both purposes – so much as whether they are equipped with modern electronic locks or not.

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[48] For a critique of this approach, see Tom Z. Collina and Jon B. Wolfsthal, "Nuclear Terrorism and Warhead Control in Russia," *Arms Control Today* (April 2002; available at http://www.armscontrol.org/act/2002_04/colwolfapril02.asp as of January 13, 2003).

[49] See, for example, T. Susiluoto, ed., *Tactical Nuclear Weapons: Time for Control* (Geneva, Switzerland: United Nations Institute for Disarmament Research, September 2002); Also, Alistair Millar, "The Pressing Need for Tactical Nuclear Weapons Control," *Arms Control Today,* (May 2002; available at http://www.armscontrol.org/act/2002_05/millarmay02.asp as of January 13, 2003); and William Potter, Nikolai Sokov, Harald Müller, and Annette Schaper, *Tactical Nuclear Weapons: Options for Control*, UNIDIR/2000/20 (Geneva, Switzerland: United Nations Institute for Disarmament Research, 2000).

[50] The Intermediate-Range Nuclear Forces (INF) Treaty did require the destruction of the aerodynamic shells for the warheads on the missiles reduced under the agreement, but that treaty imposed no subsequent controls on the warheads themselves.

In the United States, such locks are referred to as "permissive action links" (PALs). In essence, PALs are intended to make it difficult to detonate the weapon without first inserting an authorized code. Modern versions are designed to be integral to the weapon, making it very difficult to bypass the locking device and "hotwire" the weapon to detonate. They are also equipped with "limited try" features that will permanently disable the weapon if the wrong code is entered too many times, or if attempts are made to tamper with or bypass the lock.[52] Older versions do not have all of these features, and therefore would provide somewhat less of an obstacle to a terrorist group attempting to detonate a stolen weapon they had acquired. In addition to PALs, many weapons are equipped with devices which prevent the weapon from detonating until it has gone through its expected flight-to-target sequence – for example, in the case of a nuclear artillery shell, the explosive acceleration of being fired from a cannon, followed by the coasting through the air of unpowered flight. These features, if designed to be very difficult to bypass, can also pose a serious obstacle to a terrorist group detonating a stolen weapon.

Unfortunately, what little information is publicly available suggests that older Soviet-designed weapons, particularly older tactical weapons, may not be equipped with modern versions of such safeguards against unauthorized use.[53] In both the United States and Russia, thousands of nuclear weapons, particularly older varieties, have been dismantled in recent years, and it is likely that most of the most dangerous weapons lacking modern safeguards have been destroyed. But neither country has made any commitment to destroy all of these weapons.

The reality is that both Russia and the United States still retain thousands more warheads than they actually need for any conceivable military purpose. These excess warheads – particularly the most dangerous ones – should be permanently dismantled, reducing the risk that they might someday fall into terrorist hands. But a new initiative that focused *only* on warhead dismantlement would not solve the problem, as securing canisters containing plutonium and HEU components from dismantled warheads is roughly as difficult as securing the weapons themselves. Hence, a comprehensive approach to particularly dangerous nuclear weapons would include securing them, monitoring their security pending dismantlement, dismantling them, and then monitoring the security of their fissile material components after dismantlement.

President Bush could substantially improve U.S. nuclear security by taking a page from his father's playbook – a page largely designed by senior members of the current Bush administration, including Colin Powell and Dick Cheney – and launching a new initiative that builds and improves on the reciprocal nuclear reduction initiatives launched by President George H.W. Bush in 1991. Under such a new initiative, the United States and Russia

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[51] Russian officials have confirmed that some Russian nuclear weapons weighed 34 kilograms – less than 80 pounds. But the distinction between the terrorist risk posed by smaller, more portable warheads and larger ones should not be over-emphasized, as any insider or outsider group with the resources to successfully remove a nuclear weapon from a storage site is likely also to be able to provide a suitable truck to carry it in.

[52] For discussions of PALs and their role, see, for example, Peter Stein and Peter Feaver, *Assuring Control Over Nuclear Weapons: The Evolution of Permissive Action Links* (Cambridge, Mass.: Center for Science and International Affairs, Harvard University, 1987); Peter Feaver, *Guarding the Guardians: Civilian Control of Nuclear Weapons in the United States* (Ithaca, N.Y.: Cornell, 1992); and Donald R. Cotter, "Peacetime Operations: Safety and Security," in Ashton B. Carter, John D. Steinbruner, and Charles A. Zraket, eds., *Managing Nuclear Operations* (Washington, D.C.: Brookings Institution, 1987).

[53] See, for example, Bruce G. Blair, Testimony to the House National Security Committee, Subcommittee on Research and Development, March 17, 1997 (in which Blair reports that tactical nuclear weapons "built before the early 1980s lack the safety locks known as permissive action links"), and Bruce W. Nelan, "Present Danger: Russia's Nuclear Forces Are Sliding Into Disrepair and Even Moscow is Worried About What Might Happen," *Time Magazine Europe,* April 7, 1997 (which reports U.S. intelligence estimates that Russian tactical weapons "often" have external locks "that can be removed, and many have none at all").

would each announce that they would take the following steps:

- Place thousands of excess warheads (both strategic and tactical), including specifically *all* warheads not equipped with modern electronic locks to prevent unauthorized use, in secure storage facilities, and open those facilities to monitoring by the other side;[54]

- Commit that these warheads will be verifiably dismantled as soon as agreed procedures are developed to do so without compromising information that must remain secret, even between the United States and Russia;

- Commit that once dismantled, the nuclear materials from these warheads will also be stored in agreed, highly secure storage facilities subject to joint monitoring (such as the Mayak Fissile Material Storage Facility under construction in Russia);

- Commit that these plutonium and HEU stockpiles, along with other excess plutonium and HEU, will be eliminated, using secure, agreed procedures, as rapidly as practicable; and

- Agree that the United States would provide Russia financial assistance in implementing these steps, giving Russia an incentive to agree to the arrangement.

With such an accord, in a matter of months thousands of the most dangerous warheads could be under jointly monitored lock and key, and committed to eventual dismantlement. This would constitute a substantial step forward for U.S. security. Permitting joint monitoring of the warheads that had been placed in secure storage would dramatically improve on the 1991 reciprocal initiatives, making it possible for each side to confirm how many warheads the other side had committed to this initiative, to see for itself that these warheads were secure and accounted for, and, ultimately, to confirm their dismantlement. While it would not be possible to verify that the commitment to include every warhead without modern safeguards against unauthorized use had been met, such an initiative would provide each side with a strong political underpinning for eliminating these dangerous warheads. Given the current level of U.S.-Russian cooperation in the counterterrorism struggle, the prospects for each side meeting its commitments to rid itself of these warheads would be good. To provide the political context that would allow Russia to place thousands of its warheads under such arrangements would require the United States to assign a substantial number of its own warheads to the initiative – which would mean giving up a substantial part of what is currently considered the "hedge" warhead stockpile. But the security benefits of doing so in this way far outweigh the risks.

By taking this action with their own warhead stocks, the United States and Russia would establish a new standard: in the post–September 11 world, assembled warheads without modern safeguards against unauthorized use are simply too dangerous to be allowed to exist. They would then be in a position to communicate that message forcefully to all the other states with nuclear weapons, by urging those states to dismantle any warheads that do not incorporate such modern safeguards in their design. States that have not developed warhead designs incorporating such modern safeguards (as is likely to be the case for India and Pakistan, and possibly for China and Israel as well) should be pressed to take the simple and effective expedient of storing separately the key warhead components needed for detonation (as South Africa, for example, reportedly did with its small nuclear weapon stockpile when it existed).[55]

To add to the progress of the G-8 Global Partnership, such a "Bush-Putin Initiative" can and should be a lasting achievement to be announced as part of the two leaders' meeting at the G-8 summit in June 2003.

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[54] Large central storage facilities for nuclear warheads already exist in both the United States and Russia, whose security could be upgraded as needed.

[55] See discussion in Mitchell Reiss, *Bridled Ambition: Why Countries Constrain Their Nuclear Capabilities* (Princeton, N.J.: Woodrow Wilson Center Press, 1995), p. 13.

Recommendation: ***Launch a new reciprocal initiative with Russia to secure, monitor, and dismantle thousands of the most dangerous warheads (including many tactical warheads and all warheads not equipped with modern electronic locks to prevent unauthorized use).***

Expanded Support for the International Atomic Energy Agency

The International Atomic Energy Agency (IAEA) plays a critical role in verifying nonproliferation of nuclear weapons worldwide, and in international cooperation to prevent nuclear terrorism. It is time for the world to give the IAEA the resources it needs to do its job.

The IAEA is charged with monitoring stockpiles of plutonium and HEU in all of the world's non-nuclear weapon states, to ensure that these states are not diverting these materials to nuclear weapons. While IAEA safeguards are not designed to prevent theft of nuclear material, they nonetheless impose a multilateral discipline in ensuring effective accounting and control for nuclear materials, which does contribute significantly to preventing theft. With the adoption of the Additional Protocol to safeguards agreements, the IAEA verification effort has expanded beyond monitoring declared materials at declared sites to the challenging task of attempting to confirm that there are no secret nuclear weapons activities at hidden sites. Today, the IAEA is charged with detecting any illegal nuclear activities Iraq may be undertaking, and is a central player in the unfolding crisis over North Korea's nuclear weapons efforts.

Moreover, in recent years, the IAEA has taken an ever larger role in helping its member states ensure effective security for their nuclear materials, by providing international peer reviews of security arrangements, arranging for donor states to fund security upgrades where reviews determine that they are needed, providing training courses and workshops to help states upgrade their own security regulations and arrangements, setting out comprehensive recommendations on best practices for securing nuclear materials, and hosting international negotiations to amend the Convention on Physical Protection of Nuclear Materials.[56] At the same time, the IAEA is playing a central role in organizing global efforts to better control radioactive sources, and to reduce the risks of sabotage of nuclear facilities. Within weeks after the September 11 attacks, the IAEA put together a comprehensive "Action Plan" of steps to prevent nuclear terrorism, including measures to help states improve security for nuclear materials, reduce the risk of sabotage of nuclear facilities, and upgrade controls over radioactive sources that might be used in radiological "dirty bombs." [57]

Yet for a decade and a half, the IAEA has been kept to a zero-real-growth safeguards budget, even as the amount of material under safeguards increased more than three-fold, and the number of countries and facilities where safeguards are being implemented also increased dramatically. IAEA Director General ElBaradei recently warned that "the Agency can no longer continue with a policy of zero real growth. ...[W]ithout additional resources in the next biennium [the agency's two-year budget cycle], we will no longer be able to guarantee credible safeguards."[58] Yet the amounts involved are extraordinarily small by comparison to the security stakes: the entire global safeguards budget is in the range of $85 million a year (of which the United States pays only a fraction).[59] That amount, which funds the international safeguarding of nuclear

[56] As described above, a political commitment through the new G-8 Global Partnership may provide a route to achieve a more effective global nuclear security standard than the amended Convention on Physical Protection is likely to provide.

[57] For discussion, see Matthew Bunn, "International Nuclear Security Upgrades," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/securing/secure.asp as of March 12, 2003). For a summary of what has been accomplished under this effort so far, see International Atomic Energy Agency (IAEA), "Nuclear Security – Progress on Measures to Protect Against Nuclear Terrorism: Report by the Director General," GOV/INF/2002/11-GC(46)/14 (Vienna, Austria: IAEA, August 12, 2002; available at http://www.iaea.org/worldatom/About/Policy/GC/GC46/Documents/gc46-14.pdf as of January 13, 2003). See also the update GOV/INF/2002/11/Mod.2-GC(46)/14/Mod.2 (Vienna, Austria: IAEA, September 20, 2002; available at http://www.iaea.org/worldatom/About/Policy/GC/GC46/Documents/gc46-14m2.pdf as of January 13, 2003).

activities of all the world's non-nuclear-weapon states, is roughly the same as the budget of the police department of the city of Indianapolis.[60] ElBaradei estimates that the safeguards budget was underfunded by at least $20 million in the current year – roughly what the U.S. Department of Defense spends every half hour of every day.[61]

Similarly, the IAEA estimated that the cost of implementing its nuclear terrorism Action Plan would be $12 million per year for the agency, and $20 million per year from donor states to implement the security upgrades identified as needed in reviews the agency would carry out. Unfortunately, the IAEA's member states refused to allow it to add the cost of this plan to its regular budget (to which states are required to contribute), forcing it to rely instead on voluntary contributions. As of mid-November 2002, one year after the plan was approved by the IAEA's Board of Governors, $12 million had been pledged to the nuclear terrorism fund – but much of this was in multi-year pledges, and only $7.6 million had actually been received.[62] In short, substantial parts of the Action Plan have become unfunded mandates: the IAEA simply does not have the money to carry out some of the actions needed to prevent nuclear terrorism. Sadly, once again the amounts involved are tiny in comparison to the security stakes.

To the Bush administration's credit, it has seen that the security stakes outweigh bureaucratic concerns over holding the budget line in other parts of the UN system, and has broken the pattern of past administrations to call for substantial increases in the IAEA's budget.[63] Congress has also taken action to increase the U.S. voluntary contribution to the IAEA.[64] Indeed, of the $12 million pledged from all sources to the nuclear terrorism Action Plan, $8 million is from the U.S. government – and another $1.2 million from the pri-

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[58] Mohammed ElBaradei, IAEA Director General, "Introductory Statement to the Board of Governors" (address given to the IAEA Board of Governors Meeting, Vienna, Austria, November 28, 2002; available at http://www.iaea.org/worldatom/Press/Statements/2002/ebsp2002n008.shtml as of January 13, 2003). For an eloquent statement on the need for the world to give the IAEA the resources to do its job, see Charles Curtis, "Reducing the Nuclear Threat in the 21st Century" (address to the IAEA Safeguards Symposium, Vienna, Austria, October 29, 2001; available at http://www.nti.org/c_press/c_index.html as of January 13, 2003).

[59] See for example, IAEA, *Annual Report 2001* (Vienna, Austria: IAEA, 2002; available at http://www.iaea.org/worldatom/Documents/Anrep/Anrep2001 as of January 13, 2003), p. 95.

[60] Indianapolis Police Department, "Staff and Budget," January 2002 (available at http://www.indygov.org/ipd/aboutipd/staffbud.htm as of January 13, 2003).

[61] ElBaradei, "Introductory Statement to the Board of Governors," op. cit.

[62] See IAEA, "Nuclear Security Fund Tops $12 Million" (press release, Vienna, Austria, January 13, 2003; available at http://www.iaea.org/worldatom/Press/News/2002/11-22-118949.html as of January 13, 2003). For an update on the progress of the action plan, see IAEA, "Nuclear Security – Progress on Measures to Protect Against Nuclear Terrorism," op. cit.

[63] Spencer Abraham, U.S. Secretary of Energy, Remarks at the International Atomic Energy Agency 46th General Conference, Vienna, Austria, September 26, 2002 (available at http://energy.gov/HQDocs/speeches/2002/sepss/IAEA46_v.html as of January 14, 2003).

[64] Though the amount proposed by the administration for Fiscal Year (FY) 2003 in the State Department account normally used to contribute voluntary funds beyond the regularly assessed annual dues was unchanged from the previous year ($50 million for various IAEA activities, including safeguards), President Bush did sign a FY 2002 supplemental appropriations act that provided an additional $4 million to be contributed to the IAEA safeguards program, and $5 million to be used for nuclear materials security programs in the IAEA member countries. For information on the account usually used to supplement IAEA dues, see U.S. Department of State, "Bilateral Economic Assistance – State and Treasury," *FY 2003 Congressional Budget Justification for Foreign Operations* (Washington, D.C.: State Department, April 15, 2002; available at http://www.state.gov/documents/organization/9467.pdf as of December 16, 2002), pp. 109–110. For the supplemental funding legislation, see *2002 Supplemental Appropriations Act for Further Recovery From and Response To Terrorist Attacks on the United States*, Public Law 206, 107th Congress (August 2, 2002; available at http://thomas.loc.gov/cgi-bin/bdquery/z?d107:h.r.04775: as of January 10, 2003), Chapter 5.

vate Nuclear Threat Initiative. No other government has even managed to muster a pledge larger than NTI's.[65] Once again, the world's response to the post–September 11 threat appears mired in petty budget politics – far from the bold and determined response that ElBaradei correctly identified as being needed.

President Bush should redouble his efforts and the efforts of his administration to gain the support of other countries for increasing the IAEA's safeguards budget, and should be prepared to provide even larger U.S. voluntary contributions as needed until this is achieved. The G-8 Global Partnership participants should include contributions to the IAEA's Nuclear Security Fund, and separate contributions to carrying out the security upgrades identified as needed in IAEA-led reviews, in their priorities for expenditure of the $20 billion pledged for threat reduction activities at the G-8 summit in June 2002. At the same time, the Bush administration should work with the IAEA and other IAEA member states to launch a faster-paced and more focused effort to meet the goals outlined in the IAEA's Action Plan – possibly creating an independent IAEA nuclear security unit reporting directly to the Director General, led by an official with considerable experience and authority, on the model of the IAEA's Action Team for inspections in Iraq.

Recommendation: ***Provide increased resources to the International Atomic Energy Agency (IAEA) to implement its action plan to prevent nuclear terrorism, and to strengthen its global safeguards system.***

[65] The United Kingdom has roughly matched NTI's pledge, but no other government has made a pledge even half as large. See IAEA, "Voluntary Contributions to the Agency's Nuclear Security Fund: 31 December 2002" (available at http://www.iaea.org/worldatom/Press/News/2002/actionplan_table.html as of January 14, 2003).