

Controlling Nuclear Warheads and Materials

A Report Card and Action Plan

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Foreword

We were proud twelve years ago to launch America's effort to secure weapons of mass destruction, materials and know-how in the former Soviet Union to keep them from falling into the hands of people who would do us harm. This work has been vitally important. It has accomplished important objectives. But today, the scope of the effort does not match the scale of the threat.

As the demand for weapons of mass destruction rises and the chance of their use grows, we are concerned to see urgent calls for increased threat reduction dismissed because "current programs are doing all they can."

The threat of nuclear, biological and chemical weapons terrorism is too near and too dire to be discussed in the context of "current programs." The threat cannot be made to fit the program; the programs must be remade to fit the threat. We must ask and answer the essential questions: "What is the threat? What is our response? What must we do to close the gap?"

These are not questions for only one or two countries. The world must give its answer, and give it soon. We need a Global Partnership Against Catastrophic Terrorism, based on the fundamental premise that the greatest dangers of the 21st century are threats all nations face together and no nation can solve on its own. Today, the most likely, most immediate, most potentially devastating threat is the terrorist use of weapons of mass destruction. The best way to address the threat is to keep terrorists from acquiring weapons or weapons material in the first place. But the chain of worldwide security is only as strong as the link at the weakest, least-protected site. The odds are dangerously uneven. The terrorist margin for error is almost infinite – numerous failures will not end the threat. Our margin for error is miniscule; one failure anywhere in the world could lead to catastrophe.

Preventing terrorism with weapons of mass destruction must become the central organizing

security principle of the 21st century. It is the only threat whose danger is dire and diffuse enough to unify all nations, and it will take the unity of all nations to meet that threat. In the end, every nation that possesses materials or weapons of mass destruction must secure them and account for them, in a manner that meets stringent standards and is internationally verifiable – using their own funds, supplemented with international funds where needed.

For more than a year, we have been working in Washington, D.C., Moscow, and other major capitals to develop and build support for a Global Partnership Against Catastrophic Terrorism, and we were pleased when the leaders of the G-8 took a crucial step in this direction. In June 2002, G-8 leaders launched a Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, and they pledged \$20 billion over 10 years to efforts designed to reduce these deadly threats. But there is much to be done to transform this initiative into an effective, fast-paced global effort to block the terrorist pathway to a bomb.

One of our biggest obstacles to action is overcoming the denial that such an attack could occur and the paralysis that comes from believing the job is too massive and too overwhelming to be done. It is a big job, no doubt. But it is also measurable and manageable, and the world needs to know it. That is why we are pleased to present this vital and timely report – *Controlling Nuclear Warheads and Materials: A Report Card and Action Plan*. President Bush has said: "Our highest priority is to keep terrorists from acquiring weapons of mass destruction." His words express the goal. This report presents a strategy.

First, it describes the threat. Al Qaeda has said, and their actions have proved, that they are determined to acquire nuclear weapons. Four times, terrorists have been caught "casing" Russian nuclear warhead storage facilities or the trains that carry these warheads. Osama bin Laden has met with

top Pakistani nuclear weapons scientists to seek information on making nuclear weapons. And the essential ingredients of nuclear bombs are spread around the world in abundant and poorly secured supply.

Second, this report grades the efforts to secure nuclear weapons, material and know-how. While existing efforts are making progress, most of the work of keeping nuclear weapons and materials out of terrorist hands remains to be done. In Russia, for example, comprehensive security and accounting procedures must be installed for every facility that houses nuclear material. That will take several years. In the meantime, therefore, we must do rapid security upgrades first. We are only 37% of the way to completing our short-term goal of installing rapid security upgrades and 17% of the way to our longer-term goal of putting comprehensive security measures in place. That pace must be accelerated to protect us from this deadly threat.

We do not have the luxury of time. We are in a new kind of arms race. Terrorists are racing to acquire weapons of mass destruction, and we must race to stop them. This report makes it clear that we are not yet moving fast enough to block the terrorist pathway to the bomb. In virtually every category, we're not even halfway to safety.

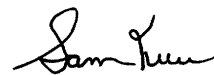
Third, the report offers comprehensive recommendations to close the gap between threat and response, focused on a systematic analysis of the most critical steps on the terrorist pathway to the bomb, and what can be done to block them. It is focused primarily on what the U.S. government can do, but also provides guidance for the global partnership. Yet this information is not for governments alone. Governments provide best what their citizens demand most. The world's citizens need to know there is an increasingly dangerous gap between what their governments are doing and what they ought to be doing. If people understood this, they wouldn't stand for it.

In his recent State of the Union Address, President Bush described the efforts America is making to reduce threats from weapons of mass destruction, then concluded: "In all these efforts, however, America's purpose is more than to follow a process – it is to achieve a result: the end of terrible threats to the civilized world."

This report presents the facts we need to keep our sights on the high strategic purpose described by President Bush. Merely doing more than last year isn't sufficient to meet his charge or reduce the danger. We must finally face the truth about the scale of the threat, and build a partnership of nations with the methods and means to respond. These pages show the way.



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Executive Summary

President Bush has warned that terrorists armed with weapons of mass destruction (WMD) pose the “most horrifying” danger civilization faces, and he has said that keeping WMD out of terrorist hands is his administration’s “highest priority.” In his 2003 State of Union address, the President warned of the possibility of a terrorist attack with nuclear, chemical, or biological weapons, and he pledged: “We will do everything in our power to make sure that day never comes.”

Yet despite a number of new initiatives to strengthen and accelerate international efforts to keep WMD out of terrorist hands launched by the Bush Administration since September 11, there remains an enormous gap between the seriousness and urgency of the threat, and the scope and pace of the U.S. and the international response.

For example, by the end of fiscal year (FY) 2002, only 37% of the potentially vulnerable nuclear material in Russia was protected by initial “rapid” security upgrades, and less than one-sixth of Russia’s stockpile of highly enriched uranium (HEU) had been destroyed. HEU-fueled research reactors in countries around the world remain dangerously insecure. And in the year following the September 11 attacks, comprehensive security and accounting upgrades were completed on only an additional two percent of the potentially vulnerable nuclear material in Russia, while rapid upgrades were completed on only an additional nine percent of this material. If one asks whether, today, the U.S. government’s effort to keep nuclear weapons and materials out of terrorist hands meets the President’s “everything in our power” standard, the clear answer is no – whether the effort is measured by the time and energy of senior officials focused on it, the level of organization and planning devoted to it, or the funding it receives (amounting, in the President’s FY 2004 request, to one-quarter of one percent of U.S. defense spending).

This report and its online companion (available at <http://www.nti.org/cnwm>) provide the most detailed available program-by-program evaluation of what has been done so far, both in terms of work completed and dollars spent. We also outline a comprehensive, integrated plan for next steps. In doing so, we seek to clarify the size and shape of the gap between the threat and the current response – and offer a roadmap for closing that gap.

For more than 10 years, the U.S. government has funded threat reduction programs intended in part to reduce the chance that terrorists could acquire a nuclear weapon and explode it in a major city, and it is these efforts that are the focus of this report. Achieving a nuclear explosion would be more difficult for terrorists than a chemical or biological attack, but the massive, assured, instantaneous, and comprehensive destruction of life and property that a nuclear weapon would cause may make this route a priority for terrorists. The same measures needed to keep nuclear weapons and materials out of the hands of terrorists would also contribute to keeping them out of the hands of hostile states – whose nuclear weapons ambitions could be achieved far more rapidly if they could get stolen nuclear weapons or the materials to make them, as opposed to having to start with the production of the materials from scratch.

This report provides an American perspective, focused primarily on steps the U.S. government should take. But it is clear that to succeed, a comprehensive plan for this mission must be developed not as a made-in-America effort, but in full partnership with Russia and the other states that must take part. And it is equally clear that while the United States has a special responsibility to lead, the threat is a threat to all nations, not just to the United States, and other nations around the world must contribute to its solution as well – as the members of the Group of Eight (G-8) industrialized democracies have recently agreed.

Our examination of the threat of nuclear weapons terrorism, the progress that has been made so far in addressing that threat, and the opportunities for further action leads us to four key findings, and recommendations in seven areas.

Key Finding 1: *The threat that terrorists could acquire and use a nuclear weapon in a major U.S. city is real and urgent.*

- For at least a decade, Osama bin Laden and his al Qaeda terrorist network have been attempting to get stolen nuclear weapons or nuclear materials and the nuclear expertise to make a bomb. Detailed analysis of the nuclear documents recovered in Afghanistan, and of other evidence, suggests that, had al Qaeda not been deprived of their Afghanistan sanctuary, their quest for a nuclear weapon might have succeeded – and the danger that it could succeed elsewhere still remains.
- Hundreds of tons of HEU and separated plutonium, the essential ingredients of nuclear weapons, located in hundreds of buildings in scores of countries around the world, are dangerously insecure – demonstrably unprotected against the scale of outsider attack that the terrorists have already proven their ability to mount, as well as against the more insidious danger of insider theft. Yet the amounts of these materials required for a bomb are measured in kilograms, not tons – amounts small enough that unless proper security and accounting systems are in place, a worker at a nuclear facility could put in a briefcase or under an overcoat and walk out. While assembled nuclear weapons are generally somewhat better secured, in some cases they too may not be adequately protected against the scale of threat that terrorists and insiders may be able to mount.
- There have been multiple documented cases of theft of kilogram quantities of weapons-usable nuclear material. The International Atomic Energy Agency has a database that includes 18 incidents involving seizure of stolen HEU or plutonium that have been confirmed by the relevant states. To cite just one example, in 1998 there was a conspiracy by insiders at one of Russia's largest nuclear weapons facilities to steal 18.5 kilograms of HEU – potentially enough for a nuclear bomb at a single stroke. Russian official sources confirm four incidents of Chechen terrorists – who have close ties to al Qaeda – carrying out reconnaissance on storage sites or transport trains for Russian nuclear warheads in 2001–2002. In early 2003, the commander of the force that guards Russia's nuclear weapons warned that “operational reports indicate that Chechen terrorists intend to get hold of an important military facility or a nuclear warhead in order to threaten not just our country but the whole world.” Theft of the essential ingredients of nuclear weapons is not a hypothetical worry – it is an ongoing reality.
- If they got the materials, most states and even some well-organized terrorist groups – such as al Qaeda – could potentially make at least a crude nuclear bomb. With enough HEU, for example, terrorists could potentially make a simple “gun-type” bomb, involving little more than firing two pieces of HEU into each other to form a critical mass. Making a bomb from plutonium (or from a stock of HEU too small for a gun-type bomb) would be more difficult, because it would have to be an “implosion” bomb, for which the needed high-explosive “lenses” would be a significant challenge.
- Just as the United States is unable to stop the vast bulk of the illegal drugs that cross its borders, the chances of preventing terrorists from smuggling a nuclear weapon or nuclear materials into the United States would be small. The length of the border, the diversity of means of transport, and the ease of shielding the radiation from plutonium or highly enriched uranium all operate in favor of the terrorists. Today, none of the major ports that ship cargo to the United States are equipped to inspect that cargo for nuclear weapons or weapons-usable nuclear material, and few of the points of entry into the United States have an effective ability to carry out routine searches for nuclear weapons or materials, either.
- If detonated in a major city, a terrorist nuclear bomb could wreak almost unimaginable carnage. A 10-kiloton bomb detonated at Grand Central

Station on a typical work day would likely kill some half a million people, and inflict over a trillion dollars in direct economic damage. America and its way of life would be changed forever.

These facts lead immediately to an inescapable conclusion: the United States and its partners must do everything in their power to ensure that every nuclear weapon, and every kilogram of HEU and plutonium, wherever it may be in the world, is secure and accounted for, to stringent standards. Insecure nuclear bomb material anywhere is a threat to everyone, everywhere. The job of securing the homeland against nuclear terrorism begins wherever insecure nuclear weapons or weapons-usable nuclear materials are found. The stakes are enormously high: while terrorists and thieves can afford to try and fail again and again to get a nuclear bomb or the materials to make one, the consequences of even a single failure in efforts to stop them could be catastrophic.

Key Finding 2: *The most effective approach to reducing the risk is a multi-layered defense designed to block each step on the terrorist pathway to the bomb. But securing nuclear weapons and materials at their source is the single most critical layer of this defense, where actions that can be taken now will do the most to reduce the risk of terrorists acquiring nuclear weapons and materials, at the least cost.*

Threat reduction programs designed to improve controls over nuclear weapons, materials, and expertise; homeland security efforts; and the war on terrorism each have critical roles to play in blocking the terrorist pathway to the bomb. This is illustrated in Figure ES.1, which highlights the steps in that pathway and the programs that may be able to interdict those steps. The war on terrorism, for example, can and should focus on identifying and destroying groups with the capabilities and intent to commit mass-destruction terrorism; can eliminate terrorist safe havens (the overthrow of the Taliban may well have reduced the risk of an al Qaeda nuclear attack more than any other action taken since the September 11 attacks); and the war of ideas and efforts to address the root causes of terrorism can reduce terrorists' ability to recruit the expertise they need for a nuclear attack,

and increase the ability of key states to clamp down on terrorist groups without facing domestic unrest. Homeland security programs can increase to some extent the chances of preventing a nuclear bomb or the materials to make one from being smuggled into the United States, or contribute to finding it and disabling it if intelligence offers clues on where to look. Both foreign and domestic intelligence are critical to all the elements of blocking the terrorist pathway to the bomb.

The most critical choke-point on that pathway is in preventing nuclear weapons and materials from being stolen in the first place. Once a nuclear weapon or the material to make one has been stolen and is beyond the gates of the facility where it was supposed to be, it could be anywhere – and finding and recovering it, or blocking it from being smuggled to a terrorist safe haven or into a target country, becomes an enormous challenge. As former Senator Sam Nunn has said, “The most effective, least expensive way to prevent nuclear terrorism is to secure nuclear weapons and materials at the source. Acquiring weapons and materials is the hardest step for the terrorists to take, and the easiest step for us to stop. By contrast, every subsequent step in the process is easier for the terrorists to take, and harder for us to stop.” Hence, threat reduction programs are central to any serious effort to reduce the risk of nuclear weapons terrorism.

Key Finding 3: *Current programs designed to reduce the threat of nuclear weapons or materials falling into terrorist hands are making headway, but have finished much less than half the job in virtually every category, and the pace of progress is unacceptably slow. There is a substantial gap between the urgency of the threat and the pace and scope of the current response.*

We examined both inputs to current programs – ranging from the time and energy of senior political leaders to the requested and appropriated budgets – and the outputs, measured by what fraction of various parts of the job of controlling nuclear warheads, materials, and expertise has been accomplished, and the pace at which the rest of job is being done. This examination was complicated by the fact that no integrated plan for these efforts exists, setting out all the work that needs to be



Figure ES.1

done. In addition, many specific programs have not publicly outlined their objectives and measurable milestones for meeting them against which their progress could be judged.

In each of the critical inputs to the effort we have examined – political leadership, organization and planning, information, and resources – much more can and should be done to address the threat of terrorists getting nuclear explosives than is now being done.

Leadership. The effort to ensure that nuclear weapons and materials around the world are effectively secured and accounted for faces a wide range of impediments that are slowing progress, and cannot move forward at anything like the pace required without sustained, day-to-day engagement from the White House. The lesson from the history of U.S. arms control and nonproliferation efforts is very clear: when the President is personally and actively engaged in making the hard choices, overcoming the obstacles that arise, and

pushing forward, these efforts succeed. When that is not the case, they fail.

President Bush has led the way in focusing unprecedented attention on the danger that terrorists might acquire weapons of mass destruction, and he and senior officials of his administration have launched several new initiatives designed to strengthen and accelerate efforts to address this threat – most notably the \$20 billion “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction” announced at the G-8 summit in June 2002. But between occasional initiatives, the level of sustained, day-to-day engagement from the highest levels in accelerating efforts to secure nuclear warheads and materials has been very modest (as, indeed, it was in the previous administration, and the one before that). This stands in sharp contrast to the level of sustained Presidential engagement in the war on terrorism, the confrontation with Iraq, or even in more modest efforts such as the withdrawal from the Anti-Ballistic Missile (ABM) Treaty and deployment of a national missile defense system.

Organization and Planning. The U.S. government has dozens of separate programs, in several cabinet departments, doing important parts of the job of keeping nuclear weapons and weapons-usable nuclear materials out of terrorist hands – but there is no senior official anywhere in the government with the full-time job of leading and coordinating these efforts. With no single leader, there is also no integrated plan, no overarching strategy that would set goals and priorities, allow these programs to work together efficiently, close the gaps in the response, and eliminate overlap and duplication. Without such a strategy, there is no rational basis for making trade-offs and hard choices among the many programs underway. In this area, the U.S. government has a substantial fleet, but no admiral, and no overall battle plan.

Resources. Currently, the United States is spending roughly \$1 billion per year for all cooperative threat reduction. Of that, in the President’s FY 2004 budget request, some \$656 million would be devoted to programs focused on controlling nuclear

warheads, materials, and expertise. The total budget for threat reduction represents less than one-third of one percent of U.S. defense spending. Nevertheless, the budgets for most of the key programs we examined are large enough that simply adding more money, without changing anything else, would not greatly accelerate or strengthen them. But additional funds *would* be needed to finance the new initiatives recommended in this report, and to accelerate and strengthen existing programs in the ways we recommend, *if* other changes made it possible to overcome the other roadblocks that now pose the most substantial constraints.

Progress. Existing programs to improve controls over nuclear weapons, materials, and expertise have made significant progress. Hundreds of tons of potential bomb material and thousands of nuclear weapons are demonstrably more secure; enough nuclear material for thousands of nuclear weapons has been permanently destroyed; and thousands of under-employed nuclear weapons experts have received support for redirecting their talents to civilian work. These efforts have represented an extremely cost-effective investment in the security of the United States, Russia, and the world.

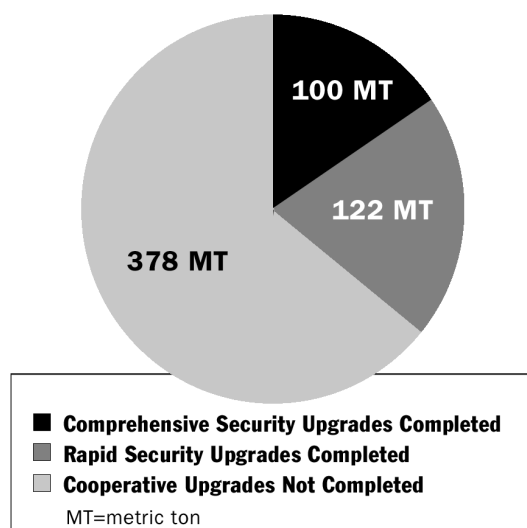


Figure ES.2 – Status of Security Upgrades on Weapons-Usable Nuclear Material in the Former Soviet Union

But as already noted, whether progress is measured by the fraction of potentially vulnerable nuclear warheads and materials secured, the fraction of the excess stockpiles destroyed, or the fraction of unneeded nuclear weapons experts and workers provided with sustainable civilian employment, much less than half the job has been done. For example, Figure ES.2, based on official data from the program doing the work, shows the number of tons of potentially vulnerable nuclear material in the former Soviet Union that has comprehensive security and accounting upgrades completed, the number of tons that has only interim, rapid upgrades completed, and the far larger number of tons for which neither of these levels of cooperative upgrades have been completed.

Figure ES.3 provides a broader summary of our estimates of what fraction of the job has been accomplished, across the spectrum of efforts to control nuclear warheads, materials, and expertise, as measured using metrics developed in the main text. Most of these estimates are based on official data; some are informed guesses, based on government data and interviews with relevant participants, where adequate data for the measure is not available. As can be seen, in most cases, the fraction of the mission accomplished is between zero and one-third.

Moreover, despite a variety of efforts devoted to accelerating these programs, the pace at which the remainder of the job is being accomplished

Controlling Nuclear Warheads & Materials: How Much Work Has Been Completed?

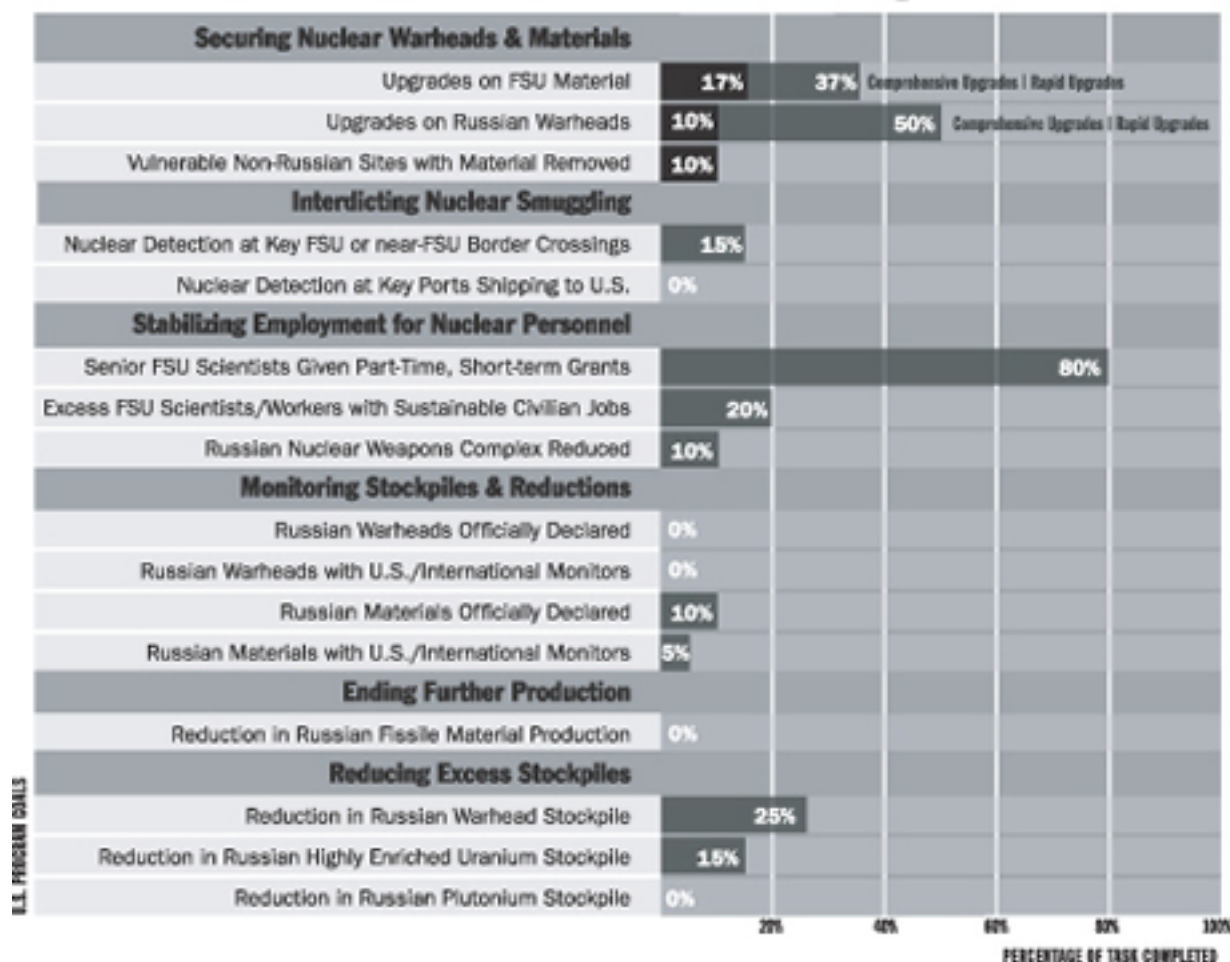


Figure ES.3

remains unacceptably slow. To take just one example, because of disputes over just how much access U.S. experts would be granted to sensitive sites, some equipment to improve security for Russian nuclear warheads that was purchased more than five years ago is still sitting in warehouses, uninstalled, while the vulnerabilities it was intended to fix remain.

In short, it is simply not the case that the U.S. government is doing everything in its power to prevent a terrorist nuclear attack on the United States from occurring. There continues to be an enormous gap between threat and response. But President Bush is right – the threat is substantial enough that “everything in our power” is the standard by which efforts to reduce this threat should be judged.

Key Finding 4: *Opportunities exist for new initiatives and steps to strengthen and accelerate existing efforts, which, if fully implemented, could rapidly and dramatically reduce the risk.*

The technology exists to secure all of the world’s stockpiles of nuclear weapons and materials – with the potentially important exception of the unknown quantity that may already have been stolen without detection. Many of the most important steps could be taken quickly. There are many impediments to progress, but we believe a focused, sustained, and high-level effort to overcome them can succeed. With a focused program with the necessary authority, resources, and expertise in a single set of hands, weapons-usable nuclear material could be removed entirely from many of the world’s most vulnerable sites within a few years. With changes in approach and a major effort to overcome the current obstacles, rapid upgrades for all the nuclear warheads and materials in Russia could probably be completed within two years, and comprehensive upgrades within four – and we recommend that, as part of an accelerated and strengthened nuclear security partnership, Russia and the United States set themselves that goal. After more than a decade of threat reduction cooperation, these efforts must shift from a focus on short-term stop-gaps to improvements that can and will be sustained for the long haul – while maintaining the emergency pace justified by the need to secure nuclear weapons, materials, and expertise before terrorists or hostile states get hold of them.

Key Recommendations

This report makes a large number of recommendations, and it is important to set priorities. We believe that the first priority should be steps to structure the U.S. and international response – to ensure that this mission gets the attention it deserves, and that a comprehensive approach to reduce the threat as rapidly as practicable is put in place, with the capability to adapt to changing threats and opportunities. If there was intensive, sustained leadership focused on this mission from the highest levels of the U.S. government; a single senior leader in the White House with full-time responsibility and accountability for leading the effort; an integrated and prioritized plan to accomplish the goal; and an effectively functioning global coalition of nations working together to keep nuclear weapons out of terrorist hands, all the rest of what needs to be done – including the application of the resources needed to do the job – would follow. Hence, the recommendations below begin with these crosscutting steps.

Within such an integrated plan, the first priority would be a fast-paced program to remove the nuclear material entirely from many of the most vulnerable small nuclear facilities around the world. The second priority would be a transformed and accelerated nuclear security partnership with Russia, focused on completing rapid upgrades for all Russian nuclear warheads and materials within two years, and comprehensive upgrades within four, while also taking the steps needed to ensure that security will be sustained for the long haul. The third priority would be forging sensitive nuclear security partnerships with other key nuclear states, particularly Pakistan, where both insider and outsider threats are potentially very high. The fourth priority would be a new initiative to build, through top-level political commitments within the G-8 Global Partnership, effective global standards for nuclear security that each nation with nuclear weapons and materials should meet – combined with an offer of assistance to any state willing to commit to these standards but unable to do so alone. These and our other recommendations are described below, in seven categories of effort, each of which has a clearly stated overall goal.

I. CONTROLLING WARHEADS AND MATERIALS: CROSSCUTTING STEPS

OVERALL GOAL: Reduce as much as possible, as rapidly as possible, the chance that terrorists or hostile states could get stolen nuclear weapons or weapons-usable materials.

- 1. Recommendation:** Focus sustained attention from the highest levels of government on reducing the chance that terrorists or hostile states could get stolen nuclear weapons or weapons-usable materials.
- 2. Recommendation:** Appoint a senior, full-time official, with direct access to the President, to lead the entire array of efforts focused on keeping nuclear weapons and materials out of the hands of terrorists or hostile states – seizing opportunities for rapid action, overcoming obstacles, filling gaps, exploiting synergies, and eliminating overlaps.
- 3. Recommendation:** Encourage Russia to appoint a comparable senior full-time official to lead Russian efforts to keep nuclear weapons and materials out of the hands of terrorists or hostile states, including working with the United States and other nations as part of the needed global coalition.
- 4. Recommendation:** Prepare an integrated and prioritized plan for keeping nuclear weapons and materials out of the hands of terrorists and hostile states that outlines specific goals to be achieved, means by which they will be achieved, cost estimates for implementing the needed programs, target dates for achieving both interim milestones and final goals, metrics for assessing progress toward each goal, and exit strategies for ensuring that results will be maintained after the programs phase out.
- 5. Recommendation:** Build the G-8 “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction” announced in June 2002 into an effective, working partnership to take all the actions necessary to keep nuclear weapons and weapons-usable materials from being stolen and falling into the hands of terrorists or hostile states. This would

include a key role for Russia, and a shift in approach from a donor-recipient relationship to a genuine partnership to improve nuclear security, involving Russian experts and resources from start to finish.

- 6. Recommendation:** Provide resources sufficient to ensure that the pace at which the threat of nuclear weapons terrorism is reduced is not limited by resources.
- 7. Recommendation:** Focus key U.S. government and international resources on providing the information and analysis needed to pursue a fast-paced, prioritized program to keep nuclear weapons and materials out of the hands of terrorists or hostile states – including information on what nuclear materials exist where, under what kinds of security conditions.
- 8. Recommendation:** Get in-depth independent analysis and advice on programs to keep nuclear weapons and materials out of the hands of terrorists or hostile states, by making such analysis a key part of the mandate of the new Homeland Security Institute, and by establishing independent advisory panels for each of the most important programs in this area.

II. SECURING NUCLEAR WARHEADS AND MATERIALS

GOAL: Ensure that all nuclear weapons and weapons-usable nuclear material worldwide are secure and accounted for.

- 1. 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.
- 2. Recommendation:** Accelerate and strengthen nuclear security and accounting upgrades in Russia, with a partnership-based approach.
- 3. Recommendation:** Forge nuclear security partnerships with other key nuclear states, including Pakistan, India, and China.
- 4. 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.

5. 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).

6. 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.

III. INTERDICTING NUCLEAR SMUGGLING

GOAL: Maximize the chances of recovering stolen nuclear material and stopping nuclear smuggling.

1. Recommendation: Develop and implement a comprehensive strategic plan specifying what institutions in what countries are to be provided with what capabilities by when, with what resources.

2. Recommendation: This plan should include, among other steps:

- a. Providing effective nuclear detection capabilities at ports shipping cargo to the United States and at key entry points into the United States;
- b. Strengthening U.S. and international nuclear emergency search and response capabilities;
- c. Establishing units of the national police in each relevant country trained and equipped to deal with nuclear smuggling cases;
- d. Identifying the most critical border crossings that may be routes for nuclear smugglers, and providing training and equipment to detect nuclear materials at those points;
- e. Providing regional capabilities for forensic analysis of seized nuclear materials, to attempt to determine where they came from (with increased exchange of data on the prop-

erties of materials produced at particular facilities);

- f. Greatly expanding the sharing of intelligence and police information (including through international organizations such as Interpol) related to nuclear theft and smuggling;
- g. Strengthening intelligence efforts focused on identifying and disrupting nuclear theft and smuggling organizations, including sting operations and other means to make it more difficult for smugglers and buyers to connect;
- h. Putting in place severe legal penalties for theft and smuggling of weapons-usable nuclear material in all the relevant countries; and
- i. Providing resources to the IAEA to allow it to help track and analyze nuclear smuggling and help states improve their nuclear smuggling interdiction capabilities.

IV. STABILIZING EMPLOYMENT FOR NUCLEAR PERSONNEL

GOAL: Ensure that nuclear scientists, workers, and guards are not desperate enough to want to steal nuclear weapons and materials or sell nuclear knowledge, and close unsustainable and unnecessary nuclear facilities.

1. Recommendation: Establish a broader and higher-level dialogue with Russia on steps that Russia and other governments need to take to ease the transition to a smaller nuclear complex in Russia, and avoid proliferation risks in that process.

2. Recommendation: Pursue a much broader approach to fostering re-employment for Russia's nuclear experts and workers, including such measures as:

- a. Tax and other incentives for firms to locate or expand operations in Russia's nuclear cities, and to employ former employees of Russia's nuclear weapons complex;
- b. Increased reliance on private sector capabilities in matching technological capabilities from Russia's nuclear cities to market needs and investors;

- c. Providing incentives for people with real business management and marketing expertise to lead enterprises in or near Russia's nuclear cities;
- d. Providing start-up capital for new or expanding enterprises in or near Russia's nuclear cities;
- e. Assigning a small fraction of the unclassified R&D sponsored by the U.S. government in key areas such as counterterrorism, nonproliferation, nuclear cleanup, and energy to be done by experts from Russia's nuclear weapons complex – getting the U.S. government's work done for less while providing large numbers of jobs employing the skills of Russia's nuclear weapons experts.

3. Recommendation: Cooperate with Russia to ensure a secure retirement for nuclear experts and workers (including possible early buy-outs), reducing the job creation requirement.

4. Recommendation: Undertake a more focused approach to assisting Russia in closing or converting excess nuclear weapons complex facilities, and other unneeded nuclear facilities.

V. MONITORING STOCKPILES AND REDUCTIONS

GOAL: Put in place sufficient monitoring and data exchanges to build confidence that nuclear stockpiles are secure and accounted for, agreed reductions are being implemented, and assistance funds are being spent appropriately.

- 1. Recommendation:** Offer Russia and other partners with whom the United States is negotiating transparency arrangements substantial incentives – strategic, financial, or other – to do the hard work of overcoming decades of nuclear secrecy. As one necessary but not sufficient step, offer reciprocal information about and access to U.S. nuclear activities.
- 2. Recommendation:** Seek Russian agreement to exchange data on stockpiles of

nuclear weapons and weapons-usable materials, beginning with completing lab-to-lab efforts to prepare a full accounting of Russia's plutonium stocks and past production, comparable to the U.S. declaration published in 1996.

3. Recommendation: Build “bridges” among the different transparency initiatives now being pursued – such as transparency for the U.S.-Russian HEU Purchase Agreement, the Mayak Fissile Material Storage Facility, the Plutonium Production Reactor Shutdown Agreement, and the Plutonium Disposition Agreement – by reaching agreement on implementing tags, seals, and other monitoring measures to ensure continuity of knowledge as material moves from one regime to the next.

4. Recommendation: Conduct a series of joint monitoring experiments to develop and demonstrate procedures for confirming warhead dismantlement and secure storage of warheads and materials without unduly compromising sensitive information.

5. Recommendation: Carry out monitored storage and dismantlement of the excess warhead covered by the reciprocal warhead security and dismantlement initiative recommended above.

6. Recommendation: Take a flexible approach to providing assurances that taxpayer funds are being spent appropriately at particularly sensitive facilities, combining direct on-site access at some locations with other measures such as photographs and videotapes of installed equipment.

VI. ENDING PRODUCTION

GOAL: Stop further production of nuclear weapons and weapons-usable nuclear materials.

- 1. Recommendation:** Complete the program to provide alternative heat and power and shut down Russia's plutonium production reactors as quickly as possible.

- 2. Recommendation:** Complete negotiations of a long-term U.S.-Russian moratorium on separation of plutonium from civilian spent fuel.
- 3. Recommendation:** Put in place agreed monitoring measures to confirm U.S. and Russian statements that they are no longer producing HEU.
- 4. Recommendation:** Carry out joint U.S.-Russian demonstrations of approaches to verifying that older reprocessing plants are not separating plutonium for weapons – a key element of a proposed international fissile cutoff treaty.
- 5. Recommendation:** Continue seeking to put in place an international moratorium on production of plutonium or HEU for weapons, and continue negotiations toward a verifiable international treaty banning further production of nuclear materials for weapons.

VII. REDUCING STOCKPILES

GOAL: Drastically reduce the massive existing nuclear stockpiles, so that unneeded stockpiles do not have to be guarded forever.

- 1. Recommendation:** Maintain and stabilize implementation of the U.S.-Russian HEU Purchase Agreement, including purchasing a stockpile of blended material to cover interruptions in deliveries, and leaving open the option to designate additional executive agents if necessary.
- 2. Recommendation:** Reach agreement with Russia on an “accelerated blend-down” initiative, paying Russia a fee to blend additional HEU to non-weapons-usable levels and store it for later sale when the market is ready.
- 3. Recommendation:** Move ahead with the currently planned approaches to disposition of excess weapons plutonium.
- 4. Recommendation:** Seek to reach agreements by the end of 2003 on a financing and management arrangement, and a step-by-step work plan, for disposition of Russian excess weapons plutonium.

5. Recommendation: Begin now to discuss going beyond the 34 tons of plutonium on each side covered by the U.S.-Russian Plutonium Disposition and Management Agreement.

6. Recommendation: Begin now to plan in detail for maintaining very high levels of security and accounting throughout the disposition process.

7. Recommendation: Continue exploring complements or alternatives to the current approach to plutonium disposition, including:

- a. Initiate discussions of a “plutonium swap” approach, using existing plutonium fuel fabrication facilities and reactors already burning civilian plutonium fuel, which could burn weapons plutonium fuel instead.
- b. Pursue options for burning part of Russia’s excess plutonium in reactors outside of Russia, including through leasing arrangements.
- c. Restart development of plutonium immobilization technologies.
- d. If advanced reactors and fuel cycles are developed and built for other purposes, consider their use for disposition of whatever excess plutonium remains at that time.
- e. Consider options for purchasing Russian excess plutonium stockpiles.

Running the Race to Win

In short, President Bush has an historic opportunity to take actions now that could, by the end of his current term, eliminate some of the world’s most dangerous proliferation risks. By the end of the next Presidential term, the danger that terrorists could get and use a nuclear bomb could be reduced to a fraction of what it is today. By taking such steps today, President Bush could dramatically increase the speed and effectiveness of U.S. efforts to prevent nuclear weapons terrorism – putting his own indelible imprint on these programs and leaving a lasting and visible legacy of improved

nuclear security for the U.S. homeland and the world. As former Senator Sam Nunn has said, “Terrorists are racing to get weapons of mass

destruction. We need to be racing to stop them.” The time for action is now – indeed, we cannot afford to wait.

Part I: Setting the Stage



A terrorist nuclear bomb could multiply the devastation of September 11 manyfold.

To seek to possess the weapons that could counter those of the infidels is a religious duty. If I have indeed acquired these weapons, then this is an obligation I carried out and I thank God for enabling us to do that.

– OSAMA BIN LADEN, RESPONDING TO A QUESTION ABOUT NUCLEAR AND CHEMICAL WEAPONS IN AN INTERVIEW WITH ABC NEWS, DECEMBER 1998

1. Introduction

President Bush has aptly warned that terrorists armed with weapons of mass destruction (WMD) pose the “most horrifying” danger civilization faces.¹ “Our highest priority,” he has said, “is to keep terrorists from acquiring weapons of mass destruction.”² Warning of the possibility of a terrorist attack with nuclear, chemical, or biological weapons, he pledged: “We will do everything in our power to make sure that day never comes.”³

President Bush and senior officials of his administration have launched a number of initiatives to strengthen and accelerate international efforts to keep WMD out of terrorist hands. Yet there remains an enormous gap between the seriousness and urgency of the threat the President has identified, and the scope and pace of the U.S. and international response. Myriad programs are taking steps in the right direction, improving security for WMD and related materials, or preparing to mitigate the effects of WMD attacks. But as former Senator Sam Nunn has remarked, “A gazelle running from a cheetah is taking a step in the right direction.”⁴ The question – for the gazelle and for the world – is whether the steps being taken are fast enough to avoid a fatal catastrophe. We believe that today, the answer is no. These efforts have secured or destroyed enough nuclear material for thousands of nuclear bombs, demonstrably

improving U.S. and world security. But as we will demonstrate in this report, most of what needs to be done to keep nuclear weapons out of terrorist hands has not yet been done, and even after September 11, the pace at which the remaining work is moving forward is unacceptably slow.

The terrorists who have sworn to kill Americans wherever they can be found have undertaken an intensive effort to get a nuclear bomb, or the materials and expertise needed to make one⁵ – and as we will show in this report, the materials they would need are alarmingly vulnerable in countries around the world. The United States and its partners in the fight against terrorism must move as quickly as humanly possible to block the terrorist pathway to the bomb; the response must be every bit as determined, resourceful, and intelligence as the terrorists are. In the aftermath of the September 11 attacks, it is simply not acceptable to allow limited budgets, lack of high-level attention, and bureaucratic wrangling to delay the efforts need to keep nuclear weapons and their essential ingredients out of terrorist hands. As President Bush has said, in describing the danger of terrorist attack with weapons of mass destruction: “History will judge harshly those who saw this coming danger but failed to act.”⁶ So far, the United States and its partners are not running the

¹ President George W. Bush, “Remarks by the President To United Nations General Assembly, U.N. Headquarters, New York, New York” (Washington, D.C.: The White House, Office of the Press Secretary, press release, November 10, 2001; available at <http://www.whitehouse.gov/news/releases/2001/11/20011110-3.html> as of January 3, 2003).

² The White House, Office of the Press Secretary, “President Announces Reduction in Nuclear Arsenal: Press Conference by President Bush and Russian President Vladimir Putin” (Washington, D.C., press release, November 13, 2001; available at <http://www.whitehouse.gov/news/releases/2001/11/20011113-3.html> as of January 3, 2003).

³ President George W. Bush, “State of the Union Address” (Washington, D.C.: The White House, Office of the Press Secretary, press release, January 28, 2003; available at <http://www.whitehouse.gov/news/releases/2003/01/20030128-19.html> as of January 30, 2003).

⁴ Sam Nunn, remarks to the Carnegie Endowment for International Peace 2002 Nonproliferation Conference, Washington, D.C., November 14, 2002 (available at http://www.nti.org/c_press/speech_samunn_1114.pdf as of January 3, 2003).

⁵ For the best available summary, see David Albright, “Al Qaeda’s Nuclear Program: Through the Window of Seized Documents,” *Special Forum* 47 (Berkeley, Cal.: Nautilus Institute, November 6, 2002; available at http://www.nautilus.org/fora/Special-Policy-Forum/47_Albright.html as of January 27, 2003).

race to stop terrorists from getting nuclear weapons or the materials to make them as fast as they can – or fast enough to have a very good chance of winning it. The stakes are enormously high: while terrorists and thieves can afford to try and fail again and again to get a nuclear bomb or the materials to make one, the consequences of even a single failure in efforts to stop them could be catastrophic.

This report, building on our previous study,⁷ focuses on one particularly devastating aspect of the mass destruction terrorist threat: the control of nuclear weapons themselves, and the materials and expertise needed to make them. This report goes well beyond our previous examination of the issue, in providing both an in-depth report card on what has been done so far, and in outlining a comprehensive, integrated plan for next steps. In essence, the purpose of this report is to clarify the size and shape of the gap between threat and response – and then to describe how that gap can be closed.

President Bush has an historic opportunity to take actions *now* that could, by the end of his current term, eliminate some of the world's most urgent proliferation risks. By the end of the next Presidential term, the danger that terrorists could get and use a nuclear bomb could be reduced to a fraction of what it is today. By taking such steps, President Bush could dramatically increase the speed and effectiveness of U.S. efforts to prevent nuclear weapons terrorism – putting his own indelible imprint on these programs and leaving a lasting

and visible legacy of improved nuclear security for the U.S. homeland and the world.

What we propose is nothing less than a coalition of all the world's leading states, working together on their common interest in ensuring that the horrifying destructive power of nuclear weapons is kept from falling into the hands of terrorist groups. This should be a central focus of the next round of the war on terrorism, organized as a coalition of the willing, each contributing what they can – and receiving assistance when needed to strengthen their contribution, much as the fight against terrorism has been structured.⁸ Indeed, as Senate Foreign Relations Committee Chairman Richard Lugar (R-IN) has said, the war on terrorism cannot be considered won, and the homeland of the United States cannot be considered adequately secured, until every cache of WMD and their essential ingredients around the world is secured and accounted for, to stringent standards.⁹

The same measures needed to keep nuclear weapons and materials out of the hands of terrorists would also contribute to keeping them out of the hands of hostile states – whose nuclear weapons ambitions could be achieved far more rapidly if they could get stolen nuclear weapons or the materials to make them, as opposed to having to start with the production of the materials from scratch. The world community simply cannot allow a future to arise in which any terrorist or dictator who wanted a nuclear bomb could buy the essential ingredients on a nuclear black market.

⁶ President George W. Bush, "Introduction" in *National Security Strategy of the United States of America* (Washington, D.C.: The White House, September 2002; available at <http://www.whitehouse.gov/nsc/nss.pdf> as of February 23, 2003).

⁷ See 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).

⁸ For discussions, see, for example, the remarks of former Senator Sam Nunn and Senator Richard Lugar the Conference on a Global Coalition Against Catastrophic Terrorism, sponsored by the Nuclear Threat Initiative, Moscow, May 27, 2002, as well as the joint statement from that conference (available at http://www.nti.org/c_press/c_index.html as of February 23, 2003). See also Ashton Carter, "Arms Control and Nuclear Terrorism: A Global Coalition Against Catastrophic Terrorism," testimony to the Senate Armed Services Committee, August 1, 2002 (available at http://bcsia.ksg.harvard.edu/publication.cfm?program=CORE&ctype=testimony&item_id=30 as of February 23, 2003).

⁹ See, for example, Richard Lugar, "Eye on a Worldwide Weapon Cache," *The Washington Post*, December 6, 2001.

Today, attention in Washington and the world is focused on the unfolding crises over the WMD capabilities of Iraq and North Korea. These crises are urgent, and they must be addressed. But they must not be allowed to draw attention away from dealing with the danger of nuclear theft – which is by far the most likely means by which terrorists might get a nuclear bomb or the materials needed to make one. If, as President Bush has argued, Iraq's WMD capabilities must be addressed to ensure that they do not fall into terrorist hands, then securing the world's stockpiles of WMD and their essential ingredients is part of that same struggle, and must be addressed with comparable determination and resources. Moreover, preventing nuclear theft is critical to managing the Iraqi and North Korean threats themselves. Repeated intelligence estimates have warned that getting stolen nuclear material from abroad would be the only way that Iraq could acquire nuclear weapons in the next few years¹⁰ – and if North Korea managed to get 100 kilograms of stolen weapon-grade plutonium, it could sidestep any constraints that may be agreed on its plutonium production and uranium enrichment programs.

After more than a decade of threat reduction cooperation,¹¹ these efforts must shift from a focus on short-term stop-gaps to improvements that can and will be sustained for the long haul.¹² At the same time, however, with both terrorist groups and hostile states attempting to get nuclear weapons or the materials to make them as fast as they can,

the problem of insecure nuclear weapons and materials remains a security emergency that must be addressed as rapidly as humanly possible. This need for an emergency pace for measures that must work for the long haul compounds the policy problem.

This report is intended to provide a detailed overview of the problem and potential solutions, in several steps:

- First, we outline the threats to U.S. and world security posed by insecure nuclear weapons and materials and by the desire of terrorists and hostile states to acquire them. This section is brief, as these threats have been described extensively elsewhere.¹³
- Second, as a device to guide thinking on what needs to be done, and with what priority, we outline the steps a terrorist group would have to take to acquire a nuclear weapon and detonate it on U.S. soil, and the contributions that different elements of the war on terrorism, homeland security efforts, and cooperative threat reduction efforts (the focus of this report) can make to blocking each of the steps on this pathway. This represents, in effect, an outline of an integrated, comprehensive plan for preventing terrorist use of nuclear weapons.
- Third, we provide an assessment of the current response to the threat, using quantifiable metrics

¹⁰ See, for example, *Iraq's Weapons of Mass Destruction: The Assessment of the British Government* (London: Office of the Prime Minister, September 2002; available at <http://www.official-documents.co.uk/document/rep/iraq/iraqdossier.pdf> as of January 20, 2003); and U.S. Central Intelligence Agency, *Iraq's Weapons of Mass Destruction* (Langley, Virginia: October 2002; available at http://www.cia.gov/cia/publications/iraq_wmd/Iraq_Oct_2002.pdf as of January 20, 2003).

¹¹ Officially, Cooperative Threat Reduction (CTR) is the name for the principal U.S. Department of Defense (DOD) program in this area; related programs elsewhere in DOD and in other agencies each have their own names. In this report, however, we use the phrases “cooperative threat reduction” and “threat reduction” to refer to the general approach of working cooperatively with other countries to reduce common threats posed by weapons of mass destruction, and all of the programs pursuing that objective, including DOD's CTR program and many others.

¹² See discussion in *Reshaping U.S.-Russian Threat Reduction: New Approaches for the Second Decade* (Washington, D.C.: Carnegie Endowment for International Peace and Russian American Nuclear Security Advisory Council, November 2002; available at <http://www.ceip.org/files/pdf/Reshaping.Threat.Reduction.pdf> as of February 9, 2003).

¹³ See, in particular, Matthew Bunn, “The Threat in Russia and the NIS,” *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/threat/Russia.asp as of March 12, 2003), and Matthew Bunn, “The Global Threat,” *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/threat/global.asp as of March 12, 2003).

to assess what fraction of the steps necessary to keep nuclear weapons out of terrorist hands have been taken, and how fast the remaining work is being accomplished. That section also addresses the inputs to the effort – how much money has been spent, what organizations are focused on the task, and, crucially, how much of the attention and effort of the senior political leaders of the U.S. government and its international partners are devoted to addressing this effort.

- Fourth, we provide a series of recommendations that, together, represent a first draft of an integrated action plan for a comprehensive response to the threat of nuclear weapons terrorism – the kind of plan that the government itself needs to prepare, in far more detail than we can offer here.

This report has an on-line companion, “Controlling Nuclear Warheads and Materials” (available at <http://www.nti.org/cnwm>), which provides in-depth supporting information, including the most comprehensive program-by-program assessments of programs focused on keeping nuclear weapons, materials, and expertise out of terrorist hands available anywhere. For each program covered, we describe its mission and approach, how much it has accomplished so far, how much has been spent, and what remains to be done. We then discuss the key issues each program now faces, and make recommendations for how to overcome them. These recommendations are in some cases similar to those in this report, but are more specific, focused on the particular issues facing individual programs. Performing this program-by-program examination of existing efforts provided the essential foundation for developing the broader conclusions and recommendations in this report. The web section also provides an interactive database with data on the budgets of all U.S. threat reduction programs since the inception of the efforts, technical background on nuclear weapons and materials, legislative updates, hundreds of annotated links to other sources of information available on the web, and more.

For the purposes of this report, we have divided the myriad programs focused in one way or another

on controlling nuclear warheads, materials, and expertise into six categories, based on the goals the programs are seeking to accomplish:

■ **Securing nuclear warheads and materials.**

Here, the goal is to ensure that every nuclear weapon and every kilogram of weapons-usable nuclear material worldwide is secure and accounted for. Security for these stockpiles must be effective in preventing either outsiders or insiders – or both working together – from stealing them, and must be designed to be sustained for the long haul. Programs in this category focus both on providing secure storage and transportation (such as the Department of Energy (DOE) Material Protection, Control, and Accounting (MPC&A) program, Department of Defense (DOD) and DOE warhead security programs, and the Mayak Fissile Material Storage Facility), and on removing nuclear weapons or weapons-usable material from potentially vulnerable sites (as was done in airlifting enough highly enriched uranium (HEU) for 2–3 nuclear bombs from an insecure facility in Yugoslavia in Project Vinca, for example).

- **Interdicting nuclear smuggling.** The goal here is to provide the next line of defense, by maximizing the chance that a nuclear weapon or weapons-usable nuclear material, once stolen, could be found and recovered, and efforts to smuggle such items between countries could be detected and stopped. Where the focus is keeping nuclear weapons or materials from entering the United States, or finding them once there, these efforts are in the province of homeland security programs, which we address only briefly in this report. Where the focus is recovering stolen nuclear weapons or materials abroad, and interdicting nuclear smuggling closer to its source, the mandate falls both to threat reduction programs and to a variety of intelligence sharing and law enforcement cooperation efforts. The Departments of State, Energy, and Defense each sponsor programs focused on interdicting nuclear or other WMD smuggling, with implementation help from the U.S. Customs Service, the Federal Bureau of Investigation (FBI), and other agencies.

■ **Stabilizing employment for nuclear personnel.** Even the best security system is only as good as the people who run it. Hence, another crucial goal is to ensure that nuclear scientists, workers, and guards are not desperate enough to want to steal nuclear weapons and materials or sell nuclear knowledge, and to close unsustainable and unnecessary nuclear facilities, so that stronger and more sustainable security can be achieved at the remaining facilities. Programs focused on these objectives include the International Science and Technology Centers (ISTC), DOE's Initiatives for Proliferation Prevention (IPP) effort, and DOE's Nuclear Cities Initiative (NCI), among others.

■ **Monitoring stockpiles and reductions.** The direct purpose of most proposed monitoring and data-exchange measures is to confirm that agreed nuclear reductions are being implemented. But these measures can have substantial indirect benefit in reducing the risk of theft of nuclear weapons and materials, easing the access that facilitates cooperation, highlighting weaknesses in security and accounting, and providing an incentive to fix potentially embarrassing problems before they are revealed. Overall, the goal here should be to put in place sufficient monitoring and data exchanges to build confidence that nuclear stockpiles are secure and accounted for, agreed reductions are being implemented, and assistance funds are being spent appropriately. Programs in this area include transparency for U.S.-Russian HEU Purchase Agreement, for the Mayak Fissile Material Storage Facility, and for the Plutonium Production Reactor Shutdown Agreement. A variety

of forms of informal transparency – such as visits to particular nuclear facilities as part of ongoing cooperation – have been successful in U.S.-Russian threat reduction cooperation, and several of the relevant programs have access agreements of their own, designed to provide the transparency needed to confirm that taxpayer dollars are being spent as agreed.

■ **Ending production.** With the end of the Cold War, the United States and Russia have far more nuclear weapons and weapons material than they could possibly need, and so they should stop making more. Programs in this area include the effort to provide alternative power sources so that Russia's last plutonium production reactors can shut down, and efforts to put in place a global moratorium, to be followed by a verifiable international treaty, on production of nuclear materials for weapons.

■ **Reducing stockpiles.** Here, the goal is to reduce the massive excess stockpiles of nuclear weapons and weapons-usable nuclear material, so that unneeded stockpiles do not have to be guarded forever. While this is a long-term objective, in a number of cases (such as the U.S.-Russian HEU Purchase Agreement) these programs also make critical immediate contributions to nuclear security – and in other cases (such as disposition of excess plutonium), near-term action is needed if progress toward longer-term objectives is not to grind to a halt.

Together, the programs in these six categories – coupled with new efforts, suggested here, that are designed to fill gaps that are not yet covered – offer

¹⁴ For discussions of steps to prevent chemical and biological terrorism, see, for example, Richard A. Falkenrath, Robert Newman, and Bradley Thayer, *America's Achilles' Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack* (Cambridge, Mass.: MIT Press, 1998); the resources on the subject provided by the Center for Nonproliferation Studies, Monterey Institute of International Studies (available at <http://cns.miiis.edu/research/cbw/cbw.htm> as of January 17, 2003); and the resources provided by the Johns Hopkins University Center for Civilian Biodefense Strategies (available at <http://www.hopkins-biodefense.org/> as of January 17, 2003). For a discussion of the security of Russia's chemical and biological complexes against possible theft, see Amy E. Smithson, *Toxic Archipelago: Preventing Proliferation from the Former Soviet Chemical and Biological Weapons Complexes*, Report No. 32 (Washington, D.C.: Henry L. Stimson Center, December 1999; available at <http://www.stimson.org/cbw/pubs.cfm?ID=27> as of January 17, 2003). For a nuanced discussion of past terrorist incidents involving chemical or biological weapons, see Jonathan B. Tucker, ed., *Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons* (Cambridge, Mass.: MIT Press, April 2000). For an annotated bibliography of resources on nuclear sabotage and dirty bomb issues (as well as additional resources on securing nuclear weapons and materials), see "Preventing Nuclear Terrorism," available at <http://ksnotes1.harvard.edu/BCSIA/MTA.nsf/www/N-Terror> as of January 20, 2003.

a comprehensive strategy for controlling nuclear warheads, materials, and expertise. Outlining that strategy is the key objective of this report.

It is important to be clear about what this report does *not* cover. This report is focused only on steps to prevent terrorist acquisition of an actual nuclear explosive, not on the broad range of means by which terrorists might be able to cause catastrophic harm. Thus, this report does not cover chemical, biological, nuclear sabotage, or radiological “dirty bomb” threats, or the various means by which terrorists might do devastating damage with conventional weapons.¹⁴ It does not discuss the many important and useful cooperative threat reduction efforts focused on goals beyond the six categories just described – from dismantling missiles and bombers to destroying chemical weapons to improving enforcement of export controls.¹⁵ The use of nuclear weapons would be among the most difficult types of attack for terrorists to accomplish – but the massive, assured, instantaneous, and comprehensive destruction of life and property that would result may make nuclear weapons a priority for terrorists despite the difficulties.¹⁶

Intended primarily to contribute to decision-making by the U.S. government, moreover, this report focuses almost entirely on programs that have been funded by the United States – which has been the preeminent, but not the only, sponsor of threat

reduction programs to date. We discuss other programs only briefly, primarily as they are relevant to determining how much more the U.S. government and its international partners have left to do in addressing these threats. Nearly all cooperative threat reduction efforts to date have focused on the unique security hazards created by the collapse of the Soviet Union; hence, although we emphasize that the control of nuclear weapons, materials, and expertise is a global problem, and make recommendations for efforts that would take place in countries around the world, most of our specific account of what has been accomplished so far also focuses on the former Soviet Union. Finally, this report does not address a wide range of international efforts aimed at controlling nuclear arms that are not focused on the terrorist threat – from negotiated nuclear arms reductions and restraints, to International Atomic Energy Agency (IAEA) safeguards, to international nuclear export control arrangements, to the verification arrangements of the Comprehensive Test Ban Treaty Organization (CTBTO).¹⁷

This report provides an American perspective, focused primarily on steps the U.S. government should take. But it is clear that to succeed, a comprehensive plan for this mission must be developed not as a made-in-America effort, but in full partnership with Russia and the other states that must take part.¹⁸ And it is equally clear that while

¹⁵ Effective export controls are crucially important to preventing transfers of technologies that states could use to produce nuclear weapons, and may have some modest benefit in restraining terrorists’ ability to acquire some technologies that would be useful to their efforts to cobble together an improvised bomb. For an excellent discussion of al Qaeda’s nuclear weapons potential that includes a mention of export controls as one element of an effort to keep nuclear weapons out of terrorist hands, see Albright, “Al Qaeda’s Nuclear Program,” op. cit. For recent treatments of the broader threat reduction agenda, see *Reshaping U.S.-Russian Threat Reduction: New Approaches for the Second Decade*, op. cit.; Robert J. Einhorn and Michèle Flournoy, eds., *Protecting Against the Spread of Nuclear, Biological, and Chemical Weapons: An Action Agenda for the Global Partnership* (4 Vols.) (Washington, D.C.: Center for Strategic and International Studies, 2003; available at http://www.csis.org/pubs/2003_protecting.htm as of February 23, 2003); and Michael Barletta, ed., *After 9/11: Preventing Mass-Destruction Terrorism and Weapons Proliferation* (Monterey, Cal.: Center for Nonproliferation Studies, Monterey Institute of International Studies, May 2002; available at <http://cns.miis.edu/pubs/opapers/op8/op8.pdf> as of February 24, 2003). While we point out in this report that much of the work needed to prevent nuclear weapons terrorism has not yet been done, a careful reading of the works just cited makes clear that the fraction of the job of controlling the chemical and biological complexes of the former Soviet Union (and the world) that is already accomplished is far less. For a detailed account of the remaining challenge in controlling biological weapons, see *Addressing the Biological Security Challenge: What is Still to be Done? U.S. Government Programs, Budgets and Related Activities* (Washington, D.C.: Chemical and Biological Arms Control Institute for the Nuclear Threat Initiative, forthcoming Spring 2003).

¹⁶ For a useful discussion of the relative dangers posed by different types of mass destruction terrorist threats, see Falkenrath, Newman, and Thayer, *America’s Achilles’ Heel*, op. cit.

the United States has a special responsibility to lead, the threat is a threat to all nations, not just to the United States, and other nations around the world must contribute to its solution as well – as the members of the Group of Eight (G-8) industrialized democracies have recently agreed.¹⁹ An all-American analysis such as this one can be no more than a first draft.

More fundamentally, this report has been compiled by a small group of researchers at a single U.S. university. While we have the advantage of not being distracted by the day-to-day crises of managing federal programs, we do not have remotely the resources the U.S. government and its agencies can bring to bear. We believe that in order to reduce the chance of terrorists acquiring nuclear weapons as much as possible, as rapidly as possible, the government itself – working with its inter-

national partners – must regularly prepare reports such as this one, laying out clear objectives, the means to be used to accomplish them, and measures for judging how much success is being achieved. Indeed, we would like nothing better than for the U.S. government to reply to this report by issuing a strategic plan it believes can get the job done faster and more effectively than the plan we propose, with metrics and milestones that the government believes offer a more accurate approach to measuring progress than the one contained in this report. Such regular strategy and progress reports – perhaps on an annual basis – would not only help the government integrate these myriad efforts, identify and eliminate gaps and overlaps among them, and set priorities, but would provide political decision-makers with the transparency and accountability for results they need to make decisions on how best to move this agenda forward.

¹⁷ A strong IAEA safeguards system does make a contribution to preventing nuclear terrorism, and in that context will be discussed briefly in this report: it does so by ensuring that nuclear material is accounted for on an international basis; requiring that states meet reasonable standards in accounting for their own nuclear material; identifying sites where accounting may be a problem; putting in place a cadre of inspectors, who sometimes take note if there appear to be serious security problems at a particular site; and encouraging states to fix potentially embarrassing problems before inspectors arrive. Moreover, some of the measures included in the Additional Protocol to safeguards agreements, if widely adopted, might help identify sites where terrorist activity using nuclear materials was taking place. See the brief discussion in Albright, “Al Qaeda’s Nuclear Program,” *op. cit.*

¹⁸ It appears that at least some senior Russian experts are ready to endorse many of the initiatives recommended in this report. See, for example, John P. Holdren and Nikolai P. Laverov, *Letter Report From the Co-Chairs of the Joint Committee on U.S.-Russian Cooperation on Nuclear Non-Proliferation* (Washington, D.C.: The National Academies, December 4, 2002; available at <http://www4.nationalacademies.org/news.nsf/isbn/s02052003?OpenDocument> as of February 25, 2003).

¹⁹ For a general discussion of future steps toward such a global threat reduction partnership, see Einhorn and Flournoy, eds., *Protecting Against the Spread*, *op. cit.*

2. The Threat

In January 2001, long before the September 11 attacks occurred, a distinguished bipartisan panel warned that “the most urgent unmet security threat to the United States today is the danger that weapons of mass destruction or weapons-usable material in Russia could be stolen and sold to terrorists or hostile nation states and used against American troops abroad or citizens at home.”¹ What the world has learned since then only emphasizes the danger. The attacks of September 11 demonstrated beyond doubt that the threat of terrorists with global reach, bent on inflicting mass destruction, is not hypothetical but real. Since then, information gathered from al Qaeda camps in Afghanistan has highlighted the group’s extensive efforts to get weapons of mass destruction, including nuclear weapons, while further examination of the state of nuclear security has made it clear that the problem of insecure nuclear weapons and materials is not limited to Russia, but spread across the globe. The danger that terrorists might acquire a stolen nuclear weapon or the materials to make one is very real – and is likely to grow unless fast and effective action is taken to reduce it.

Mother Nature has been both kind and cruel in setting the laws of physics that frame the nuclear predicament the world faces. Kind, in that the essential ingredients of nuclear weapons, highly enriched uranium (HEU) and plutonium, do not occur in significant quantities in nature, and are quite difficult to produce. Making them is well beyond the plausible capabilities of terrorist groups. Hence, if all of the existing stockpiles

could be effectively guarded, nuclear weapons terrorism could be reliably prevented: no material, no bomb. (This makes nuclear weapons quite different from chemical and biological weapons, for which the essential ingredients can be found in nature.) Cruel, in that, while it is not easy to make a nuclear bomb, it is not as difficult as many believe, once the needed materials are in hand. Most states, and even some particularly well-organized terrorist groups, could do it. And cruel, in that HEU and plutonium, while radioactive, are not radioactive enough to make them difficult to steal and carry away, or to make them easy to detect when being smuggled across borders. Therefore the best defense is keeping these items from being stolen in the first place.

Since September 11, many officials have said that while there were warnings, there was no intelligence specific enough to tell the U.S. government what actions to take. Here, that is not the case – the warning signs are undeniable:

■ By word and deed, Osama bin Laden and his al Qaeda terrorist network have made it clear that they are seeking nuclear weapons to use against the United States and its allies.² Bin Laden has called the acquisition of weapons of mass destruction (WMD) a “religious duty.”³ Intercepted al Qaeda communications reportedly have referred to inflicting a “Hiroshima” on the United States.⁴ Al Qaeda operatives have made repeated attempts to buy stolen nuclear material from which to make a nuclear bomb.

¹ Howard Baker and Lloyd Cutler, co-chairs, *A Report Card on the Department of Energy’s Nonproliferation Programs with Russia* (Washington, D.C.: U.S. Department of Energy, Secretary of Energy Advisory Board, January 10, 2001; available at <http://www.hr.doe.gov/seab/rusrpt.pdf> as of January 13, 2003).

² For more on demand for stolen nuclear materials by both terrorist groups and hostile states, see Appendix B.

³ “Interview with Bin Laden: ‘World’s Most Wanted Terrorist’,” *ABCNews.com* (available at http://more.abcnews.go.com/sections/world/DailyNews/transcript_binladen1_990110.html as of January 31, 2003).

⁴ See James Risen and Steven Engelberg, “Signs of Change in Terror Goals Went Unheeded,” *New York Times*, October 14, 2001.

They have tried to recruit nuclear weapon scientists to help them. The extensive downloaded materials on nuclear weapons (and crude bomb design drawings) found in al Qaeda camps in Afghanistan make clear the group's continuing desire for a nuclear capability.⁵ Detailed analysis of al Qaeda's efforts suggests that, had they not been deprived of their Afghanistan sanctuary, their quest for a nuclear weapon might have succeeded within a few years – and the danger that it could succeed elsewhere still remains.⁶

■ If they got the materials, making a bomb is at least potentially within the capability of a large and well-organized terrorist group. With enough HEU, terrorists could potentially make a simple “gun-type” bomb, little more than firing two pieces of HEU into each other to form a critical mass. Making a bomb from plutonium (or from a stock of HEU too small for a gun-type bomb) would be more difficult, because it would have to be an “implosion” bomb, in which explosives are set off all around a nuclear material core, crushing it down to a smaller, denser configuration where the nuclear chain reaction will begin. Getting these explosives right was a tremendous challenge in the Manhattan Project, when such a thing had never been done before. It would still be a significant challenge – but today the rele-

vant explosive technology is in wide use in conventional military and even commercial applications. Detailed examinations by U.S. nuclear weapons experts have concluded again and again that with enough nuclear material in hand, it is plausible that a sophisticated terrorist group could build at least a crude nuclear explosive – including, potentially, an implosion bomb, though that would be substantially more difficult for them than a gun-type bomb.⁷ These conclusions were drawn before September 11 demonstrated the sophistication and careful planning and intelligence gathering of which al Qaeda is capable. Indeed, Department of Energy (DOE) internal security regulations envision the possibility of an “improvised nuclear device” – a nuclear bomb the terrorists might be able to put together while they were still inside the facility where they stole the HEU.⁸

■ The amounts needed to build a bomb are small. With an efficient implosion design, a baseball-sized lump of plutonium weighing 4 kilograms (about 10 pounds), or a softball-sized lump of HEU weighing perhaps three times as much, is enough.⁹ For a less-efficient gun-type design, four to five times more HEU would be needed. Unless proper security and accounting systems are in place, a worker at a nuclear facility could put

⁵ For the best available summary of al Qaeda's nuclear efforts, see David Albright, “Al Qaeda's Nuclear Program: Through the Window of Seized Documents,” *Special Forum* 47 (Berkeley, Cal.: Nautilus Institute, November 6, 2002; available at http://www.nautilus.org/fora/Special-Policy-Forum/47_Albright.html as of January 27, 2003). See also David Albright, Kathryn Buehler, and Holly Higgins, “Bin Laden and the Bomb,” *Bulletin of Atomic Scientists* 58, no. 1 (January/February 2002; available at <http://www.thebulletin.org/issues/2002/jf02/jf02albright.html> as of January 31, 2003); Mike Boetcher and Ingrid Arnesen, “Al Qaeda Documents Outline Serious Weapons Program,” *CNN*, January 25, 2002 (available at <http://www.isis-online.org/publications/terrorism/cnnstory.html> as of January 31, 2003); Gavin Cameron, “Multi-Track Microproliferation: Lessons from Aum Shinrikyo and Al Qaeda,” *Studies in Conflict and Terrorism* 22, no. 4 (1999); and Kimberly Mclound and Matthew Osborne, “WMD Terrorism and Usama bin Laden,” (Monterey, Cal: Monterey Institute for International Studies, Center for Nonproliferation Studies; available at <http://cns.miis.edu/pubs/reports/bin-laden.htm> as of January 31, 2003).

⁶ Albright, “Al Qaeda's Nuclear Program,” op. cit. Albright has likely examined more of the al Qaeda nuclear documents than any other analyst – certainly any other analyst outside the government.

⁷ See J. Carson Mark et al., “Can Terrorists Build Nuclear Weapons?” in Paul Leventhal, and Yonah Alexander, *Preventing Nuclear Terrorism* (Lexington, Mass.: Lexington Books, 1987; available at <http://www.nci.org/k-m/makeab.htm> as of January 31, 2003). This remains the most authoritative unclassified treatment of the subject – in part because it represents something of a negotiated statement by experts with a range of views on the matter. See also John P. Holdren and Matthew Bunn, “Technical Background,” *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/overview/technical.asp as of March 12, 2003).

⁸ U.S. Department of Energy (DOE), Office of Security Affairs, Office of Safeguards and Security, *Manual for Protection and Control of Safeguards and Security Interests, Chapter I, Protection and Control Planning* (Washington, D.C.: DOE, July 15, 1994; available at http://www.fas.org/irp/doddir/doe/m5632_1c-1/m5632_1c-1_c1.htm as of January 31, 2003).

enough material for a bomb in a briefcase or under an overcoat and walk out.

■ By contrast, the world stockpiles of nuclear warheads, plutonium, and HEU are immense. More than a decade after the end of the Cold War, the world's arsenals still contain some 30,000 assembled nuclear weapons. Enough separated plutonium and HEU exists in the world to make nearly a *quarter million* nuclear weapons – all of it intentionally produced by human beings during the five decades of the nuclear age.¹⁰

■ These stockpiles are not only immense, but are widely dispersed. Nuclear weapons are owned by at least eight countries, and exist on the territories of several others as well, in many hundreds of individual bunkers and weapon deployment sites. Weapons-usable nuclear materials exist in many hundreds of buildings in scores of countries around the world. For example, there are over 130 operating research reactors fueled with HEU, in more than 40 countries around the world, ranging from the United States to Ghana.¹¹ Most of these research reactors have only small amounts of HEU – but some, including a significant number outside the nuclear-weapon states, have enough fresh HEU for a bomb. Even more have enough HEU for a bomb

if “spent” HEU that is not radioactive enough to deter suicidal terrorists from taking it and using it in a bomb is included, as it should be.¹²

■ The world's stockpiles are not only immense and widely dispersed, but some of them are very poorly secured. No binding international standards for securing nuclear weapons and materials exist, and the security now in place varies from excellent to appalling.

■ Security for nuclear weapons and weapons-usable nuclear materials in the former Soviet Union poses a particular challenge. The collapse of the former Soviet Union, an empire armed with tens of thousands of nuclear weapons and enough nuclear material for tens of thousands more, created a unique security crisis, for much of the Soviet system for securing warheads and materials fell apart when the Soviet Union crumbled. The Soviet nuclear security system was based on a closed society with closed borders, pampered nuclear workers, and everyone under close surveillance by the KGB – a world that no longer exists. At most facilities, when the Soviet Union collapsed, there was no detector at the door to set off an alarm if some one walked out with plutonium or HEU; few security cameras in the areas where the plutonium and HEU were

⁹ The Department of Energy has officially declassified the fact that four kilograms of plutonium is in principle sufficient to make a nuclear weapon. See DOE, *Drawing Back the Curtain of Secrecy: Restricted Data Declassification Decisions 1946 to the Present*, RDD-5 (Washington, D.C.: DOE, January 1, 1999; available at <http://www.osti.gov/opennet/rdd-5.html> as of January 31, 2003).

¹⁰ The total world stockpile of HEU is estimated to be some 1,600 tons (potentially enough to fabricate 130,000 nuclear weapons), while the world stockpile of plutonium separated from spent fuel is estimated to be over 480 tons (enough to fabricate an additional 110,000 nuclear weapons). See David Albright and Mark Gorwicz, “Tracking Civil Plutonium Inventories: End of 1999,” *ISIS Plutonium Watch* (October 2000; available at <http://www.isis-online.org/publications/puwatch/puwatch2000.html> as of January 31, 2003); the figures presented there have been updated to reflect continuing blend-down of HEU and continuing accumulation of civil separated plutonium. The weapons equivalent calculation assumes four kilograms of weapon-grade plutonium per weapon, five kilograms for reactor-grade plutonium, and three times the weapon-grade plutonium figure for HEU.

¹¹ In last year's report, relying on numbers from DOE's budget justifications, we referred to 345 HEU-fueled reactors (both operational and shutdown) in 58 countries. Unfortunately, these DOE figures were incorrect, including a significant number of reactors whose fuel is just below the internationally defined line of 20% enriched for HEU. In addition, a large number of the reactors listed in the IAEA's database as shut down but not yet decommissioned (and included in the DOE figure we used) have in fact been decommissioned, and the HEU removed, but have not yet communicated that information to the experts who maintain the database at the IAEA. Thus, we are now relying on figures for operational research reactors fueled with HEU; including facilities that are shut down but still have HEU on-site would probably increase the figure in the text by several dozen, but not by hundreds. Data from International Atomic Energy Agency, *Nuclear Research Reactors of the World* (Vienna, Austria: IAEA, September 2000), supplemented with personal communications with James Matos, Argonne National Laboratory, and Iain Ritchie, International Atomic Energy Agency, 2002.

AL QAEDA AND CHECHEN TERRORIST ATTEMPTS TO ACQUIRE NUCLEAR WEAPONS AND MATERIALS

In late October 2002, a force of some 40 Chechen terrorists armed with automatic weapons and explosives seized more than 700 hostages at a Moscow theater. The official Russian government newspaper reported that the terrorists had previously considered seizing a reactor at the Kurchatov Institute in Moscow, where hundreds of kilograms of highly enriched uranium (HEU) are located.¹

■ In October 2001, the commander of the force that guards Russia's nuclear weapons reported that during that year, terrorist groups had twice carried out reconnaissance at Russian nuclear warhead storage sites – whose very locations are a state secret.² The Russian official government newspaper later confirmed these incidents and reported two more in which terrorists were monitoring nuclear warhead transport trains, possibly in preparation for an attempt to seize one.³

■ In 1998, senior al Qaeda deputy Mamdouh Mahmud Salim was arrested in Germany, and charged with attempting to obtain HEU in the mid-1990s. Salim is still in prison.⁴

■ In 1993, senior al Qaeda deputies instructed Jamal Ahmad al-Fadl, an al Qaeda operative, to attempt to purchase HEU for a nuclear bomb in the Sudan. Al-Fadl has described this attempted purchase in detail in court testimony. It appears that al Qaeda was scammed, and that the material on offer was not actually HEU.⁵ There are multiple credible but unconfirmed reports of al Qaeda attempts to purchase nuclear materials in the former Soviet

Union, particularly Kazakhstan and Ukraine, in the 1990s. In 1998, Israeli intelligence reportedly learned that Osama bin Laden had paid millions to a middleman in Kazakhstan who had claimed to be able to deliver a nuclear bomb. Israel reportedly sent a Cabinet minister to Kazakhstan to encourage the government to take action to block any such transfers.⁶

■ There are a large number of reports of low credibility that al Qaeda has already acquired tactical nuclear weapons from the Russian nuclear arsenal. Bin Laden himself, when asked if he had nuclear or chemical weapons, replied: "We have the weapons as a deterrent."⁷

1 Vladimir Bogdanov, "Propusk K Beogolovkam Nashli U Terrorista (A Pass To Warheads Found on a Terrorist)," *Rossiiskaya Gazeta*, November 1, 2002.

2 Pavel Koryashkin, "Russian Nuclear Ammunition Depots Well Protected – Official," *ITAR-TASS*, October 25, 2001; "Russia: Terror Groups Scoped Nuke Site," *Associated Press*, October 26, 2001.

3 Bogdanov, "A Pass To Warheads," op. cit.

4 Benjamin Weiser, "U.S. Says Bin Laden Aide Tried to Get Nuclear Weapons," *New York Times*, September 26, 1998.

5 For a discussion and a full transcript of al-Fadl's testimony, see McCloud and Osborne, "WMD Terrorism and Usama bin Laden," op. cit.

6 Marie Colvin, "Holy Warrior with US in His Sights," *Times* (London), August 16, 1998.

7 Hamid Mir, "Osama Claims He Has Nukes: If U.S. Uses N-Arms It Will Get Same Response," *Dawn* (Pakistan), November 10, 2001 (available at <http://www.dawn.com/2001/11/10/top1.htm> as of January 30, 2003).

stored; accounting systems that were never designed to detect theft of bomb quantities of nuclear material; and wax seals on containers holding plutonium or HEU, which could be easily faked by any worker with an authorized stamp. At many of these facilities, for much of the 1990s, scientists, workers, and guards were receiving pay of less than \$100 per month – and that pay was sometimes delayed for months at a time.

During the Russian financial crisis of 1998, guards at some nuclear facilities were leaving their posts to forage for food, and alarm systems were shutting down when facilities' electricity was cut off for non-payment of bills.¹³ Even at nuclear weapon storage facilities, which are generally more secure, security equipment is often outdated or broken, and guards are potentially exposed to hostile fire.¹⁴ While many of

these problems have since been addressed through the former Soviet states' own efforts and through international cooperative programs, much more remains to be done.

■ Inadequate security for nuclear materials is a global problem as well. Many of the more than 130 HEU-fueled research reactors around the world have little more security on-site than a night watchman and a chain-link fence. At some facilities where the essential ingredients of nuclear weapons reside, there are literally no armed guards on duty; at some, there is no security camera in the area where the material is stored, and no detector at the door to sound an alarm if someone was carrying out nuclear material in their briefcase; a few of these facilities are so impoverished that they have dead rats floating in the spent fuel pool.¹⁵

■ While little is known about the details of security arrangements for nuclear weapons in other countries, there appear to be substantial grounds for concern, particularly where the

potential threats are very high. In Pakistan, for example, there is widespread sympathy for the Taliban and for extreme Islamic causes within the nuclear weapons establishment – as evidenced by the case of the two nuclear weapon scientists who traveled to Afghanistan and met with bin Laden, to whom – according to Pakistani intelligence sources – they then provided classified nuclear weapons information.¹⁶ At the same time, there are large armed remnants of al Qaeda operating in Pakistan. The possibility of a large terrorist attack on a Pakistani nuclear weapons site, possibly with help from insiders, cannot be ruled out.

■ As a result of such conditions in countries around the world, there have been multiple documented cases of real theft of kilogram quantities of real weapons-usable nuclear material. The International Atomic Energy Agency has a database that includes 18 incidents involving seizure of stolen HEU or plutonium that have been confirmed by the relevant states. To cite just one example, in 1998 there was a conspiracy by

¹² Research reactors pose terrorist threats resulting from possible theft of HEU for a nuclear bomb, from possible theft of irradiated fuel of any type for use in a radiological “dirty bomb,” and from possible sabotage, given the location of many of these facilities in major urban areas. For an excellent discussion, see G. Bunn, C. Braun, A. Glaser, E. Lyman, and F. Steinhäusler, “Research Reactor Vulnerability to Terrorists: An Unrecognized Peril in Need of Urgent Attention,” *Science and Global Security*, forthcoming. For a useful discussion of the proliferation hazards of spent HEU fuel, and the lack of requirements that such material be protected from theft even in the United States, 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). Assessing which facilities have enough fresh HEU on-site to pose a serious proliferation risk is difficult, as information about stocks of fresh and spent HEU fuel at individual facilities is not typically made publicly available. The U.S. State Department has publicly estimated that there are 24 research facilities outside the United States and Russia that pose proliferation risks serious enough to justify urgent removal of the HEU. See Robert Schlesinger, “24 Sites Eyed for Uranium Seizure,” *Boston Globe*, August 24, 2002.

¹³ For an unclassified summary of the situation in Russia from 2002, well after the passing of the 1998 financial crisis, see National Intelligence Council, *Annual Report to Congress on the Safety and Security of Russian Nuclear Facilities and Military Forces* (Langley, Virginia: Central Intelligence Agency, February 2002; available at http://www.cia.gov/nic/pubs/other_products/icarusiansecurity.htm as of January 31, 2003); for earlier accounts of the state of security and accounting for nuclear weapons and materials in the former Soviet Union, see Matthew Bunn, *The Next Wave: Urgently Needed New Steps to Control Warheads and Fissile Material* (Washington, D.C.: Carnegie Endowment for International Peace and the Project on Managing the Atom, Harvard University, April 2000; available at http://bcsia.ksg.harvard.edu/BCSIA_content/documents/FullNextWave.pdf as of January 31, 2003), and sources cited therein.

¹⁴ Personal communications with Russian and American participants in cooperative efforts to upgrade nuclear warhead security, 2002.

¹⁵ For a discussion of the global threat outside the former Soviet Union, see 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).

insiders at one of Russia's largest nuclear weapons facilities to steal 18.5 kilograms of HEU – potentially enough for a nuclear bomb at a single stroke. Fortunately, Russian officials report that the conspirators were caught before the material left the facility.¹⁷ Theft of the essential ingredients of nuclear weapons is not a hypothetical worry – it is an ongoing reality. What we do not know is how many of these thefts have not been detected – how many horses have already left the barn.

- Nuclear materials, or even nuclear weapons, could readily be smuggled across U.S. borders, or other nations' borders. If stolen or built abroad, a nuclear bomb might be delivered to the United States, intact or in pieces, by ship or aircraft or truck, or the materials could be smuggled in and

the bomb constructed at the site of its intended use. The length of the border, the diversity of means of transport, and the ease of shielding the radiation from plutonium or highly enriched uranium all operate in favor of the terrorists. Today, none of the major ports that ship cargo to the United States are equipped to inspect that cargo for nuclear weapons or weapons material, and few of the points of entry into the United States have an effective ability to carry out routine searches for nuclear materials either. In an experiment in September 2002, *ABC News* shipped depleted uranium (enough for a nuclear bomb had it been HEU) to the United States in a cargo container – and although that container happened to be among the small percentage that are inspected, the uranium was not detected.¹⁸ Building the overall system of legal infrastructure, intelligence, law

AL QAEDA AND TALIBAN ATTEMPTS TO RECRUIT NUCLEAR EXPERTISE

- Two Pakistani nuclear weapon scientists, Sultan Bashiruddin Mahmood and Chaudiri Abdul Majeed, have admitted that in August 2001, they had extensive discussions with Osama bin Laden and other al Qaeda officials concerning nuclear, chemical, and biological weapons. Both have extreme Islamic views and were involved in a charity founded to support the Taliban. Mahmood had been a leading participant in Pakistan's nuclear weapons program for decades, at one time heading Pakistan's production of weapons plutonium. Pakistani intelligence sources told the *Washington Post* that the two had provided classified information on nuclear weapons to al Qaeda.¹
- In October 2000, an official of Russia's Security Council reported that Taliban envoys had attempted to recruit at least one Russian nuclear expert. While the recruiting target did not agree to work for the Taliban, three of his colleagues had left his institute for foreign

countries and Russian officials did not know where they had gone.²

- In 1998, an employee at Russia's premier nuclear weapons laboratory in Sarov (formerly Arzamas-16) was arrested for attempting to sell weapons documents – on advanced conventional weapons, in this case – to the Taliban and Iraq. The regional head of the Federal Security Service (FSB) reported that there had been other similar cases at Sarov, and said that such spying was the result of the “very difficult financial position” of workers at such defense enterprises.³

¹ See discussion in Albright, “Al Qaeda's Nuclear Program,” op. cit. and sources cited therein.

² *Radio Free Europe/Radio Liberty Daily Report*, Oct. 9, 2000.

³ “Nuclear Center Worker Caught Selling Secrets,” *Russian NTV*, Moscow, 16:00 Greenwich Mean Time, December 18, 1998, translated in *BBC Summary of World Broadcasts*, December 21, 1998.

¹⁶ See, for example, Kamran Khan and Molly Moore, “2 Nuclear Experts Briefed Bin Laden, Pakistanis Say,” *Washington Post*, December 12, 2001; and Kamran 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 Suspensions,” *Washington Post*, March 3, 2002.

¹⁷ For discussions, with references, of many of the major theft cases, including this one, see Bunn, *The Next Wave*, op. cit.

enforcement, border and customs forces, and nuclear detectors needed to find and recover stolen nuclear weapons or materials, or to interdict these as they cross national borders, is an extraordinarily difficult challenge. In short, once terrorists get or make a nuclear bomb, there is little to stop them delivering it to a U.S. city – where the destruction it could wreak, as described below, would be almost unimaginable.

These facts lead immediately to an inescapable conclusion: the United States and its partners must do everything in their power to ensure that every nuclear weapon, and every kilogram of HEU and plutonium, wherever it may be in the world, is secure and accounted for, to stringent standards. The terrorists who have sworn to destroy us have demonstrated global reach, and – with attacks such as those on the U.S. embassies in Africa in 1998 or the USS *Cole* in 2000 – an ability to identify weak points and strike at them on a global basis. The procurement agents for hostile states such as Iraq, Iran, and North Korea have demonstrated similar capabilities. Those seeking material for a nuclear bomb will go wherever it is easiest to steal, or buy it from anyone willing to sell. Thus insecure nuclear bomb material anywhere is a threat to everyone, everywhere. The world has the warning it needs to know what needs to be done. Failing to act on this clear warning would simply be irresponsible.

An Appalling Scenario

In October 2001, U.S. intelligence received a report that terrorists had acquired a 10-kiloton nuclear bomb, and were planning to smuggle it into Manhattan. After a few tense weeks, the report turned out to be false.¹⁹ But the chilling fact is that at the time, no one could dismiss the possibility that the

report might be true. Given the threat just described – the weaknesses in security for nuclear material around the world, the lack of insuperable technical barriers to making a nuclear bomb with sufficient material in hand, the desire of al Qaeda and potentially other extreme terrorist groups to inflict nuclear violence on the United States, and the virtually nonexistent ability to stop nuclear contraband coming into the United States – the scenario was all too credible.

The probability of a terrorist attack with an actual nuclear weapon cannot be reliably estimated, and is surely lower, given the difficulties of getting nuclear material and building a nuclear bomb, than the probability of virtually any other type of terrorist attack. But the devastation from such an attack would be so overwhelming that, when threat is considered to be the probability multiplied by the consequences, this must be considered one of the greatest dangers America faces.

Let us imagine that the report had been true, and that the terrorists set off their 10-kiloton nuclear bomb at Grand Central Station on an average workday. Some 550,000 people work within a half-mile (805 meter) radius of the station.²⁰ This figure does not include the tourists and visitors present on an average day, and hence is quite conservative. Within this radius, the blast overpressure would be over five pounds per square inch (psi), enough to destroy wood, brick, and cinderblock buildings. The heat from the blast would be enough to ignite paper and other combustibles throughout the area, and to give everyone not protected by a building second degree burns over much of their body. The possibility of a firestorm – a coalescence of the many fires that would be set by the blast into a raging storm of fire consuming everything and everyone within it, as occurred at

¹⁸ See Christopher Paine, “Preventing Nuclear Terrorism,” testimony to the House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, 107th Congress, 2nd Session, September 24, 2002 (available at http://www.house.gov/reform/ns/schedule_107th_2nd_session/paine_sept_24.htm as of January 21, 2003).

¹⁹ Massimo Calabresi and Romesh Ratnesar, “Can We Stop the Next Attack?” *Time*, March 11, 2002.

²⁰ See Federal Transit Administration, *Annual Report on New Starts: Proposed Allocations of Funds for Fiscal Year 2003* (Washington, D.C.: U.S. Department of Transportation, 2002), Appendix A, “Long Island Rail Road East Side Access” (available at <http://www.fta.dot.gov/library/policy/ns/ns2003/pelirr.html> as of January 20, 2003). This translates to a density, on an average workday, of 300,000 people per square kilometer. The authors are grateful to Steve Fetter of the University of Maryland for providing this reference.

Hiroshima, Dresden, and Tokyo in World War II – would be very real. The prompt radiation from the blast would be enough to sicken everyone in this zone, and kill most of those not protected by buildings. If the skyscrapers fell, those inside would virtually all be killed. Falling would be a near certainty for all the buildings within roughly 500 meters of the blast (where the blast wave pressure would be over 15 psi, with winds of 400 miles per hour), and a serious possibility for every building in this half-mile zone, given the combination of blast overpressure and fire. From the combination of these effects, the vast majority of the people in this zone would die, as would a substantial number of the people beyond. More than half a million people would likely be killed by the immediate effects of the explosion, from the combination of blast, heat, radiation, and building collapse.²¹ This zone of almost total destruction would extend from the Hudson to the East River, from just north of Battery Park up almost to Grand Street.

In addition to those killed, there would be hundreds of thousands of people injured – burned, battered, irradiated, hit by flying glass and debris. Every bed in every hospital for a hundred miles would not be remotely sufficient to handle the casualties.²² Tens of thousands, or perhaps hundreds of thousands, of injured people would likely go without treatment for days, and many would die.

Such a blast would also draw thousands of tons of rock and debris into the fireball, to be distributed as a cloud of lethal radioactive fallout extending miles downwind from the blast. If the blast occurred in late afternoon, with the wind headed north, all of Manhattan that remained would have to be evacuated. Depending on factors such as wind, weather, the effectiveness of the evacuation, and the degree to which people were able to take shelter from the radioactive fallout, tens to hundreds of thousands more people downwind from the blast might suffer a lingering death from radiation exposure.

²¹ A common approach for roughly approximating likely deaths from medium-sized nuclear blasts is to assume that the number of people who would die outside the ring where the blast overpressure would be five pounds per square inch (psi) will be about the same as the number of people who would survive within this ring – so that the total number killed would be roughly the total number within the five psi ring. The five-psi ring in this case would extend 1,000 meters in every direction from the blast. This model is not entirely appropriate in this case, as beyond 1,000 meters in several directions the destructive energy would be expended over the rivers, where the population goes to zero. The five-psi ring encloses an area of 3.1 square kilometers, so if such a “cookie cutter” model were used, with a daytime population density of 300,000 people per square kilometer, the estimate would be that over 900,000 people would die, nearly twice our half-million estimate. The rough half-million deaths estimate is partly confirmed by two recent studies of possible nuclear attacks in Manhattan. The daytime population density in lower Manhattan is more than 10 times the residential population (residential population of 50,900 in a half-mile radius around Grand Central Station, reported in FTA, *Annual Report on New Starts: Proposed Allocations of Funds for Fiscal Year 2003*, op. cit.). Each of these recent nuclear attack studies considered only the residential population, and so an approximation to a daytime attack estimate can be reached by multiplying their fatality estimates 10-fold. An estimate in the *British Medical Journal*, based on the use of software developed by the Federal Emergency Management Agency and the Defense Threat Reduction Agency, concluded that 62,000 people (620,000 with a 10-fold higher daytime population density) would die from the immediate blast, heat, and prompt radiation effects of a 12.5 kiloton bomb; while this is slightly larger than the weapon assumed here, they assumed a detonation point at the World Trade Center, so that the bomb wasted a large fraction of its destructive power over the river. They estimated an additional 200,000 deaths from radioactive fallout (a figure that should *not* be increased for higher daytime population density, since these exposures occur over a period of days and weeks). See Ira Helfand, Lachlan Forrow, and Jaya Tiwari, “Nuclear Terrorism,” *British Medical Journal* 324, February 9, 2002 (available at <http://www.psr.org/bmjarticle.pdf> as of January 20, 2003). Analysts at the Natural Resources Defense Council (NRDC), who have developed very detailed software for estimating nuclear weapons effects, estimated that some 66,000 people would die from all effects if a 10-kiloton bomb were detonated while still in its cargo container at a pier in Brooklyn, if it is assumed that all the people in affected areas were protected by buildings and none of the buildings collapsed. This estimate included fallout fatalities (which were hence far lower than those estimated in the previous study), but having been detonated in Brooklyn, the bomb’s lethal effects covered only a modest portion of lower Manhattan, and the study considered only the residential population, not the much higher daytime population. See Thomas B. Cochran, Matthew B. McKinzie, and Christopher E. Paine, “Appendix: The ABC News Nuclear Smuggling Experiment,” in Christopher E. Paine, “Preventing Nuclear Terrorism,” testimony to the Subcommittee on National Security, Veterans Affairs, and International Relations, Committee on Government Reform, U.S. House of Representatives, September 24, 2002 (excerpt available at <http://nrdc.org/nuclear/furanium.asp> as of January 31, 2003).

“DIRTY BOMBS” VS. NUCLEAR BOMBS

Both U.S. and British intelligence have reportedly concluded that al Qaeda has succeeded in making a radiological “dirty bomb.”¹ Fortunately, such a dirty bomb is a far cry from an actual nuclear explosive.

Rather than producing a nuclear blast like those that destroyed Hiroshima and Nagasaki, a “dirty bomb” is designed simply to spread radioactive material over an area. A dirty bomb would be more a weapon of mass disruption than a weapon of mass destruction, designed to sow panic and chaos. By forcing the evacuation of many blocks of a city, it could potentially cause billions of dollars in economic disruption, and billions more in cleanup costs, but it would not kill tens of thousands of people in a flash or obliterate a major section of a city as an actual nuclear bomb could.²

As suggested by the conclusion that al Qaeda may have already acquired such a device, a dirty bomb would be far easier for terrorists to acquire than would a nuclear bomb. Millions of radioactive sources are in use for a wide range of beneficial medical, industrial, and agricultural purposes around the world, ranging from tiny bits of material in smoke detectors, whose dispersal would probably not even be noticed, up to sources containing thousands of curies of radioactivity, whose use in a dirty bomb could require the evacuation of tens or hundreds of city blocks. All but the largest radioactive sources have traditionally had very little security. Hence, the material for at least a modest dirty bomb would not be difficult to get – and making at least a crude means of dispersing the material would be a far less difficult task than making a nuclear bomb.

In short, the probability of a dirty bomb attack is much higher than the probability of a nuclear attack, but the consequences would be much lower. A dirty bomb attack would be likely to create an annoying and expensive mess, and profound public fear – but it would not take the lives of thousands of innocent people.

To reduce the threat of a dirty bomb attack, actions should be taken to:³

- Find and secure lost and “orphan” radioactive sources, and develop secure means for their disposal;
- Impose strengthened controls on radiological sources and other radioactive materials around the world (including shifting where practicable to non-radioactive means – such as accelerators – for accomplishing similar objectives);
- Improve the U.S. and international ability to detect and stop radioactive materials before they are delivered;
- Educate the public on the likely health effects of a dirty bomb attack, and the actions they can take to protect themselves (including preparation of a public communication plan to provide accurate and timely information in the event of such an attack, to minimize resulting panic); and
- Develop and deploy improved capabilities to decontaminate urban areas should such an attack occur.

¹ Josh Meyer, “Al Qaeda Feared to Have ‘Dirty Bombs,’” *Los Angeles Times*, February 8, 2003, and Frank Gardner, “Al-Qaeda ‘Was Making Dirty Bomb,’” *BBC News*, January 31, 2003.

² In some scenarios, a particularly potent dirty bomb might cause low radiation doses to a large enough number of people that one would expect that several hundred to several thousand cancer deaths would result over the following 20-30 years – but these would be a tiny fraction of the cancer deaths that would be expected to occur naturally among the exposed population, and it would therefore be very difficult to detect any increased cancer rate resulting from the dirty bomb. For a discussion of the potential effects of a dirty bomb attack in several specific scenarios, see Henry Kelly and Michael Levi, “Weapons of Mass Disruption,” *Scientific American*, November 2002 (available at <http://www.fas.org/ssp/docs/021000-sciam.pdf> as of February 24, 2003).

³ See Charles D. Ferguson, Tahseen Kazi, and Judith Perera, *Commercial Radioactive Sources: Surveying the Security Risks* (Monterey, Cal.: Center for Nonproliferation Studies, Monterey Institute of International Studies, January 2003; available at <http://cns.miis.edu/pubs/opapers/op11/index.htm> as of February 24, 2003), and Kelly and Levi, “Weapons of Mass Disruption,” op. cit. See also the annotated web-based resources on dirty bombs at “Nuclear Terrorism,” Project on Managing the Atom, Harvard University (available at <http://ksg-notes1.harvard.edu/BCSIA/MTA.nsf/www/N-Terror> as of February 24, 2003).

Beyond the unprecedented human tragedy and terror of such an event, the sheer economic cost would be staggering. The New York City Comptroller has estimated that the direct cost of the September 11 attacks to the city of New York alone was approximately \$93 billion – measured only by the income those killed would have received in the remainder of their lives, the value of the property destroyed, and the first three years of the reduction in economic output resulting from the destruction in the city.²³

The Comptroller estimated that the workers killed in those attacks had an average of 25 years remaining before retirement, and that the average salary of workers in Manhattan is \$70,000 per year. Applying these figures to our estimate of lives lost in a nuclear blast at Grand Central Station results in a total lost future income of \$875 billion.²⁴

The cost of treating the wounded, and the lost income resulting from their injuries, is difficult to estimate, but is surely also in the hundreds of billions of dollars. The Comptroller estimated the cost to replace or repair the buildings, property, and infrastructure damaged or destroyed in the September 11 attacks at value of the buildings and infrastructure at \$21.8 billion. Obviously the World Trade Center towers were uniquely valuable real estate, so one cannot simply extrapolate to the much larger area that would be destroyed in a nuclear blast. Nonetheless, it appears very likely that the value of destroyed property and infrastructure in the immediate area of the blast would be well over \$100 billion.²⁵

Lost economic output would be a critical factor. The Comptroller estimated that the weekly output

of lower Manhattan was \$2.1 billion per week, while that of the rest of New York combined was \$6.3 billion per week. In the wake of a blast such as that envisioned here, a large portion of lower Manhattan would be permanently destroyed, and the whole of lower Manhattan would certainly be evacuated for some period. If we assume, conservatively, that the output of lower Manhattan would be reduced to zero for two weeks and permanently reduced by one-third, and that the remainder of the city's output was only reduced by 5% over the next several years, the lost economic output over 3.3 years after the attack (the period covered in the Comptroller's report) would be \$180 billion. This is surely a conservative estimate, since the Comptroller estimated the lost output from the far smaller September 11 attacks at \$52–\$64 billion. To these figures must be added the immense cost of cleaning up the contamination from the radioactive fallout, which would certainly run into tens or hundreds of billions of dollars. In short, it seems certain that the direct costs of a nuclear attack such as this would be well over \$1 trillion.²⁶

As was the case for the September 11 attacks, the indirect costs – from loss of value in the stock market, to preparations for war that might result, to all the myriad changes in American life that would follow such a catastrophe – would inevitably be several times the direct costs, amounting to several trillion dollars. One can easily imagine the panic and horrifying economic chaos that would result if the terrorists, after setting off such a bomb, claimed to have another that would soon go off in another major U.S. city: with the cities emptying out, the U.S. economy would effectively grind to a halt, and

²² See, for example, Joseph A. Barbera, Anthony G. Macintyre, and Craig A. DeAtley, *Ambulances to Nowhere: America's Critical Shortfall in Medical Preparedness for Catastrophic Terrorism* (Cambridge, Mass.: Executive Session on Domestic Preparedness, Harvard University, October 2001).

²³ William C. Thompson, Jr., Comptroller, City of New York, *One Year Later: The Fiscal Impact of 9/11 on New York City*, September 4, 2002 (available at <http://www.comptroller.nyc.gov/bureaus/bud/reports/impact-9-11-year-later.pdf> as of January 20, 2003).

²⁴ Here, we follow the Comptroller's approach in not discounting these future incomes to the present, because these people's salaries would likely have increased over time at a rate comparable to a reasonable discount rate.

²⁵ That figure is only five times higher, for an area of destruction many times as large as that of September 11.

²⁶ The lives lost represent a much higher fraction of this estimated cost than was the case for the Comptroller's estimate of September 11 costs, for the simple reason that on September 11, most of the people inside the buildings that were destroyed survived, whereas in the case of nuclear bomb, very few would have time to flee, so that the number of people killed per unit of property destroyed would be much higher.

the problems of supporting millions of panicked people outside the cities would be immense.

Such a catastrophe would transform America and its way of life forever – and not for the better. The

history of the world would be indelibly changed. The chance of such a disaster may not be high – but it is high enough to justify doing everything in our power to reduce it. For the safety of ourselves and our children, we cannot afford to wait.

3. Blocking the Terrorist Pathway to the Bomb

Maximizing the chance of preventing a terrorist attack with a nuclear weapon requires systematically thinking through each step terrorists would have to take on the pathway to a nuclear attack, and putting in place a multi-layered defense focused on blocking them every step of the way.¹

The most critical choke-point on that pathway, where actions that can be taken now can do the most to reduce the risk, is in preventing nuclear weapons and materials from being stolen in the first place. As former Senator Sam Nunn has said:²

The most effective, least expensive way to prevent nuclear terrorism is to secure nuclear weapons and materials at the source. Acquiring weapons and materials is the hardest step for the terrorists to take, and the easiest step for us to stop. By contrast, every subsequent step in the process is easier for the terrorists to take, and harder for us to stop... That is why homeland security and the defense against catastrophic terrorism must begin with securing weapons and fissile materials in every country and every facility that has them.

Yes, this is an awesome challenge, but it is finite and doable.

Figure 3.1 outlines the key steps on the terrorist pathway to attack with a nuclear weapon, and highlights the elements of the war on terrorism, homeland security, and threat reduction that are intended to block each of these steps on the path.³ Some scenarios would sidestep one or more of the steps on this pathway; as the figure shows, for example, if a state were willing to provide a nuclear weapon or weapons material to the terrorist group, this would get the terrorists past several of the key obstacles they would otherwise face. (For a discussion of why that scenario is unlikely, see “Will States Give Terrorists the Bomb?” p. 22.)

Similarly, if terrorists stole nuclear material within the target country and assembled it there, this would sidestep several of the steps in the pathway.⁴ Nevertheless, the set of steps outlined below is representative of the key obstacles a terrorist group would have to overcome to acquire and set off a nuclear weapon, and the key opportunities for stopping them from reaching that objective.

¹ This approach of laying out a step-by-step pathway and means to interrupt each step was inspired by a similar still-classified U.S. government analysis of steps to interdict the entire supply chain for illegal narcotics entering the United States. For a somewhat similar step-by-step approach focused more generally on blocking a “sustained campaign” of lethal terrorism against U.S. interests, see Phillip Heymann, “Dealing With Terrorism: An Overview,” *International Security* (Winter 2001/2002). For a related list of steps to block terrorist acquisition of nuclear weapons, see David Albright, “Al Qaeda’s Nuclear Program: Through the Window of Seized Documents,” Special Forum 47 (Berkeley, Cal.: Nautilus Institute, November 6, 2002; available at http://www.nautilus.org/fora/Special-Policy-Forum/47_Albright.html as of January 27, 2003).

² Sam Nunn, remarks to the Carnegie Endowment for International Peace 2002 Non-Proliferation Conference, November 14, 2002 (available at http://www.nti.org/c_press/speech_samnunn_1114.pdf as of January 7, 2003).

³ This figure does not include the possibility of terrorists producing their own plutonium or highly enriched uranium (HEU); as discussed earlier, that is well beyond the plausible capabilities of terrorist groups.

⁴ As noted earlier, this is not implausible: Department of Energy (DOE) security regulations require facilities to be defended against the possibility of terrorists putting together a crude nuclear bomb – described as an “improvised nuclear device” – while they were still in a nuclear facility they had broken into. See U.S. Department of Energy, Office of Security Affairs, Office of Safeguards and Security, *Manual for Protection and Control of Safeguards and Security Interests, Chapter I, Protection and Control Planning* (Washington, D.C.: DOE, July 15, 1994; available at http://www.fas.org/irp/doddir/doe/m5632_1c-1/m5632_1c-1_c1.htm as of January 20, 2003).

Step 1: Form a Highly Capable Group With Extreme Objectives

Most terrorist groups simply would not have the capability to take all the steps required to get and use a nuclear bomb. This is not a type of attack that Timothy McVeigh and his co-conspirators could plausibly have accomplished. An operation

on this scale would require a sophisticated group capable of an operation requiring substantial planning, sustained preparation over a long period of time, absolute secrecy among the participants, and significant technical know-how (recruited or bought).

The most authoritative unclassified discussion of the possibility that terrorists might make a nuclear



Figure 3.1

WILL STATES GIVE TERRORISTS THE BOMB?

A conscious decision by a nation-state to provide nuclear weapon capabilities to a terrorist group would enable the terrorists to bypass instantly the most difficult steps on their pathway to nuclear-weapon use. In essence, all the terrorists would have to do is get the bomb to the target country and set it off.

Fortunately, however, the probability that a hostile state such as Iraq would intentionally provide a nuclear weapon or the materials to make one to a terrorist group – one often-cited rationale for a near-term U.S.-led attack on Iraq – appears to be small.¹ The Defense Department's own most recent comprehensive assessment of the proliferation threat concludes "the likelihood of a state sponsor providing such a weapon to a terrorist group is believed to be low."² There are several arguments supporting this conclusion.

First, a terrorist nuclear attack on the United States or one of its major allies and friends could be expected to provoke an overwhelming, devastating response. A state might hope that its transfer of such capability to a terrorist group would not be detected – but it would be impossible to be sure it would not be, and the prospect of a retaliation that would destroy every remnant of the leadership of the state that provided the weapon would be very real. As the CIA has concluded, Iraq in particular is unlikely to attempt a WMD attack on the United States, or help a terrorist group with one – *unless* Saddam Hussein concludes that the United States is bent on destroying his regime, in which case "Saddam might decide that the extreme step of assisting Islamist terrorists in conducting a W.M.D. attack against the United States would be his last chance to exact vengeance by taking a large number of victims with him."³

Second, states hostile enough to even consider such an action are generally dictatorships – ruled by men, like Saddam Hussein and Kim Jong Il, with an obsessive desire for control. Putting the most fearsome power they had ever acquired – power that might be turned against them, or used in a way that would lead to unpredictable retaliation against them – in the hands of a terrorist group they could not absolutely control would be contrary to the very nature of such leaders.

Third, nuclear weapons are extremely difficult for such states to acquire, and are regarded as the ultimate deterrent and therefore the ultimate guarantor of regime survival. Leaders with only a few such bombs are likely to believe that the numbers matter. They will be reluctant to draw down their stock of this currency for regime survival in order to share it with others. (This argument is much less strong for chemical and biological weapons, for there, if a state can make enough for its own use, it is straightforward to make more to transfer to others.)

In Iraq's case, it is clear that Saddam Hussein does not have a nuclear weapon or nuclear material to give (in contrast to chemical or biological weapons). U.S. and British intelligence agencies agree with the international inspectors, moreover, that unless the kinds of measures discussed in this report fail, and Iraq is able to get a stolen nuclear weapon or nuclear materials from abroad, it will be years before Iraq can get a nuclear weapon.⁴ Saddam Hussein has spent billions of dollars in his effort to build a nuclear bomb, and has endured a decade of international sanctions to protect his nuclear, chemical, and biological programs. It is extraordinarily difficult to believe that if he finally got a nuclear bomb or the materials to make one, he would hand these hard-won

bomb concludes that the team to design and make the bomb would have to include at least three to four individuals, possibly more, with expertise ranging from physics to explosives to the metal-

lurgical properties of the plutonium or uranium to be used – not the typical expertise of most members of a terrorist group.⁵ A substantial amount of money would be needed, to purchase a nuclear

⁵ See J. Carson Mark et al., "Can Terrorists Build Nuclear Weapons?" in Paul Leventhal, and Yonah Alexander, *Preventing Nuclear Terrorism* (Lexington, Mass.: Lexington Books, 1987; available at <http://www.nci.org/k-m/makeab.htm> as of January 21, 2003).

items over to a terrorist group whose actions he could not absolutely control.

Although the Bush administration has argued that there is at least tacit cooperation between Iraq and al Qaeda,⁵ al Qaeda would seem to be a highly unlikely group for Saddam to choose to give the potentially regime-destroying power of a nuclear weapon. A central avowed purpose of al Qaeda is to destroy the secular regimes of the Arab world and replace them with fundamentalist Islamic governments, and Saddam Hussein is the leader of just such a secular regime. The putative bin Laden tape of February 2003 makes just this point, referring to the Iraqi regime as “infidels.”⁶ Indeed, when Iraq invaded Kuwait in 1990, bin Laden offered to use his mujahedeen to fight the Iraqi forces – an incident Saddam Hussein would surely remember.⁷

Unlike Iraq, North Korea is close to succeeding in producing enough nuclear material to build a nuclear deterrent of its own and have enough left over to sell; has a record of marketing its arms to anyone who will buy; and, far from the Islamic world, would presumably have little concern over the threat a nuclear-armed al Qaeda might pose to North Korea itself. Iran, of the three states the Bush administration has dubbed an “axis of evil,” has the closest ties to terrorism (as a major sponsor of Hezbollah, the world’s largest terrorist organization), but like Iraq, Iran does not yet have a nuclear weapon to give, and there is no evidence that Iran has considered providing WMD to terrorists.

In short, this threat appears to be a very limited one. While the world focuses on forcing Iraq to disarm – in significant part to ensure that its weapons of mass destruction never fall into terrorist hands – it is crucial to focus a comparable global effort on blocking the many more likely routes by which ter-

rorists might acquire such weapons.

¹ For a useful discussion, see, Richard A. Falkenrath, Robert Newman, and Bradley Thayer, *America’s Achilles’ Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack* (Cambridge, Mass.: MIT Press, 1998).

² U.S. Department of Defense (DOD), *Proliferation: Threat and Response* (Washington, D.C.: DOD, January 2001; available at <http://www.defenselink.mil/pubs/ptr20010110.pdf> as of September 19, 2002), p. 61.

³ Director of Central Intelligence George Tenet, letter to Senator Bob Graham, October 7, 2002 (available at <http://www.globalsecurity.org/wmd/library/news/iraq/2002/iraq-021007-cia01.htm> as of February 4, 2003). Tenet wrote, “Baghdad for now appears to be drawing a line short of conducting terrorist attacks with conventional or C.B.W. [chemical and biological weapons] against the United States. Should Saddam conclude that a U.S.-led attack could no longer be deterred, he probably would become much less constrained.”

⁴ For overviews, see Gary Samore, ed., *Iraq’s Weapons of Mass Destruction: A Net Assessment* (London: International Institute for Strategic Studies, September 2002); U.S. Central Intelligence Agency, *Iraq’s Weapons of Mass Destruction* (Langley, Virginia: CIA, October 2002; available at http://www.cia.gov/cia/publications/iraq_wmd/Iraq_Oct_2002.pdf as of January 29, 2003).

⁵ Secretary of State Colin Powell, “Remarks to the United Nations Security Council” (Washington, D.C.: State Department, press release, February 5, 2003; available at <http://www.state.gov/secretary/rm/2003/17300.htm> as of February 10, 2003).

⁶ See the transcript in “Osama bin Laden Urges Attacks on the U.S.,” *Washington Post*, February 12, 2003 (available at <http://www.washingtonpost.com/wp-dyn/articles/A58869-2003Feb11.html> as of February 24, 2003).

⁷ See, for example, the description offered by former chief of Saudi intelligence Prince Turki Al-Faisal in “Prince Turki: Bin Laden Had No Links With the CIA,” *arabia.com*, November 8, 2001 (available at <http://www.arabia.com/news/article/english/0,11827,86558,00.html> as of February 24, 2003).

weapon or materials to make one from people who had stolen it (or to arrange for the theft to take place), to provide the equipment needed to fabricate a bomb (if the group were making one from nuclear material), and to pay the various individuals involved while the operation was underway. Some form of safe haven, a base where the group could plan, work on its design, make bomb parts

and confirm that they worked, and the like would be extremely useful (see discussion below).

Thus, the first step toward a terrorist attack with a nuclear weapon is the formation of a sophisticated, capable, and well-financed terrorist group – and one with the kinds of extreme objectives that would make it a candidate for

deciding to pursue a nuclear attack (see discussion below).

Unfortunately, al Qaeda has already taken this step. They have demonstrated, with the September 11 attacks and others, a substantial degree of sophistication, a considerable capacity to collect intelligence on opponents' weak points, an ability to plan and train for attacks for well over a year beforehand, an ability to maintain secrecy and strike without warning, and an impressive knowledge of explosives (as was needed, for example, to blow a huge hole in the side of the heavily armored USS *Cole*). Today, however, there is no evidence that al Qaeda has the technical knowledge of nuclear matters that would be needed to make a nuclear bomb – though we cannot know for sure that they do not.

A wide range of U.S. actions can address this fundamental first step in the chain. As Figure 3.1 shows, these steps are mainly in the domain of the war on terrorism. First, to prevent other groups from following al Qaeda on this path, there is much to be done to address the root causes of terrorism – the regional, political, religious, and ethnic conflicts that breed the necessary hatred, the poverty, and the humiliation that foster desperation and violence. A just resolution of the Israeli-Palestinian conflict, coupled with equitable economic and political development in the Arab world, would probably do as much to reduce the risk of catastrophic terrorism in the United States as any other events that could occur.

As Phillip Heymann has noted, actions to reduce the degree of hatred for the United States probably cannot succeed in preventing terrorist groups from recruiting enough people to pose a serious danger

to U.S. interests – but may be essential to allow key states to crack down on terrorists within their borders without provoking regime-threatening domestic opposition.⁶

Similarly, there is much to be done to continue to build global support for the norm against terrorism, to make terrorist action a less and less acceptable means for achieving political or other ends.

Second, intelligence and other counterterrorism efforts can and should focus on identifying, monitoring, disrupting, and destroying the small subset of terrorist groups with the sophistication, finances, and extreme objectives that could lead to truly catastrophic attacks – including nuclear attacks. The U.S. response since the September 11 attacks has surely done a great deal to make it more difficult for al Qaeda to carry out an operation with all the requirements involved in getting and using a nuclear bomb – and therefore has significantly reduced the risk. That risk has by no means been eliminated however: most of the top leadership of al Qaeda and many of its key operatives remain at large;⁷ progress in disrupting the group's financing has been quite modest;⁸ the repeated attacks in the latter half of 2002 demonstrate that al Qaeda and its loose collection of affiliates continue to plan and conduct attacks in countries around the world; and repeated intelligence testimony reinforces the conclusion that these organizations probably still retain both the potential and the desire to carry out large-scale, catastrophic attacks on the United States and U.S. allies and interests in the future.⁹

Third, by word and deed, the United States and its partners should continue to attempt to deter other states from sponsoring and offering havens for ter-

⁶ Heymann, "Dealing With Terrorism: An Overview," op. cit.

⁷ Faye Bowers, "Al Qaeda network frayed," *Christian Science Monitor*, September 6, 2002 (available at <http://www.csmonitor.com/2002/0906/p01s04-uspo.html> as of January 20, 2003). Despite the article's headline, it states, "Still, intelligence officials inside and outside government say the war on terror remains in its infancy. For starters, Mr. bin Laden may still be out there, along with his No. 2, Ayman al-Zawahiri, and the remaining two-thirds of his leadership."

⁸ See Bowers, "Al Qaeda network frayed," op. cit. Also, Maurice Greenberg, Chair, *Terrorist Financing: Report of an Independent Task Force Sponsored by the Council of Foreign Relations* (New York: Council of Foreign Relations, 2002; available at http://www.cfr.org/pdf/Terrorist_Financing_TF.pdf as of January 20, 2003).

⁹ "Al Qaeda Still a Major Threat, Tenet Says," *Washington Post*, December 13, 2002.

rorist groups, particularly those with the substantial capabilities and extreme objectives that could contribute to truly catastrophic attacks. President Bush's immediate statement that those states that were not with us in the war on terrorism were against us, combined with the quick destruction of the Taliban regime in Afghanistan, surely sent a powerful message to other states around the world, increasing their incentive to cooperate with the United States in fighting terrorism, and possibly deterring some from sponsoring or providing havens for groups that might launch large attacks against U.S. interests.

Step 2: Decide to Escalate to the Nuclear Level of Violence

Most terrorist groups would have no interest in escalating to the ultimate violence of detonating a nuclear weapon in a major city. They are focused on specific political objectives – such as independence for Northern Ireland or the Basque area of Spain – whose achievement would only be undermined by escalating from car bombs in marketplaces to a nuclear attack.¹⁰ Their specialty, in short, is retail violence, not wholesale violence. As terrorism expert Brian Jenkins famously remarked decades ago, “Terrorists want a lot of people watching, not a lot of people dead.”

Only groups motivated by a brand of religious extremism they see as calling for mass destruction of non-believers, or groups with objectives on a

global scale, are likely to be strong candidates for escalating to the nuclear level of violence. Here, too, unfortunately, al Qaeda is different from most terrorist groups. The leaders of al Qaeda have made their desire to inflict mass destruction on Americans and their allies very clear, by both words and deeds. This desire is driven by extreme global, religiously based objectives, specified in some detail in their public statements – specifically, ejecting the United States and other infidels from the Middle East, replacing the secular regimes of the Arab world with fundamentalist Islamic regimes, and destroying Israel.¹¹ Similarly, Aum Shinrikyo, the Japanese terror cult that launched a nerve gas attack in the Tokyo subways and sought nuclear weapons, was focused on a religious nihilist vision of bringing on a cleansing Armageddon by launching catastrophic attacks.¹²

Once a highly capable group of this scale has formed, and adopted the kinds of extreme objectives that might justify nuclear violence, there may be little the United States can do to influence the internal decision-making of the group on whether or not to pursue a nuclear weapon option – though even in the case of large and extreme terrorist groups, deterrence can work some of the time, and should remain one element of the counterterrorism toolkit.¹³ But the United States and its partners can and should focus an intense intelligence collection and analysis effort on identifying and learning as much as possible about groups with the kinds of objectives that make them plausible candidates for escalating to

¹⁰ For discussions, see, for example, Jessica Stern, *The Ultimate Terrorists* (Cambridge, Mass.: Harvard University Press, March 1999); Richard A. Falkenrath, Robert Newman, and Bradley Thayer, *America's Achilles' Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack* (Cambridge, Mass.: MIT Press, 1998); Bruce Hoffman, “Terrorism and WMD: Some Preliminary Hypotheses,” *Nonproliferation Review* 4, no. 3 (Spring-Summer 1997; available at <http://cns.miis.edu/pubs/npr/vol04/43/hoffma43.pdf> as of January 20, 2003); Gavin Cameron, *Nuclear Terrorism: A Threat Assessment for the 21st Century* (Basingstroke: McMillan Press, 1999); and Brian M. Jenkins, “Will Terrorists Go Nuclear? A Reappraisal,” in Harvey W. Kushner (ed.), *The Future of Terrorism: Violence in the New Millennium* (London: Sage, 1998), pp. 225–49. For a view highly skeptical of the threat, see Ehud Sprinzak, “The Great Superterrorism Scare,” *Foreign Policy* (Fall 1998; available at <http://radiobergen.org/terrorism/super-1.html> as of January 20, 2003).

¹¹ Peter Bergen, *Holy War, Inc.* (New York: Free Press, 2001).

¹² David Kaplan and Andrew Marshall, *The Cult at the End of the World* (New York: Crown Publishers, 1996); also Gavin Cameron, “Multi-track Microproliferation: Lessons from Aum Shinrikyo and Al Qaida,” *Studies in Conflict and Terrorism* 22, no. 4 (October-December 1999).

¹³ Paul K. Davis and Brian Michael Jenkins, *Deterrence and Influence in Counterterrorism: A Component in the War on Terrorism* (Santa Monica, Cal.: RAND, 2002; available at <http://www.rand.org/publications/MR/MR1619/MR1619.pdf> as of January 20, 2003).

weapons of mass destruction – followed by an intense effort to disrupt and destroy them, wherever they may be. Efforts to infiltrate such groups or to recruit agents from them, if successful, would be particularly valuable in providing information on their goals and activities related to weapons of mass destruction. Here, too, as shown in Figure 3.1, the key efforts to disrupt the terrorist pathway to the bomb are elements of the war on terrorism.

Step 3: Steal Nuclear Weapon or Weapons Material

Unless a state consciously transfers a nuclear weapon or the material to make one to a terrorist group (see “Will States Give Terrorists the Bomb?” p. 22), the next essential step is for a nuclear weapon or nuclear material somewhere to be stolen. One option would be for the terrorists to carry out the theft themselves – either by attacking a facility that had what they wanted, or by attempting to infiltrate the staff of such a facility so as to carry out an insider theft. (Terrorists might also bribe or coerce existing staff at such a facility into carrying out an insider theft, or providing insider help to an outsider attack; kidnapping a family member of a key guard or staffer, for example, and threatening to harm them if their demands were not met, would be one obvious possibility.) Such an incident is by no means inconceivable: the commander of the force that guards Russia’s nuclear weapons, for example, has said publicly that terrorist groups carried out reconnaissance at Russian nuclear warhead storage sites – sites whose very locations are state secrets, but apparently were known to the terrorists – twice during 2001.¹⁴ Russia’s official government newspaper reported that the 40 heavily armed terrorists who seized a Moscow theater in October 2002 – a force that many nuclear facilities would not be able to fight off – had first considered seizing a reactor at the Kurchatov Institute in Moscow, a site with enough highly enriched uranium (HEU) for dozens of nuclear bombs.¹⁵

None of the known cases of nuclear theft to date, however, involve direct theft of nuclear materials by or for a terrorist group or the agents of a hostile state. Instead, they involve opportunistic thieves, who stole nuclear material with the idea of being able to sell it later. To date, this threat has been entirely a matter of insiders walking off with material to which they have authorized access.

This is the step in the pathway that can most directly and reliably be stopped. If effective security and accounting arrangements, capable enough to defeat all the threats a facility is likely to face, are put in place for every nuclear weapon and every kilogram of weapons-usable nuclear material throughout the world, the threat of nuclear weapons terrorism can be dramatically reduced. Accomplishing that task at the hundreds of buildings around the world where these weapons or materials exist is a big job, and will be a complex job, given the need to forge highly sensitive security partnerships with each of the countries where this material exists. But it is a doable job. By contrast, once the material has been stolen, the number of places where it could be jumps from hundreds to millions: unless some participant in the conspiracy provides critical intelligence on where to look – or unless the relevant government gets lucky – finding and recovering stolen nuclear material poses an almost insuperable challenge.

This, then, is the reason for the enormous importance of threat reduction programs targeted on improving security for nuclear warheads and materials; removing materials from the most vulnerable sites; stabilizing the employment of personnel with access to nuclear weapons, materials, and expertise, and reducing the overall size of nuclear complexes, so that fewer places have to be guarded; monitoring nuclear stockpiles; ending further production of these stockpiles; and, finally, reducing the massive nuclear stockpiles built up over four decades of Cold War, so that they do not have to be guarded forever. As Figure 3.1 shows, the key efforts that can help disrupt this critical step in the pathway are essentially all in the domain of cooperative threat reduction.

¹⁴ Pavel Koryashkin, “Russian Nuclear Ammunition Depots Well Protected – Official,” *ITAR-TASS*, October 25, 2001; “Russia: Terror Groups Scoped Nuke Site,” *Associated Press*, October 26, 2001.

¹⁵ Vladimir Bogdanov, “Propusk K Beogolovkam Nashli U Terrorista (A Pass To Warheads Found on a Terrorist),” *Rossiiskaya Gazeta*, November 1, 2002.

Step 4: Acquire Stolen Nuclear Weapon or Weapons Material

The next crucial step is for the terrorists to acquire the stolen nuclear weapons or material from those who stole it. (This step could be skipped if the theft were carried out directly by, or on behalf of, the terrorist group, in which case the group would presumably take possession of the stolen items immediately.) In the known cases of theft of nuclear material, this step has proved to be a difficult one. Nuclear thieves and those who might like to buy from them have had difficulty finding each other. Both parties face the risks of being turned in by co-conspirators, ripped off by con artists or unscrupulous middle-men, or trapped in government sting operations. In the known cases, stolen nuclear material has generally been seized when one of the co-conspirators, or some one they tried to sell the material to, informed on the thieves or the smugglers – or when the theft was provoked by a government sting in the first place. Al Qaeda appears to have been scammed in its attempt to buy HEU in Sudan in 1993, and there are reports that it has lost money in other nuclear scams as well.¹⁶ Similarly, Iraqi nuclear defector Khidir Hamza has reported that Iraq attempted to get stolen nuclear material, but was repeatedly confronted with sellers attempting to pass off junk material, and was concerned over the risk of getting caught in a sting operation.¹⁷

There is a good deal that governments can do to make this step even more difficult and risky for terrorists and thieves to accomplish. Sting operations (undercover agents posing as thieves, posing as buyers, and posing as middle-men), a wide range of

techniques to encourage conspirators to turn each other in, and increases in the legal penalties for anyone convicted of being involved in such operations are all worth pursuing.¹⁸ Most of the possible actions to intercept this step fall into the domain of intelligence and law enforcement – including international cooperation and sharing of key information. Threat reduction programs in our “interdicting nuclear smuggling” category can help by training and equipping foreign law enforcement and intelligence agencies to help deal with nuclear theft and smuggling cases. Programs in our “stabilizing employment for nuclear personnel” category can help reduce the pool of knowledgeable experts who may be willing to participate in such a conspiracy, forcing thieves, middle-men, and buyers to draw from a smaller and potentially less reliable pool for expertise that may be useful to smooth the transaction.¹⁹

Step 5: Smuggle Nuclear Weapon or Weapons Material to Safe Haven

Next, in most cases the stolen nuclear weapon or weapons material would have to be smuggled from the country where it was stolen to a terrorist safe haven where the stolen items would be prepared for use. This involves crossing international borders, creating at least a chance for effective border and customs controls to detect and stop the shipment.

Unfortunately, a range of factors conspires to make stopping nuclear weapons or materials at international borders an extraordinarily difficult challenge, including:

- The enormous length – thousands of kilometers – of the main borders nuclear material might cross;

¹⁶ David Albright, “Al Qaeda’s Nuclear Program,” op. cit.

¹⁷ Khidir Hamza, interview by *Frontline*, in “Gunning for Saddam,” *Public Broadcasting System: Frontline* (November 2001; transcript available at <http://www.pbs.org/wgbh/pages/frontline/shows/gunning/interviews/hamza.html> as of January 29, 2003).

¹⁸ See Philip Williams and Paul N. Woessner, “Nuclear Smuggling: Adaptability, Organized Crime, and Undercover Operations,” in *Measures to Prevent, Intercept, and Respond to Illicit Uses of Nuclear Material and Radioactive Sources: Proceedings of an International Conference Held in Stockholm, Sweden, May 7–11, 2001* (Vienna, Austria: International Atomic Energy Agency, 2002); and Rensselaer Lee, *Nuclear Smuggling and International Terrorism: Issues and Options for U.S. Policy*, CRS Report for Congress RL31539 (Washington, D.C.: Congressional Research Service, August 17, 2002).

¹⁹ Nuclear experts, for example, could be used by buyers or middle-men to confirm that the material being offered really was plutonium or HEU, or to determine how it should be packaged and transported.

- The enormous scale of legitimate border crossings, amounting to millions of people and vehicles crossing the relevant borders every year;
- The huge scale of ongoing smuggling of other items, from arms to drugs to cigarettes, which governments have been unable to stop;
- The possibility of observing which border crossings are effectively monitored, and bypassing them;²⁰
- The weaknesses of many of the relevant customs and border control forces, from limited manpower to low pay to endemic corruption;
- The small amount of material needed for a bomb – an amount roughly the size of a soda can; and
- The low levels of radiation the nuclear materials used for nuclear weapons emit, which makes it very difficult to detect them unless you know exactly where to look.

Despite these daunting challenges, it is important to make at least some investment in providing additional lines of defense should nuclear weapons or materials be stolen despite efforts to secure them. This is particularly important as there is no way of knowing how much nuclear material may already have been stolen without detection. This is where the range of threat reduction programs under our “interdicting nuclear smuggling” heading come into play, training and equipping law enforcement, customs, and border control forces in relevant countries to interdict nuclear smugglers. Expanded international law enforcement and intelligence cooperation focused on blocking nuclear smuggling – including, again, intelligence operations such as stings, to help deter the smugglers by increasing the fear of being caught – are urgently needed. Because of the massive scale of the challenges, it is crucial, in pursuing these efforts, to identify the highest priority tasks (such as the border points most heavily trafficked by smugglers) and focus on those, rather than wasting resources attempting to do everything.

Step 6: Construct Weapon or Sidestep Weapon’s Safeguards

Having gotten a stolen nuclear weapon or nuclear material to their safe haven, the terrorist group would then have to attempt to prepare these items for use.

In the case of a stolen nuclear weapon, the weapon might well be equipped with some form of electronic lock (known in the United States as a permissive action link, or PAL) or other safeguards designed to prevent its use without authorization. Some older Russian weapons may still exist that are not equipped with such built-in safeguards, and some weapons from other countries may also lack these features. Older generations of such electronic locks can in principle be bypassed, effectively “hot-wiring” the weapon – but figuring out how to do that would be a significant challenge for a terrorist group attempting to do it without help. More modern generations of such systems (on both U.S. and Russian weapons) are designed to permanently disable the weapon if there is an attempt to overcome the safeguard, posing an even more difficult hurdle, though no system is unbeatable. In some cases, a terrorist group might conclude that it would be easier to open the weapon, remove its nuclear material, and make a new bomb from that material (though an efficient modern weapon from the U.S. or Russian arsenal may use so little nuclear material that it would be difficult for terrorists to make a new bomb from it, if they had only the material from one weapon).

In the case of nuclear material, the terrorist group would have to figure out how to make it into a bomb. As discussed earlier in this report, a gun-type bomb would be much the easiest type of nuclear bomb for terrorists to construct, but such a weapon can only be made from HEU, and requires more of it (some 50 kilograms) than would be needed to make a more efficient implosion bomb. An implosion bomb, however, would be a significant technical challenge for a terrorist group – although the possibility that a

²⁰ If military personnel were involved in the conspiracy, particularly troubling bypass opportunities would become available, with the potential to transport the weapon or material from one country to another on a military aircraft, flying into military airfields where the aircraft’s cargo may not be thoroughly checked if it is accompanied by uniformed personnel.

group such as al Qaeda might be able to acquire the expertise to meet that challenge cannot be ruled out.

In both cases, having a haven where the work on the bomb can be carried out without interruption would be quite important. While there are scenarios in which a terrorist group might be able to set off at least a modest-scale nuclear explosion with HEU relatively rapidly – in essence, by simply driving two blocks of HEU together at high speed – in most cases a substantial period of intensive, sustained work would be needed. In the case of an implosion bomb (the only type that can be made with plutonium, or with an amount of HEU too small for a gun-type bomb), an ability to test the explosive designs beforehand (using other commodities such as natural uranium as stand-ins for the plutonium or HEU that would eventually be in the core) would likely be very important. Al Qaeda had such a safe haven in Afghanistan; the elimination of that safe haven by the overthrow of the Taliban, and the clear intention to attack any other al Qaeda redoubt that can be identified, wherever it may be, have probably reduced al Qaeda's chances of making a nuclear bomb more than any other step taken since the September 11 attacks. Indeed, David Albright, who may well have studied more seized documents relating to al Qaeda's nuclear efforts than any other analyst, has concluded that al Qaeda "would have likely succeeded" in getting a nuclear bomb if the Afghan sanctuary had been maintained for several more years. Albright warns that while the risk has been reduced by the elimination of the Afghan sanctuary, it has not been eliminated, as al Qaeda is highly determined and may succeed in setting up unnoticed nuclear activities elsewhere.²¹

In both cases, having help from someone with experience in nuclear weapons design and manufacture (in the case of a stolen weapon, ideally some one familiar with the design of that weapon and its safeguards), would increase the chances of success substantially. Al Qaeda is clearly interested in recruiting such experts. In the case of chemical weapons, for example, a 1999 al Qaeda progress report on nerve gas found in Afghanistan concludes that the effort to make such weapons without specialists had "resulted in a waste of effort and money," and recommended recruiting experts as the "fastest, cheapest, and safest" way to build the capability to make such weapons.²² In the case of nuclear weapons, Osama bin Laden and his deputy Ayman al-Zawahiri met at length with two senior Pakistani nuclear weapons experts, Sultan Bashiruddin Mahmood and Chaudari Abdul Majeed – both Taliban sympathizers with extreme Islamic views – and pressed them for information on making nuclear weapons. While Mahmood and Majeed deny having supplied any useful information, Pakistani intelligence officials told the *Washington Post* that the two had provided detailed technical information, in violation of Pakistan's secrecy laws, in response to bin Laden's questions.²³ Similarly, in 2000, an official of Russia's National Security Council announced that the Taliban regime had attempted to recruit a nuclear expert from a Russian facility²⁴ – and in 1998, a scientist at one of Russia's premier nuclear weapons laboratories was arrested for spying for both the Taliban and Iraq (in this case on advanced conventional weapons designs, not nuclear weapons – though the security services announced that this was by no means the first such espionage case at that laboratory).²⁵

²¹ Albright, "Al Qaeda's Nuclear Program," op. cit.

²² Alan Cullison and Andrew Higgins, "Forgotten Computer Reveals Thinking Behind Years of al-Qaeda Doings," *Wall Street Journal*, December 31, 2001, quoted in Albright, "Al Qaeda's Nuclear Program," op. cit.

²³ See Kamran Khan and Molly Moore, "2 Nuclear Experts Briefed Bin Laden, Pakistanis Say," *Washington Post*, December 12, 2001; and Kamran Khan, "Pakistan Releases Nuclear Scientists for Ramadan's End," *Washington Post*, December 16, 2001.

²⁴ *RFE/RL*, Oct. 9, 2000.

²⁵ "Nuclear Center Worker Caught Selling Secrets," *Russian NTV*, Moscow, 16:00 Greenwich Mean Time, December 18, 1998, translated in *BBC Summary of World Broadcasts*, December 21, 1998.

Here is where the threat reduction programs under the category “stabilizing employment for nuclear personnel,” which are designed to keep weapons scientists and engineers employed in useful civilian work and thereby reduce the desperation that could create incentives to sell nuclear knowledge, have their greatest importance. At the same time, the United States and its partner countries should work with countries around the world to ensure that nuclear weapons experts are adequately paid, monitored, and controlled, with effective personnel reliability programs in place. Another important step would be to work with other nuclear states around the world to ensure that classified information related to nuclear weapons is adequately controlled, and to develop common guidelines on what information should stay secret and what information can be released – so that those seeking nuclear weapons cannot piece key information together by combining facts inconsistently declassified by different countries.

Step 7: Smuggle Weapon Into Target Country

Once the terrorist group has figured out how to overcome whatever safeguards there may be on a stolen weapon, or figured out how to make a bomb of its own, the bomb must be smuggled into the target country. This could be done whole, or in pieces, with the idea of assembling the bomb at the target.

If the target country is the United States, the basic structure of the situation – long borders, millions of people and vehicles crossing them, small size and low detectability of the bomb material – again make preventing the smuggling an enormous challenge. U.S. borders remain extremely vulnerable to a wide range of possible smuggling.²⁶

Blocking this step in the terrorist pathway is the province of homeland security measures focused on better controlling U.S. borders (coupled with intelligence efforts that might receive a hint of where to look – a key element throughout this pathway). The U.S. Customs Service and other agencies are attempting to meet this daunting challenge – but as we will describe later, for now, very little ability to detect nuclear material is in place at major entry points into the United States, or at major ports that ship cargo to the United States. Customs is attempting to push the key focus of cargo inspection to those ports, rather than doing it after the cargo arrives as at present, for a shipping container holding a nuclear bomb could simply be set off as soon as it enters a U.S. port, long before it was ever inspected, killing tens of thousands of people, destroying the port, and raising fears of container shipments that would likely lead the container traffic to the United States to be shut down for weeks, causing hundreds of billions of dollars in economic damage. Indeed, the possible means of bringing such a weapon into the United States are virtually unlimited: if a terrorist group was concerned that a bomb in a shipping container might be found, for example, they could put it in the hold of a yacht and sail it right up the Potomac or the Hudson, with no requirement to stop for inspection.

Step 8: Transport Weapon to Target Location

If the terrorist group has a particular target location in mind, beyond simply detonating the weapon as soon as it enters the target country, it will have to be transported to that location. Obvious possibilities would include the middle of Manhattan, as described above, the middle of Washington, D.C., or, for that matter, the center of any other major city.

²⁶ For an authoritative overview, see Gary Hart and Warren Rudman, co-chairs, Stephen J. Flynn, Project Director, *America Still Unprepared – Still in Danger* (Washington, D.C.: Council on Foreign Relations, October 2002; available at http://www.cfr.org/pdf/Homeland_Security_TF.pdf as of February 26, 2003).

²⁷ Recently, for example, a patient in New York who had been treated with radioactive Iodine-131 complained of being repeatedly stopped and strip-searched in the New York subways, because he set off hidden radiation detectors. See Christoph Buettner and Martin I. Surks, Albert Einstein College of Medicine, New York, “Police Detainment of a Patient Following Treatment With Radioactive Iodine: Letters to the Editors,” *Journal of the American Medical Association* 288, no. 21 (December 4, 2002; available at <http://jama.ama-assn.org/issues/v288n21/ffull/jlt1204-3.html> as of January 20, 2003).

Here again, the challenge of stopping such an operation is daunting, given the myriad ways that terrorists might choose to use – and here again, it falls within the purview of homeland security efforts. Nuclear detectors of various types have been quietly installed at some points in some U.S. cities,²⁷ but it is not hard to imagine how these might be bypassed. If terrorists were concerned that major highways leading into their chosen target city might be equipped with some sort of detector, for example, they could either put some lead shielding around their bomb or carry it in by some other means – for example by renting a modest-sized airplane and flying it over the city. The Nuclear Emergency Search Team (NEST), which has been deployed again and again since September 11, has considerable capabilities to search for and attempt to disable a nuclear device – if they have specific information on where to look. But without such information, there would be little hope of finding a weapon.

Step 9: Detonate Weapon

Finally, if they had succeeded on each previous step of the pathway, the terrorists would detonate their

bomb – unleashing a terrifying holocaust of blast, fire, and radiation, as described above. The consequences of such an attack would be horrifying no matter what preparations had been made – but improving plans for evacuation, treatment of the wounded, and decontamination could modestly reduce the consequences.

Looking at this pathway, it is clear that the most effective countermeasures start with the early steps in the chain – and particularly with preventing nuclear weapons and materials from being stolen in the first place. After such a theft, each of the later lines of defense is more desperate and more doubtful of success. Indeed, if defenses against nuclear weapons at the U.S. border or within the United States are ever called into play, this will represent a serious failure of U.S. policy, in failing to intercept the threat earlier in the terrorist pathway to the bomb. Hence, this report focuses on those programs intended to improve controls over nuclear weapons, materials, and expertise – programs which offer the greatest leverage for keeping these items from falling into the hands of terrorists or hostile states.

Part II: Assessing the Current Response



U.S. Department of State

Vulnerable highly enriched uranium being prepared for removal from Yugoslavia.

We commit ourselves to prevent terrorists, or those that harbour them, from acquiring or developing nuclear, chemical, radiological and biological weapons; missiles; and related materials, equipment and technology.

– GROUP OF EIGHT SUMMIT STATEMENT LAUNCHING THE
“GLOBAL PARTNERSHIP AGAINST THE SPREAD OF
WEAPONS AND MATERIALS OF MASS DESTRUCTION,”
KANANASKIS, CANADA, JUNE 2002

4. Input Measures: “Everything in Our Power”?

As we noted above, President Bush pledged in his January 2003 State of the Union address that “we will do everything in our power” to keep terrorists from attacking America with weapons of mass destruction. In this section, we assess whether, today, the U.S. government is in fact doing everything in its power to accomplish that goal. The short answer is no. There is much more that can and should be done to protect America against this threat.

In Washington, the common shorthand for assessing the priority a problem is being given is its budget – how much is the government spending, and is the budget being increased or cut? More broadly, this chapter focuses on the *inputs* to controlling nuclear weapons and materials – leadership, organization, information, and budgets. The next chapter will assess measures of the *outputs* – how much has actually been accomplished, and how much remains to be done. In the area of controlling nuclear warheads and materials, while there are certainly areas where more money could lead to more progress, we argue that the most critically needed input is sustained political leadership, and we begin there.

Leadership

Ensuring that nuclear weapons and materials around the world are effectively secured and accounted for requires forging partnerships with countries around the globe, on subjects every country regards as extraordinarily sensitive. At the same time, to make rapid progress, a huge number of impediments will have to be overcome (see “Impediments to Accelerated Progress,” p. 36). These things simply will not happen without sustained, day-to-day engagement from the White House – the kind of

engagement now being focused, with considerable effect, on the problems posed by Iraq.

The lesson from the history of U.S. arms control and nonproliferation efforts is very clear: when the President is personally and actively engaged in making the hard choices, overcoming the obstacles that arise, and pushing forward, these efforts succeed. When that is not the case, they fail. Lower-level officials may work hard to carry out programs and resolve issues, but without sustained leadership from the top, they routinely encounter roadblocks posed by other offices, Congress, or their counterparts in partner countries. Without sustained, focused leadership targeted on overcoming obstacles as they arise, problems fester and delay progress – sometimes for years at a time.

To date, President Bush has led the way in focusing unprecedented attention on the threat posed by the possibility that terrorists might acquire weapons of mass destruction (WMD).¹ After one alarming briefing on al Qaeda’s nuclear ambitions, President Bush reportedly directed his national security team to give nuclear terrorism priority over all other security threats to the United States.²

The President and other senior officials – particularly the Secretary of Energy – have intervened personally to launch a number of new initiatives to strengthen and accelerate efforts to control weapons of mass destruction. (See “New Bush Administration Initiatives,” p. 40.)

Nonetheless, the President and his administration have not yet closed the gap between the urgency of the threat and the scope of the U.S. response.

¹ See, for example, President George W. Bush, *National Strategy to Combat Weapons of Mass Destruction* (Washington, D.C.: The White House, December 2002; available at <http://www.whitehouse.gov/news/releases/2002/12/WMDStrategy.pdf> as of February 26, 2003), p. 1.

² Barton Gellman, “Fears Prompt U.S. to Beef Up Nuclear Terror Detection,” *Washington Post*, March 3, 2002.

Between occasional initiatives, the level of sustained, day-to-day engagement from the highest levels in accelerating efforts to secure nuclear warheads and materials has been very modest (as, indeed, it was in the previous administration, and the one before that). Improving security for nuclear warheads and materials is a topic which the President, the Vice President, the Secretary of State, the Secretary of Defense, and the National Security Advisor mention only rarely in their public statements.³ It is only occasionally an item for in-depth discussion when they meet with their foreign counterparts. In most cases, the key issues have been delegated to lower levels and are not the focus of sustained high-level attention.

This level of sustained leadership stands in sharp contrast to the efforts President Bush and his national security team have made in other areas. Compare, for example, the few instances in which controlling nuclear weapons and materials has been explicitly discussed to the massive attention – what one press report described as “nearly eight weeks of administration arm-twisting, cajoling, and concessions” – devoted to the task of winning U.N. Security Council approval for a forceful approach to inspections in Iraq.⁴ For months, a

day has not gone by in which the national security team has not been intensely focused on working out the next steps with respect to Iraq. Much the same can be said for the war on terrorism more broadly.⁵

Even more limited efforts, such as the negotiation of the short Moscow Treaty on strategic arms reductions, followed by the withdrawal from the Anti-Ballistic Missile (ABM) Treaty and the decision to deploy a limited national missile defense, drew hundreds of hours of sustained engagement from the most senior officials of the government – a claim that controlling nuclear warheads and materials simply cannot make. On missile defense, as Secretary of State Powell himself pointed out, “we took 10 months to discuss that issue with the Russians, discuss that issue with our European friends. We made the case, some people agreed with the case, some people did not. But it wasn’t a matter of the United States not sharing, not talking, not listening.”⁶ The administration has made sure, moreover, that there would be no financial obstacles for missile defense. In late 2002, the administration announced that it would add \$1.5 billion to the \$16 billion previously planned for the next two years for the missile defense effort.⁷

³ President Bush, for example, devoted a line to the topic in his 2003 State of the Union address – “We’re working with other governments to secure nuclear materials in the former Soviet Union, and to strengthen global treaties banning the production and shipment of missile technologies and weapons of mass destruction.” – but did not mention it in his 2002 State of the Union or his 2001 inaugural address, and has mentioned it in speeches only a few other times during his administration. Perhaps his strongest speech on the subject since becoming President was his address on December 11, 2001, to the cadets at the Citadel Military Academy in South Carolina: “Working with other countries, we will strengthen nonproliferation treaties and toughen export controls. Together, we must keep the world’s most dangerous technologies out of the hands of the world’s most dangerous people. ...A crucial partner in this effort is Russia — a nation we are helping to dismantle strategic weapons, reduce nuclear material, and increase security at nuclear sites. Our two countries will expand efforts to provide peaceful employment for scientists who formerly worked in Soviet weapons facilities.” All of these speeches can be found at The White House, “Presidential News and Speeches” (available at <http://www.whitehouse.gov/news/> as of February 7, 2003). From this page, click on the relevant month and year for the particular speech, and then scroll down to the particular date of the speech.

⁴ Karen DeYoung and Colum Lynch, “U.S., France Agree On Iraq; Resolution Vote May Come Today,” *Washington Post*, November 8, 2002. For just one description of the level of seniority involved and the time being committed, see Colum Lynch and Karen DeYoung, “U.S. Officials Meet on Bolstering U.N. Effort,” *Washington Post*, October 16, 2002.

⁵ For a window into the intense focus of Bush’s national security team on the war on terrorism, see Bob Woodward, *Bush at War* (New York: Simon & Schuster, 2002).

⁶ President George W. Bush, “President Speaks on War Effort to Citadel Cadets: Remarks by the President at the Citadel, Charleston, South Carolina” (Washington, D.C.: The White House, Office of the Press Secretary, press release, December 11, 2001; available at <http://www.whitehouse.gov/news/releases/2001/12/20011211-6.html> as of December 19, 2002)

⁷ Bradley Graham, “Missile Defense in 2004; Bush Commits U.S. to Initial System,” *Washington Post*, December 18, 2002.

IMPEDIMENTS TO ACCELERATED PROGRESS

Dramatically increasing the pace of progress in improving controls over nuclear weapons, materials, and expertise will require intensive leadership to overcome a huge number of impediments to progress. The following is an illustrative list of some of the most important:

Bureaucracy. Bureaucracies around the world tend to follow their standard operating procedures, and to have difficulty moving quickly to pursue a new mission in a new way. The incidents of threat reduction efforts being substantially delayed or bogged down by bureaucratic procedures, interagency infighting, and the like – both in Washington and in Moscow and other recipient capitals – are legion. When an expert on physical protection of nuclear facilities is spending his time doing the twelfth revision of a contract proposal requested by headquarters, he is not spending his time actually implementing security upgrades.

Lingering distrust and lack of partnership.

Whatever the relationship at the top political levels, distrust and suspicion remain throughout substantial sections of the U.S. and Russian nuclear establishments. Russian officials suspect U.S. experts are out to spy on sensitive facilities; U.S. officials suspect that Russia is using threat reduction assistance to free up resources to spend on threatening military forces. U.S. concerns over Russian nuclear cooperation with Iran have also undermined confidence, and will be a major obstacle to accelerated progress until they are resolved. Across a wide range of programs, there is often a lack of real partnership to move these joint efforts forward – including a U.S. tendency toward “made in America” approaches designed with only modest consultation with

Russian experts, and a Russian tendency to rely on the United States to pay virtually the entire cost of these joint efforts. There are exceptions, of course – and it is those exceptions that have been most successful.

Secrecy. Keeping some nuclear information secret is essential to preventing the spread of nuclear weapons. But the scale of secrecy, particularly in Russia, is far beyond what is needed, and frequently slows or stops ongoing threat reduction cooperation. Cooperation to secure nuclear warheads, materials, and expertise is inevitably difficult when it is impossible to exchange information on how big the nuclear stockpiles are, where they are located, and what the most dangerous vulnerabilities are.

Disputes over access to sensitive sites.

One particular manifestation of secrecy – and of lingering distrust – has been the extended dispute over access to sensitive sites. To ensure that a particular site really holds dangerous materials, to assess the kinds of upgrades needed at that site, and to ensure that installation work is done to contract specifications, U.S. officials often demand direct access by U.S. personnel, even at highly sensitive locations – which Russian officials have often rejected. Work at most of Russia’s nuclear warhead storage sites and several of its most important nuclear material sites has been delayed for years over such disputes, and different programs have pursued a patchwork of different approaches to resolving them.

Liability concerns. Given the serious safety hazards in working with these dangerous materials, before being willing to start work, U.S. and inter-

Thus, with other priority items such as Iraq or missile defense, the President has made clear what he wants to happen and when he wants it to happen, and he and his senior advisers have devoted extensive time to providing the resources and clearing away the obstacles needed to meet that goal. For the job of securing the world’s stockpiles of nuclear weapons and weapons-usable materials, the full breadth and depth of White House leadership and support has not been brought to bear to nearly the same degree.

Organization and Planning

Beyond sustained political leadership, the next most critical inputs for accomplishing any complex high-priority government mission are some one in charge, with an effective organization devoted to that mission, and an integrated plan for meeting the objective.

President Bush and the Congress have now worked together to establish an entire cabinet Department

national companies have wanted to be sure that they would not be sued if an accident occurred during the course of threat reduction cooperation. While the original Nunn-Lugar umbrella agreement included blanket liability protection, Russian officials have often balked at providing such blanket protection in subsequent agreements, and officials from the United States and other donor countries have balked at accepting anything less. Negotiations over liability provisions have been contentious and lengthy – and even where the agreements are strong, most firms have still asked their national government for indemnification.

Taxes. Countries providing their taxpayers' money for programs to dismantle or secure weapons of mass destruction want the money to go for that purpose, and not into the general coffers of the recipient state – and hence have insisted that their assistance be tax free. Most recipient countries have agreed to this in principle, but in many countries projects face a complex set of local, regional, and national tax collection agencies which have sometimes been reluctant to implement such exemptions. Negotiating tax exemption provisions and ensuring that they are implemented in practice has taken up an enormous amount of energy that could otherwise have been devoted to the work at hand.

Travel restraints. Travel restrictions have been an area where bureaucratic logjams have had a particularly severe effect. In the case of an expert from a Department of Energy laboratory, a typical trip requires laboratory approval, DOE headquarters approval, State Department approval, a Russian visa, and Russian permission to visit a closed area (which typically

requires at least 45 days advance notice). These approvals usually take at least two months to arrange, and can often fall through at the last moment. Participants from former Soviet countries coming to visit the United States face similar problems – severely exacerbated, since September 11, by the new intensity of review of visa applications, which routinely delays such visits for months at a time. All told, a substantial fraction of the time of participants in threat reduction programs is spent making travel arrangements, rather than getting the work done.¹

In their statement launching the Global Partnership Against the Spread of Weapons and Materials of Mass Destruction, the leaders of Russia and the other members of the G-8 agreed on a set of implementation principles designed to overcome some of these logjams – including access, tax exemption, and liability protection, among others.² It is crucial that Russia actually implement these undertakings – and that the United States, Russia, and other participating states apply sustained leadership from the highest levels to overcome these obstacles to progress.

¹ For a discussion of the importance of resolving this impediment, see John P. Holdren and Nikolai P. Laverov, *Letter Report From the Co-Chairs of the Joint Committee on U.S.-Russian Cooperation on Nuclear Non-Proliferation* (Washington, D.C.: The National Academies, December 4, 2002; available at <http://www4.nationalacademies.org/news.nsf/isbn/s02052003?OpenDocument> as of February 24, 2003.)

² Group of Eight, "The G8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction" (statement by G-8 leaders, Kananaskis, Canada, June 2002; available at <http://www.g8.gc.ca/kananaskis/globpart-en.asp> as of February 24, 2003).

of Homeland Security, with some 170,000 employees drawn from agencies throughout the government. But for one absolutely central element of homeland security – keeping weapons of mass destruction out of terrorist hands in the first place – there is literally no one in charge.

Today, the U.S. government has dozens of separate programs, in several cabinet departments, doing important parts of the job of keeping nuclear

weapons and weapons-usable nuclear materials out of terrorist hands – securing and accounting for vulnerable nuclear material, helping states intercept nuclear smugglers at their borders, and getting rid of vulnerable caches of bomb material where possible. As described below, hundreds of millions of dollars are being spent each year, and thousands of people, both in the United States and abroad, are involved in carrying these efforts out. Many of these programs are managed by competent and

dedicated officials, and as a result, many of them are making impressive progress.

But there is no senior official anywhere in the government with the full-time job of leading and coordinating these efforts.⁸ With no single leader, there is also no integrated plan, no overarching strategy that would set goals and priorities, allow these programs to work together efficiently, close the gaps in the response, and eliminate overlap and duplication. Without such a strategy, there is no rational basis for making trade-offs and hard choices among the many programs underway. In this area, the U.S. government has a substantial fleet, but no admiral, and no overall battle plan.

With no senior official in charge of moving the entire effort forward, high priorities in some cases go unaddressed, while lower priorities are actively pursued. Problems are allowed to fester. In some cases, interagency disputes many levels down from the top are allowed to delay progress for months, and the sustained White House attention needed to push key security partnerships forward is frequently shoved aside by other priorities, from Iraq to the domestic economy. Consider, as just one example, the Department of Defense's efforts to improve security for stored nuclear weapons in Russia. Because of U.S.-Russian disputes over exactly how much access U.S. experts would have at these sensitive sites, some urgently needed security upgrade equipment that was purchased five years ago is still sitting in warehouses, uninstalled, while the vulnerabilities it was intended to fix go unaddressed.⁹ Were there a senior official in the White House leading the entire effort, this would not be allowed to happen.

Moreover, there is no single organization with "keep terrorists from getting nuclear weapons" as its principal mission – there are, instead, many small organizations with fragments of that job. Thus there is no institutional home for these efforts, no center of planning, execution, and advocacy. For this mission, there is no equivalent to Central Command (charged with preparing for and executing an attack on Iraq, should it come to that), and there is no equivalent to the Missile Defense Agency.¹⁰

Today, the Departments of Defense, Energy, and State all carry out programs to work with the states of the former Soviet Union (and, to a lesser extent, other countries) to reduce the threat posed by insecure nuclear warheads and materials. For none of these departments is this effort a central element of their primary missions. Each of these departments has specific talents and expertise to bring to bear on these problems, but none of them has the ability to pull the others into an integrated effort. The National Security Council has responsibility for coordinating these interagency efforts, and does so – but has assigned a very small fraction of its resources to that effort, and has only limited ability to control the directions that the different agencies choose to take. Ultimate control, in Washington, often comes from control of the budget. There, each program office develops its own budget proposal and performance goals first within its own agency's process; requests a budget from its own section of the President's budget team; and works with a separate congressional appropriations subcommittee to develop that budget.¹¹ There is no government-wide mechanism for preparing an integrated,

⁸ There is, today, a highly effective official several tiers down within the National Security Council staff, charged with coordinating the majority of these efforts (along with various other responsibilities). This person is part of the staff responsible for coordinating all nonproliferation, counterproliferation, and missile defense policy – meaning that nonproliferation matters have to fight with missile defense for senior-level attention. To lead the kind of program we outline here would require an official with substantially more authority, resources, and access.

⁹ 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 Charles L. Thornton, "The Nunn-Lugar Weapons Protection, Control, and Accounting Program: Securing Russia's Nuclear Warheads," in *Proceedings of the 43rd Annual Meeting of the Institute for Nuclear Materials Management, Orlando, Florida, June 23–27, 2002* (Northbrook, Illinois: INMM, 2002).

¹⁰ There is, in the Department of Defense, a Defense Threat Reduction Agency – but efforts to help other states control their weapons of mass destruction represent only a fraction of its mission, and it implements less than half of the government's overall threat reduction efforts.

prioritized budget and plan for preventing a terrorist nuclear attack on the United States.

A recent investigation by the General Accounting Office highlighted the predictable result, in the specific area of helping countries block nuclear smuggling, finding that the effort:

...is not effectively coordinated and lacks an overall governmentwide plan to guide it. Although an interagency group, chaired by the State Department, exists to coordinate U.S. assistance efforts, the six agencies that are providing assistance do not always coordinate their efforts through this group.¹²

For years, Congress has attempted to force one administration after another to put in place a more effective organizational structure for moving these efforts forward, but so far without success.¹³

This is not primarily a critique of President Bush and his administration. Identical criticisms could be – and were – leveled at the Clinton administration. Both the successes and the failures of threat reduction efforts over the years have been entirely bipartisan. Rather, this is a critique of a system and a structure, a structure that lacks any overall leader for these efforts, and any institutional focal point for moving them forward. As long as that structural problem remains, the forces of inertia and business as usual will be extraordinarily difficult to overcome, and the gap between threat and response is not likely to be closed.

Information

Information to guide decision-making is another critical input for an effective program to keep nuclear weapons and materials out of the hands of terrorists and hostile states. Decision-makers setting priorities and allocating resources need to know which facilities in the world have nuclear warheads, plutonium, or highly enriched uranium (HEU); how much of these weapons or materials these facilities have, and in what forms; how well secured these facilities are; whether the people at these facilities are being paid enough, and regularly enough, to keep them from desperation; what threats exist where these facilities are located (such as organized crime, terrorist activity, government corruption, or social collapse in the areas surrounding them); how well different borders are controlled (including controls designed to detect nuclear smuggling); where smugglers and terrorists are going to try to get nuclear materials; and more.

This information is quite difficult to get. Because there are no binding international standards for nuclear security, countries are not required to provide information to anyone on their approaches to securing their nuclear stockpiles. Most countries treat the specific arrangements for securing their nuclear facilities as closely guarded state secrets – indeed, many believe that keeping their defenses secret is the key to effective nuclear security. States with poor nuclear security may be particularly reluctant to provide information (in the

¹¹ Department of Energy programs work with the Energy and Water Subcommittee of the Appropriations Committee in both the House of Representatives and the Senate, the Department of Defense works with the Defense Subcommittee, and the Department of State deals with the Foreign Operations, Export Financing and Related Programs Subcommittee. U.S. House of Representatives, Committee on Appropriations, “Subcommittee Jurisdiction” (February 28, 2001; available at <http://www.house.gov/appropriations/info/juris.htm> as of December 27, 2002).

¹² U.S. General Accounting Office (GAO), *Nuclear Nonproliferation: U.S. Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning* (Washington, D.C.: GAO, May 2002; available at <http://www.gao.gov/new.items/d02426.pdf> as of December 27, 2002). Since the GAO report was completed, the government has put a substantial effort into developing a coordinated plan for the specific area of assistance for blocking nuclear smuggling – but not for the broader problem.

¹³ *National Defense Authorization Act for Fiscal Year 1997*, Public Law 201, 104th Congress, 2nd Session (September 23, 1996), Sec. 1441; *Floyd D. Spence National Defense Authorization Act of FY 2001*, Public Law 398, 106th Congress (October 30, 2000), Sec. 3174; *National Defense Authorization Act of FY 2002*, Public Law 107, 107th Congress, 1st Session (December 28, 2001); *Foreign Relations Authorization Act, Fiscal Year 2003*, Public Law 228, 107th Congress, 2nd Session (September 30, 2002); and *Bob Stump National Defense Authorization Act for Fiscal Year 2003*, Public Law 314, 107th Congress, 2nd Session (December 2, 2002), Sec. 1205.

BUSH ADMINISTRATION INITIATIVES TO PREVENT NUCLEAR WEAPONS TERRORISM

President Bush and the senior officials of his administration have launched several new initiatives intended to accelerate and strengthen international efforts to control nuclear weapons and weapons-usable nuclear materials.

The G-8 Global Partnership. The most important new initiative of the Bush administration is the establishment, at the June 2002 summit of the Group of Eight (G-8) industrialized democracies, of a “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction,” with the G-8 countries pledging \$20 billion to the effort over 10 years. This provides a strong foundation, if appropriately followed up, to build an effective global coalition to secure all the weapons of mass destruction (WMD) and related materials around the world. (See “The G-8 Global Partnership,” p. 60.)

Efforts to Accelerate Security Upgrades in Russia. Soon after the September 11 attacks, President Bush met with President Putin and agreed to give “urgent attention” to improving security for nuclear material. Since then, Secretary of Energy Spencer Abraham has met five times with Russian Minister of Atomic Energy Alexander Rumiantsev, working each time to accelerate efforts to secure nuclear materials, and overcome bureaucratic obstacles. As a result, the Department of Energy (DOE) has moved up the planned schedule for completing all nuclear material security and accounting upgrades in Russia from 2011 to 2008.

Unfortunately, however, progress in actually implementing upgrades has remained slow, as discussed in the main text.

Take-back of Vulnerable Highly Enriched Uranium (HEU) to Russia. In August 2002, the United States, Yugoslavia, Russia, the International Atomic Energy Agency, and the Nuclear Threat Initiative (NTI) cooperated to airlift 48 kilograms of vulnerable HEU from the nuclear research center at Vinca, Yugoslavia. The Bush administration, following up on initial efforts in the Clinton administration, has launched a tripartite initiative with Russia and the International Atomic Energy Agency (IAEA) to help get vulnerable Soviet-supplied HEU shipped back to Russia for secure storage and disposition – and several more such efforts are now in the planning stages.

Support for an Increased IAEA Budget. Soon after the September 11 attacks, the Bush administration decided to contribute millions of dollars to the IAEA’s nuclear security fund, making the United States by far the world’s leading contributor to the IAEA’s efforts to prevent nuclear terrorism. Moreover, the Bush administration has strongly supported increasing the regular IAEA budget, which funds the entire global nuclear safeguards system, and which had been locked in zero real growth for a decade and a half, despite huge increases in the number of facilities and amounts of material under safeguards. The effort to increase the IAEA regular budget has not yet succeeded, however.

absence of any strong incentive to do so, such as the prospect of assistance for improvements), for fear of both embarrassment and pressure to spend more on nuclear security.¹⁴

Moreover, while it is important to compile as much information as possible to guide decision-making,

it is essential that this information be kept out of terrorist hands. Today, pieces of the needed information exist in many different parts of the U.S. government, in other governments, and in international organizations such as the International Atomic Energy Agency (IAEA). But there is no centralized collection of this kind of information anywhere

¹⁴ The level of secrecy surrounding different parts of this information does vary: most civilian research reactors, for example, are quite open to international visitors and international collaborations. However, at the other extreme, nuclear weapons in states with small arsenals (such as Pakistan and India) or unacknowledged arsenals (such as Israel) are shrouded in nearly impenetrable secrecy.

Expanded Disposition of HEU and Plutonium. At their May 2002 summit, President Bush and President Putin established a U.S.-Russian working group to find ways to expand and accelerate efforts to reduce HEU and plutonium stockpiles. The group's initial report identified several modest steps that could be taken to reduce HEU stockpiles, including U.S. purchase of a reactor fuel reserve blended from Russian HEU, purchase of Russian HEU fuel for U.S. research reactors, and expanding the blending of HEU removed from vulnerable facilities that is under way under a joint consolidation project. Funding for these steps is included in the President's fiscal year 2004 budget request. In addition, the Bush administration has streamlined the approach to plutonium disposition decided on in the Clinton administration, provided hundreds of millions of dollars in additional funding to begin building the necessary facilities, and made progress toward raising international funds to pay for the disposition of Russian excess weapons plutonium. No large-scale acceleration of the destruction of excess HEU or plutonium has yet been agreed, however.

Nuclear Detection At, and Beyond, U.S. Borders. In the aftermath of the September 11 attacks, the U.S. Customs Service, with help from DOE, has been moving to purchase equipment for detecting nuclear contraband at points of entry into the United States. Because detecting a nuclear bomb once it got to the U.S. border might be too late, Customs has also established a "Container Security Initiative," designed to ensure that potentially high-risk cargo containers are inspected – including for nuclear materials –

before they are shipped to the United States. As described in the main text, however, these efforts are still in their infancy.

Nuclear Detection Within the United States. For decades, the United States has maintained the Nuclear Emergency Search Team (NEST) whose job is to respond to terrorist nuclear threats, and find and disable potential terrorist nuclear devices. NEST teams and related capabilities have been called out repeatedly since September 11 – and nuclear detectors have quietly been installed in at least some major U.S. cities.

In addition, the war on terrorism following September 11 has deprived al Qaeda of its Afghanistan sanctuary, driven the group's senior leadership into hiding, and broken up large numbers of terrorist cells – all of which contributes to reducing the group's ability to get and use a nuclear bomb. Moreover, the Bush administration has launched a range of steps to build a new security partnership with Russia, including the formation of the NATO-Russia Council (with a significant focus on both counterterrorism and nonproliferation), the Consultative Group for Strategic Security (chaired by the foreign and defense ministers of both countries), and upgrading the U.S.-Russia Working Group on Afghanistan to an ongoing U.S.-Russia Working Group on Counterterrorism (with a mandate that specifically includes nuclear, chemical and biological terrorism). All of these venues for cooperation with Russia can and should be used to strengthen efforts to block the terrorist pathway to the bomb.

in the world, at any level of classification. If a policymaker said today, "I have \$100 million to spend, and I want to spend it on securing the most vulnerable nuclear material in the world," the answer would be: "we know some material that is quite vulnerable, which would certainly be a worthwhile place to spend the money, but no one knows if there might be other material that poses an even greater risk."

For example, through its cooperation with Russia, the Material Protection, Control, and Accounting

(MPC&A) program at the Department of Energy (DOE) has good information on the types and quantities of nuclear material, and the security and accounting arrangements for it, for many (though not all) of Russia's nuclear sites. But it has very little information on nuclear material elsewhere in the world. DOE's Reduced Enrichment for Research and Test Reactors (RERTR) program has good information on the amounts of HEU at U.S.-supplied research reactors around the world, but little information on the security of these facilities, and no information on material at facilities other than

EFFECTIVE PROGRAM IMPLEMENTATION

No amount of money will get the job done, and no strategic plan will work, without effective implementation of the individual programs. The approaches taken to managing these efforts can make all the difference between success and failure. Indeed, good managers with the experience, judgment, and vision needed to find and implement the approaches that will lead to rapid progress may be the most critically needed input to successful threat reduction efforts.

The areas of strengths and weaknesses in the management of individual programs are many and varied. Some program managers are willing to take risks and make bureaucratic enemies to move their agenda forward; others are more cautious. The heads of some threat reduction programs are adept at building congressional support and garnering favorable publicity for their programs; programs whose managers lack those skills see their budgets languish.

The approach to partnerships – with experts from the recipient country, and between agency headquarters and those on the ground implementing the effort, whether they be laboratory or private sector experts – can be particularly crucial. Programs whose managers know how to build these partnerships, and make appropriate use of the strengths of all participants, tend to succeed, while programs whose managers seek to control every detail from agency headquarters tend to become bogged down, with many of the most effective and enthusiastic implementers drifting away to other projects that will make better use of their skills. The effort to upgrade security and accounting for nuclear warheads and materials held by Russia's Navy, for example, has focused from the beginning on building a genuine partnership with the Russian Navy and a Russian implementing team overseeing the work (at the Kurchatov Institute), who were able to navigate through the obstacles posed by the Russian security apparatus far better than U.S. experts could. As a result, this program has moved far more rapidly than most of the rest of the Material Protection, Control, and Accounting (MPC&A) effort, accomplishing rapid upgrades at most

sites in roughly six months from beginning work at those sites, and comprehensive upgrades typically within 18 months to two years.¹

Helping to ensure consistent and effective approaches to program implementation – and encouraging agencies to hold managers accountable for performance – would be among the key roles for a new senior White House leader for efforts to keep nuclear weapons, materials, and expertise out of terrorist hands. Important steps would include:

■ **Independent review of implementation approaches.**

Few of these programs have any mechanism in place for independent review or advice on policy issues related to program implementation – from how hard a line to take on access to how to manage the headquarters-contractor relationship. Many do not even have senior agency leadership with the interest and expertise to intervene on these topics. A new senior leader for these efforts and his staff could provide one layer of review – including ensuring consistency among approaches taken to similar problems between different programs – and could work to ensure that the most important efforts also established independent advisory panels to provide well-informed review and advice.

■ **Sharing of experience and best practices.**

As with most government programs, threat reduction programs generally do not talk to each other unless they need to – for example if there is an issue of which program will address a particular problem that has just arisen. There is little opportunity for sharing lessons learned, experience on practices that worked and practices that did not, between different programs. A variety of mechanisms for such sharing of experience could be envisioned, from internal newsletters to retreats where approaches to common problems could be discussed and compared. A new senior leader could help ensure that failed policies were corrected, and successful approaches more broadly adopted.

¹ For discussion of this example, see Morten Bremer Maerli, "U.S.–Russian Naval Security Upgrades: Lessons Learned and Future Steps," *Yaderny Kontrol* (Summer 2002).

research reactors. Under the terms of the Nuclear Nonproliferation Act of 1978, the United States requires that countries it supplies with nuclear materials and technologies provide adequate physical protection for these materials, and U.S. teams occasionally visit countries to check up on this requirement. Traditionally, though, the reports from these teams have not been compiled into any kind of centralized database on security for nuclear materials around the world.

The IAEA, from its safeguards inspections around the world, has detailed information on the quantities and forms of HEU and plutonium in the countries that are non-nuclear-weapon-state parties to the Non-Proliferation Treaty – and on occasion, safeguards inspectors also bring back observations on the state of physical security at sites they have inspected. But under IAEA rules, it cannot divulge the detailed findings of its safeguards inspections to anyone else, even to other offices inside the IAEA. In addition to safeguards information, IAEA experts have also compiled detailed information on HEU at research reactors around the world, and have organized international reviews of security at a small number of nuclear sites. But the IAEA has only limited information on the security arrangements for materials at most sites around the world, and has virtually no information on the nuclear stockpiles in the United States, Russia, China, France, Britain, India, Pakistan, or Israel, none of whom are subject to comprehensive agency safeguards.

One might assume that the U.S. intelligence community would have a complete compilation of such information. But that assumption would be wrong. The intelligence community has actually reduced significantly the resources devoted to nuclear issues since the end of the Cold War. And for reasons ranging from inertia to congressional mandates (which require, among other things, detailed reporting on states' compliance with their arms control obligations), U.S. nuclear intelligence still focuses much more on detailed assessment of the nuclear forces of states that already have nuclear weapons than it does on the possibility that insecure nuclear weapons or materials might allow some unexpected party to get a nuclear bomb overnight. Whether the bomb's worth of HEU sitting at a

research reactor in an obscure country is adequately secured or not, and how much the people there are paid, has not been a major focus of U.S. intelligence – yet that matters much more to U.S. security than many of the topics that have been afforded higher intelligence priority. In short, information is another critical “input gap” in the effort to control nuclear warheads, materials, and expertise.

Resources

Finally, there is the matter of money and personnel – the resources needed to do the job. It is crucial to ensure that efforts to secure nuclear weapons, materials, and expertise around the world are not slowed or weakened by lack of funds or personnel. Today, however, we would argue that changes in policy approaches and in sustained high-level leadership would do more to accelerate and strengthen these efforts than would budget increases alone. The budgets available for most of the existing programs focused on this mission are large enough that simply adding more money, without changing anything else, would not greatly accelerate or strengthen these efforts. But additional funds *would* be needed to finance the new initiatives recommended in this report, and to accelerate and strengthen existing programs in the ways we recommend, *if* other changes made it possible to overcome the other roadblocks that now pose the most substantial constraints.

As discussed later in this report, it is also crucial to begin shifting from a donor-recipient relationship with Russia, in carrying out these programs, to a true partnership – including a growing Russian financial contribution, leading ultimately to full Russian responsibility for providing long-term security for its own stockpiles. Yet Russia's budgets remain constrained, and Russia faces a large number of high-priority crises for which government funds are necessary. Thus, it remains important to identify additional revenue streams that could strengthen Russia's own ability to contribute to these efforts in the near term and sustain effective nuclear security for the long term. (See “Resources Sufficient to the Task,” p. 107.)

While increasing the budget of one program or another might not have much effect, moreover, it

CONGRESSIONAL INITIATIVES TO PREVENT NUCLEAR WEAPONS TERRORISM

Over a decade ago, the creation of the original cooperative threat reduction program with the countries of the former Soviet Union was driven largely by congressional initiative, led by Senators Sam Nunn of Georgia and Richard Lugar of Indiana. Since then, Congress has often taken the lead role in determining the direction of the effort. The following are a few of the highlights of congressional action during the current Bush administration.

Major Supplemental Funding in the Aftermath of September 11 Attacks. Immediately following the attacks, Congress substantially boosted funding for programs focused on keeping weapons of mass destruction out of the hands of terrorists and defending against them on U.S. soil. The Department of Energy (DOE) received an extra \$120 million combined for its Material Protection, Control, and Accounting (MPC&A) and Second Line of Defense programs, a nearly 70 percent increase over its base appropriation. Another \$15 million of the \$40 billion post-September 11 Emergency Response Fund (ERF) was directed toward DOE's Russian Transition Initiatives, designed to shrink Russia's nuclear complex and provide civilian jobs for excess weapons experts in the former Soviet Union. In addition, the administration used \$25 million of the \$40 billion ERF provided by Congress for the State Department's Export Control and Border Security Assistance

programs to combat nuclear and other WMD smuggling in Central Asia (on top of \$24 million otherwise directed to the program).

Further Supplemental Funding in Summer 2002. In another emergency supplemental appropriation approved in the summer of 2002, on the Senate's initiative, the Congress added more than \$40 million more to expand MPC&A activities beyond the former Soviet Union, accelerate execution of the program in Russia, and control radiological sources; to destroy highly enriched uranium and return vulnerable material to Russia; to speed the elimination of Russian plutonium production reactors; and for other matters.

Authority for the President to Waive Certain Congressional Restrictions. Early in 2002, the administration decided it could not to certify to Congress that Russia was meeting the Congressional requirement that it be committed to complying with its arms control obligations, and asked Congress for authority to waive the requirement in the national security interest. Pending approval of such a waiver, new assistance to Russia – including efforts to secure warheads and materials posing a threat to U.S. national security – was halted for several months. In the summer of 2002, Congress provided temporary waiver authority that quickly expired; by the end of the

seems clear that if Congress were to appropriate a substantial pool of funds available as needed for addressing such risks – comparable to the \$10 billion the Defense Department proposed to set aside in fiscal year (FY) 2003 for the war on terrorism – this could leverage progress in a variety of areas, making it possible for program managers to think bigger, for negotiators to be more flexible, and for commitments to foreign partners to be more credi-

ble.¹⁵ In FY 1999, for example, at the initiative of Senator Pete Domenici (R-NM), Congress added \$525 million in appropriations contingent on reaching agreements with Russia related to stabilizing the HEU deal (\$325 million) and carrying out plutonium disposition (\$200 million).¹⁶ This brought Russian negotiators to the table with greatly increased seriousness of purpose; the agreements in these two areas that were subsequently reached would not

¹⁵ The constraints on the offers that negotiators can make posed by U.S. laws have frequently slowed negotiations in these areas: U.S. negotiators are legally barred from offering financial commitments for which there are as yet no appropriated funds, but foreign negotiators often do not negotiate seriously until the U.S. side can make real financial commitments. And U.S. appropriators often will not provide funds for a project if the foreign partner is not perceived as negotiating seriously, creating a difficult Catch-22

¹⁶ *Omnibus Appropriations Bill for FY 1999*, Public Law 277, 105th Congress (October 21, 1998; available at <http://thomas.loc.gov/cgi-bin/bdquery/z?d105:HR04328:ENR> as of February 6, 2003), Division B, Chapter 2.

year, after considerable debate, Congress provided waiver authority for three years.

Senate Attempts to Expand the Scope and Pace of Global Threat Reduction. In summer 2002, a bipartisan collection of Senators, including Richard Lugar (R-IN), Pete Domenici (R-NM), and Joseph Biden (D-DE), among others, won Senate approval for a broad package authorizing the administration to expand the Department of Defense's Cooperative Threat Reduction program and DOE's MPC&A program beyond the former Soviet Union; authorizing an accelerated blend-down program for highly enriched uranium (HEU); encouraging an accelerated and broadened effort to remove nuclear material from vulnerable sites worldwide; and more. Few of these initiatives survived the conference with the House, but some were partly funded in the summer emergency supplemental just described.

Debt-for-Nonproliferation Legislation. As part of the final version of the Foreign Relations Authorization Act of FY 2003, Congress provided the administration with the authority to create a new mechanism under which money that Russia otherwise would pay to the United States to service the roughly \$2.7 billion debt it owes to the United States would instead be paid into a fund to be spent to secure WMD and related material and expertise in Russia. Administration officials have testified that they intend to use this authority, but

the administration requested no funds to do so in its FY 2004 budget request.

New Initiatives in the 108th Congress. With the start of a new Congress, members in both houses have proposed working again to advance the agenda on controlling insecure nuclear (including radiological) materials and expertise. In addition to making permanent the presidential authority to waive certain congressional restrictions (H.R. 182), legislation introduced by the Democratic Senate leadership (S. 6) incorporates several non-proliferation initiatives into larger legislation focused on homeland security – including a requirement that the administration develop a plan to address the global threat of insecure radiological materials; new authority for the State Department to work with, and provide funds to, other governments for improving the security of their nuclear facilities and nuclear materials, along with acceleration of DOE's MPC&A program; new funds for converting unneeded Russian nuclear facilities, along with a new approach to employing former WMD scientists by authorizing agencies to direct a small fraction of U.S.-sponsored R&D to be done by them; and a requirement that the administration develop a plan, with Russia, for addressing Russia's huge stockpiles of tactical nuclear warheads. Another bill expected to be re-introduced in the Senate after being introduced late in the 107th Congress focuses more exclusively on insecurity and proliferation of radiological materials.

have been possible had these funds not been appropriated.

Ultimately, it will only be possible to have a full debate over how much money is needed for this mission once a comprehensive, prioritized plan has been laid out that makes it clear what needs to be paid for. Nevertheless, some discussion of the budget picture – and whether it meets the “everything in our power” standard the President laid out – is warranted.

In addition to sheer dollars, flexible authority to spend them where they are most needed and how

they can be most effective is critically important. In exercising its oversight responsibilities – and reaching the political bargains that are often necessary to build support – Congress on occasion has restrained these programs with myriad certification requirements and program directions that have limited the government's ability to implement programs in the most efficient manner and seize opportunities as they arise.¹⁷ In the early days of the Nunn-Lugar effort, for example, there was strong Congressional pressure to “buy American” – providing U.S.-made equipment when, in many cases, equipment made in Russia or the other states of the former Soviet Union

¹⁷ For discussion of the problems posed by such restrictions, see, for example, Laura Holgate, testimony to the Senate Committee on Governmental Affairs, Subcommittee on International Security, Proliferation, and Federal Services, November 14, 2001 (available at http://www.nti.org/c_press/holgate_Nov14.pdf as of January 17, 2003).

would have been cheaper and easier for the recipients to use and maintain.

In 2002, the requirement that the President certify that the recipient states were each meeting a list of standards for eligibility to receive Nunn-Lugar funds became a serious problem when President Bush decided he could no longer certify that Russia was committed to complying with all of its arms-control obligations, putting a hold on all new Nunn-Lugar contracts for many months. Congress finally passed legislation giving the President authority to waive these certification requirements when it is in the national security interest to do so – but only for three years. A Senate effort to give the Defense Department authority to spend \$50 million of Nunn-Lugar money wherever in the world it might be needed, not just in the former Soviet Union, was not approved in conference with the House – leaving the administration with little flexibility to address problems outside the former Soviet Union. Similarly, legislation that would have explicitly given DOE authority to help secure or remove vulnerable nuclear materials anywhere in the world did not survive the conference – though DOE arguably has such authority already. Congress did, however, initiate and pass new legislation, which President Bush signed into law, giving the President the authority to negotiate “debt for nonproliferation swaps” as a complementary approach to financing threat reduction activities. (See “Resources Sufficient to the Task,” p. 107).

Total Threat Reduction Funding

Over the twelve years from fiscal year (FY) 1992 to FY 2003, the U.S. government appropriated approximately \$7.9 billion for programs in the Departments of State, Defense, and Energy intended to dismantle and control the former Soviet Union’s weapons of mass destruction.¹⁸ Of that total, just under \$4.7 billion was focused on controlling nuclear warheads, materials, and expertise.¹⁹ The remainder was directed to a broad range of other worthy objectives, from dismantling missiles and submarines to destroying chemical weapons.

By way of comparison, the budget Congress approved for missile defense in FY 2003 alone is \$7.4 billion, only slightly less than all cooperative threat reduction spending for the past twelve years combined.²⁰ Total funding for all threat reduction funding, including all the efforts devoted to ensuring that weapons of mass destruction do not fall into the hands of terrorists or hostile states, is now running at around \$1 billion per year – less than one third of one percent of a budget for the Department of Defense that in FY 2003 was \$365 billion.²¹

In its initial days in office, the Bush administration questioned even this resource level, proposing a budget of just under \$750 million, significantly lower than this \$1 billion standard.²² In the aftermath of the September 11 attacks Congress pro-

¹⁸ While the problem of insecure nuclear weapons and materials is a global one, nearly all U.S. funding for programs to manage nuclear weapons, materials, and expertise beyond the United States’ own borders has focused on the former Soviet Union. This budget analysis, therefore, focuses primarily on programs within the former Soviet Union (as do administration budget analyses). See discussion below for more on what programs we include and do not include in our analysis. This analysis draws heavily on William Hoehn, “Observations on the President’s Fiscal Year 2004 Budget Request for Nonproliferation Programs in Russia and the Former Soviet Union” (Washington, D.C.: Russian American Nuclear Security Advisory Council, February 11, 2003; available at http://www.ransac.org/new-web-site/whatsnew/fy2004_usrf_budget.html as of February 26, 2003). The authors are grateful to Hoehn for extensive discussions of issues relating to current and historical threat reduction budgets, and to several veterans of the cooperative threat reduction effort still within the U.S. Government. Any errors are entirely our own.

¹⁹ The programs included and excluded in our calculations of total cooperative threat reduction spending and the portion devoted to controlling nuclear warheads, materials, and expertise, along with the criteria used to make these determinations, are discussed below.

²⁰ U.S. House of Representatives, Committee on Appropriations, “Fiscal Year 2003 Defense Appropriations Conference: Summary of Agreements” (press release, Washington, D.C., October 9, 2002; available at http://www.house.gov/appropriations/news/107_2/03defconf.htm as of December 18, 2002).

²¹ Office of Management and Budget, “Department of Defense,” in *Budget of the United States Government, Fiscal Year 2004* (Washington, D.C.: OMB, February 3, 2003; available at <http://www.whitehouse.gov/omb/budget/fy2004/> as of February 6, 2003), p. 90.

vided hundreds of millions of dollars to programs intended to address various aspects of the risk that weapons of mass destruction would fall into terrorist hands, and the Bush administration ultimately agreed.²³

The Bush administration then shifted its stance, releasing (in December 2001) the results of its review of threat reduction programs, which endorsed most of them and called for expansions of some.²⁴ This was followed in February 2002 by the administration's FY 2003 budget proposal, which – if one accounts for later policy changes to ensure an “apples to apples” comparison – called for a total threat reduction budget of \$948 million²⁵ – almost as much as the total appropriation the year before, including the emergency supplemental increments, reflecting an administration decision to support threat reduction at a level of roughly \$1 billion per year. That level matches the last threat reduction budget proposed by the Clinton administration – long before the September 11 attacks. Out of that amount, \$597 million was targeted on controlling nuclear weapons, materials, and expertise.²⁶ Later, in mid-2002, the administration committed to continuing to invest \$1 billion a year for another decade, as a part of the Global Partnership – and the other members of the Group of Eight (G-8)

industrialized democracies agreed to match that annual investment (see “The G-8 Global Partnership,” p. 54). For FY 2003, the 107th Congress initially simply approved these Bush administration requests – but then failed to pass final versions of the Department of Energy and State budgets, as a result of partisan budget gridlock.²⁷ Finally, in February 2003 – after a third of the fiscal year had passed – the 108th Congress finished work on the FY 2003 budget with an omnibus appropriations bill that included provisions for the nonproliferation programs at the Departments of Energy and State.²⁸

The final bill agreed to by Congress slightly modified the President's original budget proposal in only two ways. First, Congress added on \$14 million in FY 2003 to develop and implement efforts with Russia for blending or otherwise securing HEU (see “Notable Congressional Initiatives to Prevent Nuclear Weapons Terrorism,” p. 47).

Additionally, Congress directed a 0.65% across-the-board rescission of all the funding levels approved in the bill to pay for a few high-priority initiatives.²⁹

In its FY 2004 request, released on February 3, 2003, the administration has met this \$1 billion commitment, proposing a total threat reduction budget of \$1,031 million.³⁰

²² Authors' calculations, described in detail in 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. 15–23. Also, William Hoehn, “Analysis of the Bush Administration's Fiscal Year 2002 Budget Requests for U.S.-Former Soviet Union Nuclear Security: Department of Energy Programs,” *Russian American Nuclear Security Advisory Council* (April 18, 2001; available at http://www.ransac.org/new-web-site/related/govt/cabinet/doe/fy2002_budget_analysis.html as of December 28, 2002).

²³ See, for example, David Broder, “Good News on Nukes,” *Washington Post*, December 23, 2001. For an account of the final spending picture after these amounts were approved, see William Hoehn, “Analysis of the Bush Administration's Fiscal Year 2003 Budget Requests for U.S.-Former Soviet Union Nonproliferation Programs” *Russian American Nuclear Security Advisory Council* (April 2002; available at http://www.ransac.org/new-web-site/related/congress/status/fy2003doe_0402.html as of February 7, 2003). Also, see our discussion in Bunn, Holdren, and Wier, *Seven Steps for Immediate Action*, op. cit., pp. 15–23.

²⁴ The White House, Office of Press Secretary, “Fact Sheet: Administration Review of Nonproliferation and Threat Reduction Assistance” (Washington, D.C., press release, December 27, 2001; available at <http://www.whitehouse.gov/news/releases/2001/12/20011227.html> as of February 26, 2003).

²⁵ In the *Seven Steps* report, we originally estimated the budget request at \$957 million. The figure offered here excludes \$6 million in the Department of Energy for a Nuclear Assessment Program that has since been moved to the new Department of Homeland Security and \$3 million in the State Department's Export Control and Related Border Security Assistance program that was reallocated to non-former Soviet countries. Personal communications with State Department officials, February 2003; and U.S. Department of Energy (DOE), *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation* (Washington, D.C.: DOE, February 2003; available at <http://www.mbe.doe.gov/budget/04budget/content/defnn/nn.pdf> as of February 5, 2003), p. 627.

Table 4.1 – Proposed and Approved Funding Levels for All U.S. Cooperative Threat Reduction Efforts in the Former Soviet Union

Dollars in Millions	FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
	Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
Department of Energy	491.8	413.7	424.9	458.4	33.5	7.9%
Department of Defense ^[1]	370.0	428.3	428.3	462.8	34.5	8.1%
Department of State ^[2]	167.4	105.9	105.5	110.0	4.5	4.2%
TOTAL	1,029.2	947.9	958.8	1,031.2	72.4	7.6%

^[1] In its own documents, the administration reports that it is requesting \$991 million in FY 2004 for cooperative nonproliferation programs as part the G-8 Global Partnership Against the Spread of Weapons of Mass Destruction, with \$451 million of that coming out of the Department of Defense. The administration's count does not include, as we do, an estimated \$9 million for the International Counterproliferation program, or an estimated \$3 million for the Arctic Military Environmental Cooperation program.

^[2] The administration also reports that it is requesting \$81 million for State Department in FY 2004 for cooperative nonproliferation programs as part the G-8 Global Partnership. This figure does not include, as we do, an estimated \$15 million for the Georgia Border Security and Law Enforcement program (which has some nonproliferation benefits), and an estimated \$14 million for the Civilian Research and Development Foundation.

Of the \$1,031 million total, the amount focused on controlling nuclear warheads, materials, and expertise is approximately \$656 million (as shown in Table 4.1 and Table 4.2).

For comparison, for the entire Department of Defense, the administration has requested approximately \$380 billion in new funding for FY 2004 (a figure which does not include a likely supplemental to be proposed by the administration to cover any hostilities in Iraq as well as additional costs in the war on terrorism). In other

words, if all the money budgeted in FY 2004 for the national defense of the United States were spent in equal amounts each day over the course of an entire year, all the resources dedicated to controlling the thousands of unsecured nuclear warheads and tons of unsecured nuclear materials that could be used in a devastating nuclear terrorist attack on an American city would run out by the late afternoon of the first day.

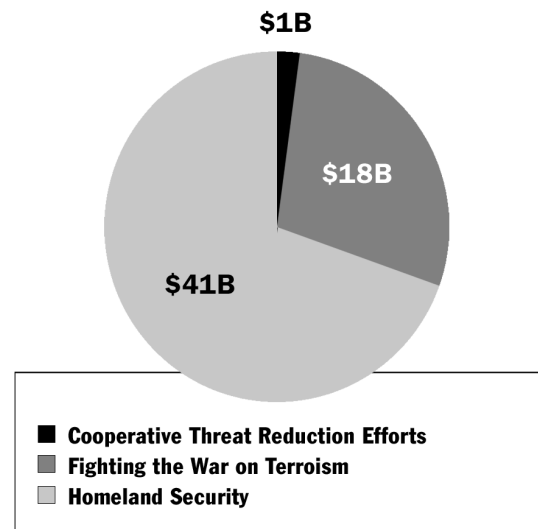
Figure 4.1 compares funding for the three elements of blocking the terrorist pathway to the

²⁶ Again, in the *Seven Steps* report, we originally estimated that the FY 2003 request by the administration for efforts to control nuclear warheads and materials was approximately \$634 million, \$37 million more than the figure offered above. \$9 million of the difference is accounted for by the adjustments discussed in the previous footnote because of new policies decided upon after the original budget request. Additionally, last year because of a State Department budget presentation that combined two figures, we were forced to include \$20 million for the Bio-Chem Redirection program in the total for the International Science and Technology Centers (ISTC) (separately funded at \$32 million). The Bio-Chem Redirection program is not a nuclear-focused program, and is better counted as in our Other Threat Reduction category when available data makes that possible (the comparable anticipated splits are \$24/\$35 million for FY 2004; personal communication with administration budget officials, February 2003). Finally, last year we counted approximately \$8 million in funding for the State Department's Nonproliferation and Disarmament Fund (NDF) as part of other nuclear cooperative efforts; we have since reclassified that funding as Other Threat Reduction. The NDF is a contingency fund that takes advantage of all types of nuclear, chemical, biological, and conventional nonproliferation and disarmament opportunities as they arise, so no specific splits on the types of projects it funds are available before they happen. Traditionally experts have estimated that about half of NDF's annual replenishment (typically around \$15 million) would go towards threat reduction projects inside the former Soviet Union, but it is impossible to say from year-to-year how much is going towards nuclear-specific projects. For FY 2004 the administration broke with that tradition on two counts. First, it is requesting replenishment in FY 2004 of \$35 million to increase the opportunities in which NDF can take advantage. And second, in its tally of State Department funds contributing to the G-8 Global Partnership, administration officials counted only \$5 million of the NDF's \$35 million request. We have chosen to follow their lead in FY 2004.

bomb outlined in Chapter 3 – threat reduction, the war on terrorism, and homeland security.³¹ As can be seen, spending on keeping weapons of mass destruction out of terrorist hands in the first place is tiny by comparison to what is being spent on the other elements the effort.

Clearly both the war on terrorism and homeland security involve a wide range of important efforts that have nothing to do with weapons of mass destruction, so the comparison is not entirely fair (though to even the balance slightly, we have included all threat reduction efforts, even those not directly related to reducing nuclear terrorist threats) – but it does make clear that the effort to keep “the world’s most dangerous technologies out of the hands of the world’s most dangerous people” as the President has put it,³² receives a miniscule slice of the overall effort to counter global terror. We would argue that while both the war on terrorism and providing for homeland security are essential investments, this picture should be brought into slightly better balance, by increasing the

Figure 4.1 – Estimated U.S. Spending in FY 2003 on Homeland Security, the War on Terrorism, and Threat Reduction



resources available for controlling weapons of mass destruction and their essential ingredients at their sources.

²⁷ For a damning post mortem on the overall FY 2003 budget process, see Stan Collender, “Budget Battles: Rock Bottom,” *GovExec.com* (November 6, 2002; available at <http://www.govexec.com/dailyfed/1102/110602bb.htm> as of December 16, 2002). The Library of Congress’ *Thomas* website presents a useful summary page of appropriations actions for the FY 2003 budget, at Library of Congress, “Status of FY 2003 Appropriations Bills,” *Thomas: Legislative Information on the Internet* (available at <http://thomas.loc.gov/home/approp/app03.html> as of December 16, 2002).

²⁸ *Consolidated Appropriations Resolution*, 2003, Public Law 7, 108th Congress, 1st Session (February 20, 2003; available at <http://thomas.loc.gov/cgi-bin/query/z?c108:H.J.RES.2.ENR>: as of February 26, 2003). Department of Energy programs are dealt with in Division D of the bill; the State Department’s nonproliferation programs are dealt with in Division E. Also see U.S. House of Representatives, *Conference Report to Accompany House Joint Resolution 2, Making Further Continuing Appropriations for Fiscal Year 2003, and for Other Purposes*, 108th Congress, House Report 10 (February 12, 2003; available at <http://thomas.loc.gov/cgi-bin/cpquery/z?cp108:hr10>: as of February 26, 2003).

²⁹ We have generally assumed in the rest of this analysis that the rescission will be applied to each individual programs, but there are cases in which the administration may end up applying certain parts of the rescission in amounts that differ slightly from the exact 0.65%

³⁰ In its own documents, the administration reports that \$991 million is being devoted to the G-8 Global Partnership. It does not count approximately \$15 million for the Georgia Border Security and Law Enforcement program (which has some nonproliferation benefits), roughly \$14 million for the Civilian Research and Development Foundation, roughly \$9 million for the International Counterproliferation program, or some \$3 million for the Arctic Military Environmental Cooperation program. All of these have been counted in at least some previous government accountings of the total threat reduction budget, and all of them have at least some threat reduction impact. We have included them in our accounting to ensure that, in arguing for a greater U.S. and international commitment to threat reduction, we are not under-reporting the existing U.S. commitment.

³¹ The \$18 billion figure for “Fighting the War on Terrorism” comes from Defense Secretary Rumsfeld’s testimony to the House Armed Services Committee, in which he explained that the Defense Department was spending about \$1.5 billion a month on this task. See Leslie Wayne, “Rumsfeld Warns He Will Ask Congress for More Billions,” *New York Times*, February 6, 2003. Homeland Security funding for FY 2003 (which still includes other homeland security functions other than just the new Department) is in OMB, *Budget of the United States Government, Fiscal Year 2004*, op. cit., p. 315.

Funding for Controlling Nuclear Warheads, Materials, and Expertise

As Table 4.2 shows, at \$656 million, the administration's funding request for FY 2004 for efforts to control nuclear warheads and materials, and expertise represents an increase of \$47 million, or almost 8%, compared to the final funding level approved by Congress. This increase is driven by increases in just a few programs – for the vast majority of these efforts, the budget proposed in FY 2004 is effectively identical to that proposed in FY 2003, without even an increase for inflation. In the sections that follow, we discuss the budget highlights under each of these goals in stopping terrorists on the pathway to the bomb, with charts showing the programs within each, and notes on any appropriate caveats and assumptions.

Of the \$47 million change, \$16 million is accounted for by a new DOE proposal called the Accelerated Materials Disposition initiative (\$30 million is being requested for this new program, but Congress on its own initiative appropriated an additional \$14 million towards these activities in FY 2003 before the administration's request even arrived). In this initiative, DOE will use \$25 million to begin purchasing a low-enriched uranium (LEU)

reserve blended from Russia's HEU stockpile.³³ The remaining \$5 million would be for other initiatives to accelerate the reduction in Russia's HEU stockpile or the conversion of HEU-fueled research reactors to LEU, following agreement to explore such options at the May 2002 Bush-Putin summit.

Another \$13 million of the increase is accounted for by an increase in the appropriation being requested for the program to dispose of Russia's excess weapons plutonium. DOE is requesting \$47 million in FY 2004, after requesting \$34 million in new funds in FY 2003 (though DOE also anticipated using \$64 million in FY 2003 from previous unobligated balances, which are no longer available this year – so the total amount slated for this purpose this year will actually be less than half the amount budgeted for FY 2003). DOE also requested a dramatic increase – from \$350 million to \$609 million – for disposition of U.S. excess fissile materials, but like the administration, we do not include these figures in the budgets for threat reduction.³⁴

The third major increase is an additional \$8 million, to \$48 million in FY 2004, requested for the Department of Defense's Nuclear Weapons Storage Security program in Russia – which reflects

Table 4.2 – Aggregate Proposed and Approved U.S. Budgets for Controlling Nuclear Weapons, Material, and Expertise in the Former Soviet Union

Dollars in Millions	FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
	Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
Securing Warheads and Materials	356.0	288.5	286.8	303.4	16.6	5.8%
Interdicting Nuclear Smuggling	120.0	105.3	105.3	104.4	-0.9	-0.9%
Stabilizing Employment for Nuclear Personnel	108.0	85.3	84.9	89.0	4.1	4.9%
Monitoring Stockpiles and Reductions	22.9	34.9	34.7	35.6	1.0	2.8%
Ending Further Production	55.9	49.3	49.0	50.0	1.0	2.0%
Reducing Excess Stockpiles	16.5	34.0	47.7	73.1	25.4	53.3%
TOTAL	679.2	597.4	608.3	655.5	47.2	7.8%

³² Bush, "President Speaks on War Effort to Citadel Cadets: Remarks by the President at the Citadel, Charleston, South Carolina," op. cit.

³³ DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 738.

optimism that the disagreements over access that have slowed progress in that program to a crawl in recent years have now been largely overcome.

No other program is requesting a budget in FY 2004 that differs from its FY 2003 request by more than \$3 million.

The degree to which the funds requested for FY 2004 are sufficient to make progress at the maximum practical rate varies for each of the six categories of effort focused on controlling nuclear weapons, materials, and expertise.

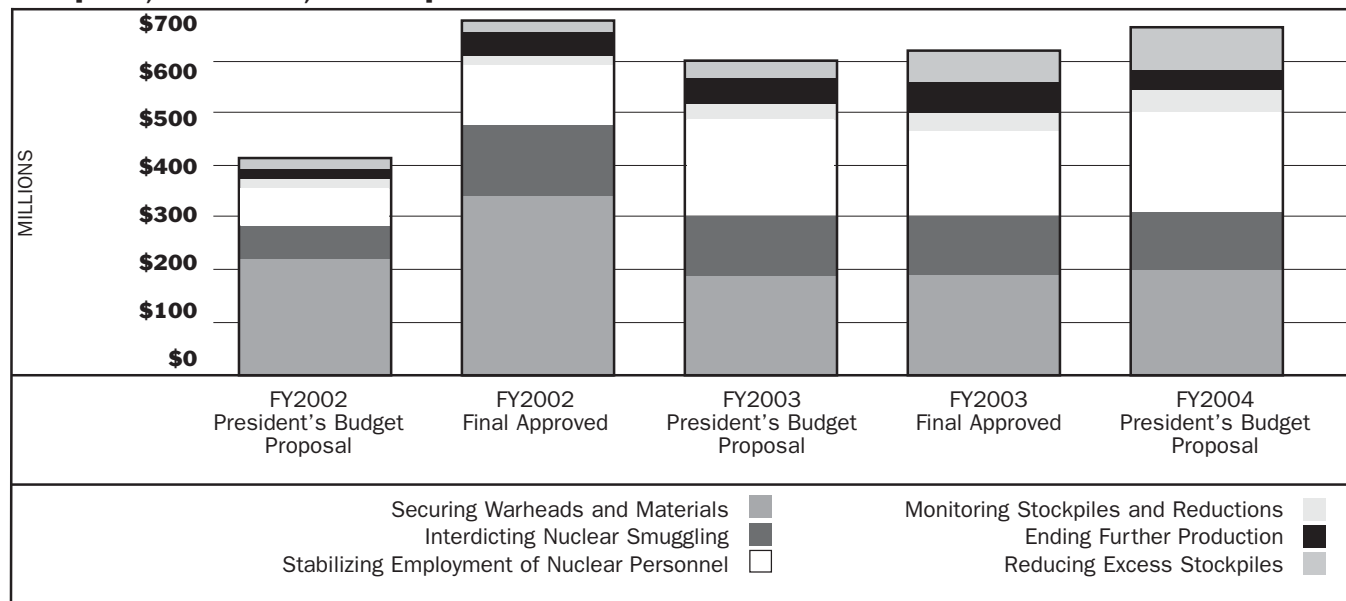
Securing Nuclear Warheads and Materials.

For this most urgent part of the mission, there is a mixed picture. For nuclear warhead security, funds are not the principal issue. As described in the next chapter, because of disputes over access to sensitive sites, there have been substantial delays in programs to improve security for Russian nuclear warheads –

meaning that there are substantial available funds as yet unspent for that purpose,³⁵ and increases in funding absent a resolution of the policy issues would have little impact on accelerating the program. Funding the new initiative on securing and dismantling warheads we propose in this report, however, would require additional funds, as that would include assistance for dismantling thousands of high-risk warheads, which is not currently funded. (See “Securing, Monitoring, and Dismantling the Most Dangerous Warheads,” p. 132.)

For nuclear materials, the principal ongoing effort is DOE’s MPC&A program. DOE’s program managers concluded that the opportunities now available to cooperate with Russia and other countries in securing nuclear and radiological materials were sufficient to require a budget of \$232 million for the relevant programs in FY 2004 (an increase of over \$30 million, or almost 15%, from the comparable FY 2003 funding

Figure 4.2 – Recent Changes in U.S. Budget Levels for Controlling Nuclear Weapons, Materials, and Expertise in the Former Soviet Union



³⁴ An argument could be made that these figures *should* be included in threat reduction budgets, because U.S. disposition is being done in part to make parallel Russian disposition possible. By that argument, however, all budgets for implementing arms reductions in the United States should also be included in threat reduction budgets, which is never done.

³⁵ While there remain substantial funds that are unspent, the amount that are “unobligated” – not yet tied up in contracts – has been greatly reduced, as in the summer of 2002, the Defense Department entered into a contract with a major U.S. firm to oversee implementation of security upgrades at Russian nuclear warhead storage sites; the actual upgrades will then be done by Russian subcontractors paid by the U.S. firm.³⁶ Hoehn, “Observations on the President’s Fiscal Year 2004 Budget Request for Nonproliferation Programs in Russia and the Former Soviet Union,” op. cit.

Table 4.3 – U.S. Funding for Securing Warheads and Materials in the Former Soviet Union

Dollars in Millions	Dep't	FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
		Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
Material Protection, Control, & Accounting ^[1,2]	DOE	266.6	203.1	201.5	203.0	1.5	0.7%
Nuclear Weapons Storage Security – Russia	DOD	55.0	40.0	40.0	48.0	8.0	20.0%
Nuclear Weapons Transportation Security – Russia	DOD	9.5	19.7	19.7	23.2	3.5	17.8%
Russian HEU Fuel Return ^[1]	DOE	1.0	9.5	9.5	9.7	0.2	2.5%
RERTR Program ^[1,3]	DOE	5.6	5.8	5.7	8.9	3.1	54.9%
BN-350 Fuel Security ^[1]	DOE	15.9	8.1	8.1	8.3	0.2	2.5%
Russia/NIS Safeguards Sustainability ^[1]	DOE	2.3	2.3	2.3	2.4	0.1	2.5%
TOTAL		356.0	288.5	286.8	303.4	16.6	5.8%

^[1] FY 2003 Final Approved includes the estimated impact of the 0.65% across-the-board rescission ordered by the FY 2003 *Consolidated Appropriations Resolution* (Public Law 208-7).

^[2] All years exclude Second Line of Defense funding. FY 2003 reflects removal of \$6 million for Nuclear Assessment Program, which has been proposed to be moved to the Department of Homeland Security. FY 2004 includes \$1 million for Accelerated Material Consolidation & Conversion (MCC) as part of Accelerated Material Disposition initiative.

^[3] Includes Russian and non-Russian RERTR components, as well as \$3 million in FY 2004 for RERTR from the Accelerated Material Disposition initiative.

level), but the Office of Management and Budget cut this proposed allocation to \$203 million for the comparable activities.³⁶ This is almost \$64 million less than Congress allocated in FY 2002 for the same core activities of the MPC&A program after the September 11 attacks – a 24% cut. In FY 2003, the administration justified a request well below the FY 2002 appropriated level by arguing that the funds provided in FY 2002 would take some time to spend out – but that argument is no longer a strong one, as virtually all of the FY 2002 funds will have been obligated before FY 2004 begins.

Given the other constraints – particularly slowdowns caused by the modest degree of genuine U.S.-Russian partnership that exists in designing and implementing the effort, and bureaucratization on both sides – more money alone would not be likely to lead to a substantial acceleration or

strengthening of the effort. But if intensive leadership succeeded in overcoming the non-monetary impediments to progress, more money would be needed to implement the accelerated effort we recommend. (See “An Accelerated U.S.-Russian Nuclear Security Partnership,” p. 118.) Additional funds would also be needed to expand the effort to other countries beyond the former Soviet Union (where such efforts are urgently needed, in some cases); to put in place security upgrades able to address more substantial threats;³⁷ to expand the program to cover additional nuclear warhead facilities; or to more rapidly address the most dangerous radiological materials. Similarly, more funds would be needed to finance a “global cleanout” effort to rapidly remove the weapons-usable nuclear material from the world’s most vulnerable sites, as recommended in this report. (See “Global Cleanout,” p. 115.

³⁶ Hoehn, “Observations on the President’s Fiscal Year 2004 Budget Request for Nonproliferation Programs in Russia and the Former Soviet Union,” op. cit.

Table 4.4 – U.S. Funding for Interdicting Nuclear Smuggling in and around the Former Soviet Union

Dollars in Millions	Dep't	FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
		Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
Second Line of Defense ^[1,2]	DOE	46.2	24.0	24.0	24.0	0.0	0.0%
WMD Proliferation Prevention	DOD	0.0	40.0	40.0	39.4	-0.6	-1.5%
International Counterproliferation ^[3]	DOD	8.4	9.0	9.0	9.0	0.0	0.5%
Export Control and Border Security (NADR Account) ^[1,4]	State	27.9	17.4	17.4	17.0	-0.4	-2.1%
Export Control and Border Security (FREEDOM Support Act)	State	20.5	0.0	0.0	0.0	0.0	N/A
Georgia Border Security and Law Enforcement ^[1,5]	State	17.0	15.0	15.0	15.0	0.0	0.0%
TOTAL		120.0	105.3	105.3	104.4	-0.9	-0.9%

[1] For FY 2003 Final Approved, the impact of the 0.65% across-the-board rescission ordered by the FY 2003 *Consolidated Appropriations Resolution* (Public Law 208-7) is not known at the time of this printing, because the administration may exercise flexibility in applying the rescission to these programs.

[2] This program's funding is actually listed under the Material Protection, Control, & Accounting line. FY 2002 reflects share of additional funding out of \$120 million and \$30 million in supplemental funding for MPC&A, contained in Public Laws 107-117 & 107-206.

[3] FY 2004 is estimated, until further information is made available by the Department of Defense.

[4] Includes only those funds from this account directed for former Soviet Union export control and border security. Total account funding is \$41.7, \$36, and \$40 million in FY 2002, 2003, and 2004 respectively.

[5] FY 2004 is estimated, until further information is made available by the State Department.

Interdicting Nuclear Smuggling. For this part of the mission, the most critical requirement is to put in place a comprehensive prioritized plan integrating the many different efforts now underway – a task that, at this writing, the administration has nearly completed.³⁸ Once that is accomplished, however, in many cases the pace of these efforts is significantly limited by available funds – with more funds, the pace at which critical

border crossings could be equipped with effective nuclear detection equipment, or the numbers of key law enforcement and border control personnel who could be trained, could be significantly increased.

Stabilizing Employment for Nuclear Personnel. There is little doubt that if the United States wishes to have any significant impact on the eco-

³⁷ Currently, the MPC&A program is installing upgrades intended to be able to defeat fairly modest threats, such as a single insider attempting to steal material, or a small group of outsiders attacking a facility to steal material, or both working together. These upgraded security systems would not be capable of handling larger threats, such as the 40 heavily armed and suicidal terrorists who took over a Moscow theater in October 2002. If a decision were taken to cooperate with Russia and other countries to secure nuclear facilities against more substantial threats, substantially more investment would be needed to secure each facility. Currently, for example, the program is generally not installing some types of upgrades, such as perimeter intrusion, detection, and assessment systems (PIDAS), because they are judged to be too expensive. (Personal communications with U.S. laboratory participants, September 2002.)

³⁸ Interviews with State Department and Department of Energy officials, February 2003. For discussion of the plan's contents, also see, Ambassador Norman Wulf, Special Representative to the President for Nonproliferation, U.S. Department of State, "Nuclear Nonproliferation and Efforts to Help Other Countries Combat Nuclear Smuggling" (testimony before U.S. Senate, Armed Services Committee, Subcommittee on Emerging Threats, July 30, 2002; available at http://www.senate.gov/~armed_services/statemnt/2002/July/Wulf.pdf as of February 7, 2003).

THE G-8 GLOBAL PARTNERSHIP

In June 2002, the leaders of the Group of Eight (G-8) industrialized democracies agreed to launch a new “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction.”¹ The agreed purpose of the partnership is to “to prevent terrorists, or those that harbor them, from acquiring or developing nuclear, chemical, radiological and biological weapons; missile, and related materials, equipment and technology.”

To fulfill that mission, they agreed on three essential elements:

- A commitment to provide \$20 billion over the next 10 years for threat reduction projects, with half coming from the United States and half coming from the other G-8 partners (hence the nickname “10+10 over 10” for this initiative);
- Agreement with Russia on a set of procedures that would allow these funds to be spent effectively (addressing issues that had delayed progress in many countries’ efforts at cooperative threat reduction, such as taxes on assistance, access to sites where cooperation is underway, and liability protection);
- A commitment by each of the participants to a set of nonproliferation principles – ranging from strengthening multilateral nonproliferation regimes to a pledge by each participant to maintain “appropriate” and “effective” security for their own WMD stockpiles, and to cooperate to interdict WMD smuggling.²

Most of the small amount of public attention this initiative has received has focused on the first point – the commitment by the other members of the G-8 to match the U.S. monetary contribution to threat reduction cooperation. But realistically,

the first point cannot be implemented unless Russia and other recipient states deliver on the second point – the procedures that will allow the funds to be effectively spent. And the third point may be equally crucial for the long term: this commitment to key principles can serve as the basis for developing effective global nonproliferation standards – including standards for security for nuclear materials.³

The G-8 leaders also agreed at the June 2002 summit that most of the projects that would be carried out under this initiative would be implemented bilaterally, in cooperation between a donor country and Russia or other recipient countries. This is how cooperative threat reduction programs have generally been implemented in the past. They agreed, however, to establish “an appropriate mechanism for the annual review of progress under this initiative which may include consultations regarding priorities, identification of project gaps and potential overlap, and assessment of consistency of the cooperation projects with international security obligations and objectives.” Senior G-8 officials met in Ottawa, Canada in September 2002 to begin the process of coordinating implementation of this initiative,⁴ and there have been a number of subsequent meetings, both multilateral and bilateral, to flesh out specific commitments and projects.⁵

As of late 2002, some \$15.5 billion of the \$20 billion total had been pledged, with \$10 billion to come from the United States, \$2 billion from Russia itself, \$1.5 billion from Germany, \$750 million from the United Kingdom, \$650 million from Canada, \$400 million from Italy, and \$200 million from Japan. France, the chairman of the G-8 for this year, is expected also to make a substantial contribution, but as of late 2002 the specifics had

nomic future of the 10 entire cities in Russia where most of Russia’s nuclear materials and nuclear personnel reside, it will have to allocate more than \$40 million a year to the task (the proposed budget for the “Russia Transition Initiatives,” comprising both the Nuclear Cities Initiative and Initiatives for Proliferation Prevention). This is sim-

ply not enough to have more than a marginal effect on the outcome of these cities’ wrenching transition away from nuclear weapons work. Here, too, however, the issue is much more than money – as described later in this report, fundamental reforms of these efforts and sustained political leadership to push them forward will be needed if

not been determined.⁶ Most of the new funds pledged have already been committed, at least conceptually, to particular projects in Russia – including particularly destruction of chemical weapons, disposition of excess plutonium, dismantlement of attack submarines, and re-employing WMD scientists.

Much remains to be done to fulfill the promise of the Global Partnership. Russia needs to take action – possibly including passing new legislation – to fulfill its commitments to provide the needed tax exemptions, access, and liability protections. The states contributing financially need to bring of pledges up to the \$20 billion target, and make arrangements to actually fulfill their pledges. (There is an unfortunate past history in the G-8 of unmet summit pledges.) Mechanisms need to be put in place to coordinate projects to avoid overlap, agree on the highest priorities and us resources on them, outline goals and timetables for achieving them, and report on progress. (The new NATO-Russia Council might provide an effective forum for leading and shaping the global effort.) The initiative needs to be broadened beyond the G-8 to the other nations around the world. And the participants need to make the non-proliferation commitments enunciated in the partnership – including the commitment to effective security and accounting for all nuclear stockpiles – effective, by spelling out what these commitments mean, and how each participant will assure the others they are being met, in more detail. It is crucial to make substantial progress on all these fronts by the next G-8 summit in June 2003, if the momentum of the Global Partnership is not to be lost.

¹ The text of the G-8 commitment can be found at Group of Eight, “The G8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction” (state-

ment by G-8 leaders, Kananaskis, Canada, June 2002; available at <http://www.g8.gc.ca/kananaskis/globpart-en.asp> as of January 13, 2003). For a general description of this initiative, see Cristina Chuen, Michael Jasinski, and Tim Meyer, “The 10 Plus 10 Over 10 Initiative: A Promising Start, But Little Substance So Far” (Monterey, Cal.: Center for Nonproliferation Studies, Monterey Institute for International Studies, August 12, 2002; available at <http://cns.miis.edu/pubs/week/020812.htm> as of January 18, 2003); further elaboration can be found in John Wolf, “Assistant Secretary of State for Nonproliferation John Wolf Provides Details on G-8 Global Partnership Against the Spread of Weapons and Materials of Mass Destruction,” interview by Leonard Spector (Monterey, Cal.: Center for Nonproliferation Studies, September 9, 2002; available at <http://cns.miis.edu/pubs/week/020909.htm> as of January 13, 2003); a very useful discussion of the status after the first several months of effort can be found in U.S. Senate Committee on Foreign Relations, “A Progress Report on 10 + 10 Over 10: A Hearing,” 107th Congress, 2nd Session, October 9, 2002 (transcript available on *LexisNexis* Congressional Information Service, Bethesda, Maryland).

² For the complete list, see 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).

³ See “Building Effective Global Nuclear Security Standards,” p. 157.

⁴ See John Bolton, Under Secretary of State for Arms Control and International Security Affairs, October 2002 testimony in “A Progress Report on 10 + 10 Over 10: A Hearing,” op. cit.

⁵ See, for example, Bryan Bender, “G-8 Nonproliferation Effort Picks Up Steam,” *Global Security Newswire*, December 20, 2002 (available at http://www.nti.org/d_newswire/issues/newswires/2002_12_20.html#1 as of January 21, 2003).

⁶ Personal communications from participants in the conference on the Nonproliferation and Disarmament Cooperation Initiative sponsored by the European Commission, December 2002.

the mission of providing alternative accomplished. (See “Stabilizing Employment for Nuclear Personnel,” p. 141.) The International Science and Technology Centers are another area where increased funding could lead directly to increased progress: though U.S. and international funding for them remains strong, they have a backlog of pro-

jects that would employ former weapons of mass destruction experts, and have been approved as worthy and meeting the Centers’ objectives, but remain unfunded due to insufficient budgets.

Monitoring Stockpiles and Reductions. Here, the most critical issues blocking or delaying

Table 4.5 – U.S. Funding for Stabilizing Employment for Nuclear Personnel in the Former Soviet Union

Dollars in Millions		FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
	Dep't	Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
International Science and Technology Centers ^[1]	State	37.0	32.0	31.8	35.0	3.2	10.1%
Civilian Research and Development Foundation ^[2]	State	14.0	14.0	14.0	14.0	0.0	0.0%
Initiatives for Proliferation Prevention ^[1,3]	DOE	36.0	22.6	22.4	23.0	0.5	2.3%
Nuclear Cities Initiative ^[1]	DOE	21.0	16.7	16.6	17.0	0.4	2.5%
TOTAL		108.0	85.3	84.9	89.0	4.1	4.9%

[1] FY 2003 Final Approved includes the estimated impact of the 0.65% across-the-board rescission ordered by the FY 2003 *Consolidated Appropriations Resolution* (Public Law 208-7).

[2] FY 2004 is estimated, until further information is made available by the State Department. For FY 2003 Final Approved, the impact of the 0.65% across-the-board rescission ordered by the FY 2003 *Consolidated Appropriations Resolution* (Public Law 208-7) is not known at the time of this printing, because the administration may exercise flexibility in applying the rescission to this program.

[3] FY 2002 includes \$15 million from FY 2002 Supplemental appropriations.

progress are almost entirely policy issues – in most cases more money for these efforts would not bring much additional progress unless those policy issues were resolved. As discussed later in this report, however, success in putting in place a declarations and monitoring regime to build confidence that agreed reductions are being implemented, that nuclear stockpiles are safe and secure, and that assistance funds are being used appropriately, is likely to require providing substantial incentives for Russian agreement – strategic or financial. In the proposal discussed in this report, for example, funding would be needed to provide assistance for warhead dismantlement, in return for agreement on measures to confirm that the dismantlement was taking place, without compromising classified information. (See “Securing, Monitoring, and Dismantling the Most Dangerous Warheads,” p. 132, and “Monitoring Stockpiles and Reductions, p. 147.)

Stopping Production. The U.S. government has allowed the schedule for the effort to shut down production of weapons plutonium in Russia to slip to 2011.³⁹ After many years of delays caused by constantly shifting approaches and bureaucratic disputes between the United States and Russia, progress still appears to be being substantially slowed by disputes over matters such as access to relevant sites, and inability to reach agreement on which land on which to build and the permits to build replacement fossil power facilities. If such obstacles were overcome, the job could be done far more quickly, as the time required to build a new coal-fired power plant from start to finish is usually roughly 3 years. More money alone could not overcome these obstacles, but if combined with an intensive effort to get past the roadblocks, more money – to make it possible to contract immediately for the full cost of building the relevant power supplies – might well contribute to accelerating this effort.

³⁹ Under current plans, the two plutonium production reactors at Seversk would shut by 2008, and the one at Zheleznogorsk by 2011. DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 713. This represents a delay of one year for Seversk and 3 years for Zheleznogorsk, compared to projections as recently as May 2002. (Personal communication from James Mulkey, program manager, May 2002.)

Table 4.6 – U.S. Funding for Monitoring Russian Stockpiles and Reductions

Dollars in Millions	Dep't	FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
		Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
HEU Transparency Implementation ^[1,2]	DOE	13.9	17.2	17.1	18.0	0.9	5.2%
Warhead Dismantlement Transparency ^[1]	DOE	7.5	16.2	16.0	16.1	0.1	0.6%
Trilateral Initiative ^[3]	DOE	1.5	1.5	1.5	1.5	0.0	0.0%
TOTAL		22.9	34.9	34.7	35.6	1.0	2.8%

^[1] FY 2003 Final Approved includes the estimated impact of the 0.65% across-the-board rescission ordered by the FY 2003 *Consolidated Appropriations Resolution* (Public Law 208-7).

^[2] FY 2002 funding reflects an appropriation transfer to Program Direction for an office move and additional staffing and travel in the amount of \$70,000 approved by Congress in early FY 2003.

^[3] While funding for this activity is embedded in a larger budget line item, in recent years, this project has been funded at approximately \$1.5 million per year.

The issues blocking progress on activities such as confirming the U.S. and Russian statements that each country has stopped production of HEU, negotiating a verifiable multilateral ban on producing additional plutonium and HEU for weapons, and putting in place a moratorium on further separation of weapons-usable civilian plutonium in Russia (as was being negotiated during the Clinton administration) are primarily policy issues. But if those policy issues could be successfully addressed, each of those initiatives would require additional funding for successful implementation.

Reducing Stockpiles. Here, too, there is a mixed picture: in essence, the current budget provides sufficient funds for current approaches, but not enough to pursue new, faster ways of getting the job done.

More than 80% of the entire increase in DOE's nonproliferation budget that the Bush administration is requesting for FY 2004 (that is, more than just nuclear materials and expertise in the former Soviet Union) is devoted to disposition of excess plutonium in the United States and Russia. (Including the additional money to reduce excess HEU, it is over 90% percent of the increase for the total DOE nonproliferation budget). With this increased budget, and the five-year budget plan

for plutonium disposition the administration committed to in early 2002 (which entails further increases next year), sufficient funds should be available to remove lack of money as a major impediment to disposition of U.S. excess plutonium – with the important exception that under current plans, there would not be sufficient funds to finance continued work on immobilization as a complement or alternative to burning the excess plutonium as reactor fuel. For employment for nuclear experts and workers who are no longer needed is to be disposition of Russian excess plutonium, money is still a serious issue. The program to reduce Russia's excess plutonium stockpile has been delayed for years by a variety of factors, including lack of funds to build the necessary facilities; efforts are still underway to pull together an international financing package. As a result of the \$20 billion G-8 pledge for the Global Partnership, the prospects for international financing now look much more promising. Nevertheless, it seems clear that the decision to rely on an international funding approach, rather than paying for this effort with U.S. funds and allowing other nations to fund other priorities, has already delayed progress and will likely result in a more complex and less responsive management structure, reporting to multiple governments, in the future.

Table 4.7 – U.S. Funding for Ending Further Production in Russia

Dollars in Millions		FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
	Dep't	Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
Elimination of Weapon-Grade Plutonium Production ^[1]	DOE	55.9	49.3	49.0	50.0	1.0	2.0%
TOTAL		55.9	49.3	49.0	50.0	1.0	2.0%

[1] FY 2002 Final Approved reflects \$4.2 million from the International Nuclear Safety program to incorporate short-term safety upgrades to the reactors, \$10.0 million from FY 2002 supplemental (Public Law 107-206), and \$41.7 million from FY 2002 and \$32.1 million from FY 2003 authorized to be moved from DOD (Public Law 107-314). FY 2003 Final Approved includes the estimated impact of the 0.65% across-the-board rescission ordered by the FY 2003 *Consolidated Appropriations Resolution* (Public Law 208-7).

For HEU, sufficient funds are in place to carry out the current approaches to disposition of U.S. HEU, and for the purchase of Russian HEU (which is financed primarily through commercial means rather than government expenditure). For FY 2004, the administration has requested \$30 million for accelerated purchases of excess HEU from Russia – enough for a quite modest increase in the pace of such purchases, amounting to roughly a 5% addition to the 30 tons per year already being purchased. In addition to the purchase, however, DOE hopes to use these funds to help finance additional blend-down of small, vulnerable stockpiles of HEU in Russia, ultimately reaching five tons per year. A larger-scale acceleration of the blend-down rate, as proposed in this report, would require additional funding. (See “Reducing HEU Stockpiles – An Accelerated Blend-Down Initiative,” p. 154.)

Conclusion

There remains a substantial gap between the scope and urgency of the threat President

Bush has identified and the efforts the United States is making to address it. In each of the critical inputs to the effort we have examined – political leadership, organization and planning, information, and resources – much more can and should be done to address the threat of terrorists getting nuclear explosives than is now being done. As we will outline in the next chapter, the predictable result is that while substantial progress has been made in many programs focused on reducing this threat, more of the work remains to be done than has been done so far, and the pace at which the job is being finished remains unacceptably slow. It is simply not the case that the U.S. government is doing everything in its power to prevent a terrorist nuclear attack on the United States from occurring. But the President is right – the threat is substantial enough that “everything in our power” is the standard by which efforts to reduce this threat should be judged.

Table 4.8 – U.S. Funding for Reducing Excess Russian Stockpiles

Dollars in Millions		FY 2002	FY 2003		FY 2004	Change from FY 2003 Final	% Change from FY 2003 Final
	Dep't	Final Approved	President's Budget Proposal	Final Approved	President's Budget Proposal		
Russian Plutonium Disposition ^[1,2]	DOE	16.5	34.0	33.8	47.1	13.3	39.4%
HEU/LEU Purchase and Stockpile ^[1,3]	DOE	0.0	0.0	13.9	25.0	11.1	79.7%
HEU Reactor Fuel Purchase ^[3]	DOE	0.0	0.0	0.0	1.0	1.0	N/A
TOTAL		16.5	34.0	47.7	73.1	25.4	53.3%

^[1] FY 2003 Final Approved includes the estimated impact of the 0.65% across-the-board rescission ordered by the *FY 2003 Consolidated Appropriations Resolution* (Public Law 208-7).

^[2] FY 2002 Final Approved excludes \$42 million, a \$63,549 rescission, and transfer to Program Direction for an office move and additional staffing and travel in the amount of \$2.48 million. FY 2003 Proposal and Final Approved exclude \$64 million in expenditures from carryover balances.

^[3] An additional \$3 million for reducing HEU stockpiles is proposed as part of the RERTR program, and \$1 million is proposed as part of Material Consolidation and Conversion program in the MPC&A program.

5. Output Measures: How Much Is Done, And How Fast is the Rest Getting Done?

After more than 10 years of effort in cooperative threat reduction, and a year and a half after the September 11 attacks, two questions must be asked:

- How much of what needs to be done to keep nuclear weapons, materials, and expertise out of the hands of terrorists and hostile states has already been accomplished?
- How fast is what's left to be done being finished?

Our effort to answer these questions is complicated by the fact that no integrated plan for these efforts exists, setting out all the work that needs to be done. In addition, many specific programs have not publicly outlined their objectives and measurable milestones for meeting them against which their progress could be judged.

Below, therefore, we have used the government's own performance measures and data where these are available, and where they are not, we have attempted to develop our own statements of the objectives these programs should be reaching, rough metrics by which progress toward these objectives can be assessed, and estimates of how much of those metrics have been completed. Where estimates were required, we have tried to be generous, to avoid understating the work accomplished in these programs to date.

In this chapter, we provide only simple, top-level measures that are inevitably incomplete (as we discuss in each case); for more detailed and nuanced program-by-program assessments of the progress of and problems facing each of these efforts, see this report's on-line companion.¹ We recommend, in keeping with the Government Performance and Results Act, that each of these programs publish

clearly defined descriptions of the objectives they are seeking (including the final end state at which their program could be considered "finished"), and clearly defined approaches that can be used to assess how much progress is being made in meeting these objectives.

From the review of dozens of threat reduction programs presented in the on-line companion to this report, there is a clear and impressive record of accomplishment. While cooperation in these sensitive areas has been difficult, and there have been plenty of problems and missteps along the way, the reality is that as a result of cooperative programs already underway hundreds of tons of nuclear material and thousands of nuclear weapons are demonstrably more secure; enough nuclear material for thousands of nuclear weapons has been permanently destroyed; and thousands of underemployed nuclear weapons experts have received support for redirecting their talents to civilian work. These efforts have represented an extremely cost-effective investment in the security of the United States, Russia, and the world. But that review also makes clear that much more remains to be done – and that the pace at which it is now being done simply does not match the urgency of the threat.

Assessing Three Types of Threat Reduction Programs

Ideally, one would like to answer the question: "how much have we reduced the risk of a terrorist setting off a bomb in a U.S. city?" Unfortunately, progress toward that goal cannot be measured directly. There is not even any way to accurately measure how much various programs have increased the probability of blocking each of the steps on the terrorist pathway to the bomb. Efforts to maintain nuclear deterrence during the Cold War

¹ *Controlling Nuclear Warheads and Materials* (available at <http://www.nti.org/cnwm> as of March 12, 2003).

faced the same problem: an absolutely critical objective with no clear and direct means for measuring how much progress was being made toward achieving it. In both cases, the best that can be done is to develop theories of what steps would lead to accomplishing the objective – providing capable and survivable nuclear forces in one case, securing and accounting for nuclear stockpiles and the other steps to block the terrorist pathway to the bomb outlined above in the other – and then attempt to develop reasonable measures of the degree to which these steps are being accomplished. In the case of threat reduction efforts, the job of measuring progress is made particularly difficult by the wide range of different purposes being pursued, and the intangible nature of many of the most important elements of some programs.

For the purposes of developing measures of progress, the many cooperative threat reduction programs fall into three principal categories, based on what they are seeking to accomplish.

Dismantling and destroying excess arms and facilities. Programs involved in eliminating ballistic missiles, destroying chemical weapon stockpiles, and dismantling weapons production facilities typically have readily quantifiable metrics – the number of relevant items destroyed.² A more informative figure is the *fraction of the total* destroyed, making it possible to judge whether the number destroyed represents just scratching the surface, nearly finishing the job, or something in between. If data is available, a useful complementary performance metric is one based on cost-effectiveness – for example, weapons dismantled per million dollars spent. This makes it possible to compare the efficiency of different programs performing similar functions, or to judge how much more one is paying to move from one approach (e.g., securing nuclear materials in place) to another (e.g., destroying those nuclear materials permanently).

Even where readily measurable metrics are available, they should be used with caution, as they can often be misleading. Even in the private sector, with the discipline of the market, one cannot simply look at profits each quarter as the only measure of performance of a business unit: during one period that unit may make minimal profit because it is investing in order to achieve greater profits in the future. Hence a “balanced scorecard” reflecting a variety of measures of how units are performing with respect to the overall goals of the organization is required.³ Much the same is true in threat reduction: spending a year investing to double the capacity of a dismantlement facility, for example, would show up in an assessment based strictly on how many items were dismantled each year as a year in which nothing was accomplished. Plutonium disposition is an extreme case, in which the entire nine-year program to date has been focused on investing to prepare for beginning to reduce excess plutonium stockpiles in the future. One can debate whether this preparation should have been accomplished more quickly, but one cannot judge the program to be a failure simply because no substantial amount of weapons plutonium has yet been eliminated.

Reemploying excess scientists and workers. Here, too, intuitively a simple metric – the number of jobs provided by projects supported by a U.S. program, or the fraction of the target population provided with jobs in this way – seems called for. Here again, however, such a metric can be misleading. The reality is that in a market economy, as Russia is now becoming, nuclear weapons scientists and workers will find jobs wherever seems to make the most sense to them, and this will often be in firms or organizations *not* receiving direct financial support from U.S. programs. But those other jobs may have come into existence because of improvements in the business and investment climate generated in part with help from U.S. programs. Measuring how much the business climate

² The Defense Department, in particular, makes constant use of this metric. See Defense Threat Reduction Agency, “Cooperative Threat Reduction Scorecard,” November 22, 2002 (available at http://www.dtra.mil/ctr/ctr_score.html as of January 21, 2003).

³ There is a vast literature on performance assessment and its use to improve management in both the public and private sectors, which we do not propose to review here. See, as a start, the website of the Balanced Scorecard Institute (available at <http://www.balancedscorecard.org> as of January 21, 2003).

of an area has improved, and how much of that improvement should be attributed to U.S. programs as opposed to other causes, is extraordinarily difficult. Reasonable metrics for assessing this kind of effect have not yet been developed.

Permanently improving the performance of certain government functions.

Many threat reduction programs are not focused on dismantling a certain number of missiles or providing a certain number of jobs, but on changing how a recipient government does its business – for example, improving implementation of export controls, strengthening security for nuclear material, or bolstering efforts to interdict nuclear smuggling at national borders. In each of these cases, one can measure the number of sites with particular types of equipment installed, or personnel provided with particular types of training, but these measures are at best incomplete: if the people using this equipment or provided this training are not motivated to carry out the mission properly, it still will not get done even with the best equipment and training in the world.⁴ Indeed, experience in other areas of international assistance suggests that programs that focus *only* on providing equipment and training to accomplish a specific technical mission – from tax collection in Bolivia to health care delivery in Botswana – usually have little long-term benefit. The program helps for a while, and then the trainees move on to other jobs, the equipment

breaks or wears out, and the system is back to where it started. Only if the programs focus on modifying the entire system in which the function is performed (from the power and budgets of the agencies doing the work, to the regulations specifying what work should be done, to the way the people doing the work are recruited, hired, trained, paid, and promoted) do such assistance programs typically have long-term benefits.⁵ Assessing how well programs are doing in the complex job of shifting the way thousands of people in a foreign country do their jobs day to day, and how much of this will last after the assistance program comes to an end, is extraordinarily difficult.⁶ Much of the future of threat reduction is in these areas, and many of the most important factors for ensuring U.S. and world security in these areas are difficult-to-measure intangibles.⁷

Accounting for a dynamic picture. Metrics often focus on how much of a task of fixed size has been accomplished – what fraction of the total number of weapons has been dismantled, for example. This is the approach taken in the discussion below, as well. The reality, however, is that for many of these programs, the size of the task is itself changing over time – in part as the result of successes or failures in other U.S. programs. As warheads are dismantled, for example, the number of warheads to be secured shrinks (and the number of sites where they are located may shrink), but the

⁴ For a useful discussion of the critical importance of how well individual people perform their roles to maintaining good security for nuclear material, see Igor Khripunov and James Holmes, eds., *The Human Factor and Security Culture: Challenges to Safeguarding Fissile Materials in Russia* (Athens, Georgia: Center for International Trade and Security, University of Georgia, November 2002; available at <http://www.uga.edu/cits/publications/Humanfactor.pdf> as of February 23, 2003).

⁵ See, for example, Merilee S. Grindle, ed., *Getting Good Government: Capacity Building in the Public Sectors of Developing Countries* (Cambridge, Mass.: Harvard Institute for International Development, 1997).

⁶ The Materials Protection, Control, and Accounting (MPC&A) program, to its credit, is one of the only threat reduction programs that has made a serious attempt to draft a set of performance metrics that reflect the full complexities of meeting its overall mission. See Department of Energy (DOE), National Nuclear Security Administration, Materials Protection, Control and Accounting Program, *MPC&A Program Strategic Plan* (Washington, D.C.: DOE, July 2001; available at http://www.nti.org/db/nisprofs/russia/fulltext/doe_mPCA/doe2001/mpca2001.pdf as of February 5, 2003). Since then, however, it has continued to use only the simplest measures (such as the number of pieces of equipment provided, the number of people trained, and the fraction of material subject to particular types of upgrades) in its public statements assessing progress; it does not appear that much internal use is made of the more complex metrics outlined in the strategic plan either. (Interviews.)

⁷ See discussion in *Reshaping U.S.-Russian Threat Reduction: New Approaches for the Second Decade* (Washington, D.C.: Russian American Nuclear Security Advisory Council and Carnegie Endowment for International Peace, November 2002; available at http://www.ceip.org/files/Publications/ransac_report.asp?from=pubdate as of February 5, 2003).

amount of nuclear material outside of warheads that needs to be secured expands. The amount of nuclear material to be secured is also expanding as ever more plutonium is produced – but it is decreasing as highly enriched uranium (HEU) is blended down, and the plutonium figures will stop increasing and begin declining if programs to end plutonium production and begin reducing stockpiles of excess weapons plutonium are successful. These shifts in the overall magnitude of the task to be accomplished, often representing synergies among different threat reduction programs, should be considered in preparing an overall integrated plan for these efforts, and assessing when that plan will be completed.⁸

What U.S. programs can take credit for.

Another key issue in assessing the progress of these efforts is judging what fraction of the overall problem needs to be addressed by U.S. programs, and how much of whatever progress is being made is the result of these U.S. programs. Thousands of Russian nuclear warheads have been dismantled over the last decade, for example, but U.S. threat reduction programs did not pay for their dismantlement (though as discussed below, the purchase of nuclear fuel blended from the HEU from these weapons provided a financial incentive for their dismantlement).⁹ Russian nuclear weapons scientists are now being paid more, and paid on time, but this is the result of the Russian government getting its budgetary house in order, not the result of anything in particular the United States did. In both cases, it is clear the threat is being reduced, but this reduction should only be attributed to U.S. threat reduction programs when a clear causal link can be drawn.

In general, while U.S. threat reduction programs should not claim credit for events they did not

cause, nonetheless those events can reduce the overall scale of the problem to be addressed, and this must be taken into account. For example, while Russia plans to reduce the number of nuclear weapons workers by some 35,000 over the next few years (representing nearly half of its nuclear weapons workforce), this does not mean that U.S. programs need to create 35,000 new jobs for excess nuclear weapons workers: thousands of these individuals will retire or die over the next few years, and Russia's own conversion programs have already created thousands of jobs (by Russia's estimates), and are expected to create thousands more. Hence, a U.S. program that succeeded in creating 5,000 jobs for excess nuclear weapons workers might solve a quarter of the overall problem rather than only a seventh of the overall problem.

Keeping these caveats and difficulties in mind, we have developed a set of rough metrics for assessing how much of the job of controlling nuclear warheads, materials, and expertise has been accomplished, and how fast the remaining work is being done. Below, we provide discussions of rough metrics for such an assessment in each of the six categories described above.

Securing Nuclear Warheads and Materials

The overall goal in this category is simple: every nuclear weapon and every kilogram of nuclear material anywhere in the world must be secured and accounted for, to stringent standards. The best measure of progress, if the data were available, would be one that was performance-based: the fraction of buildings containing warheads or nuclear material that had demonstrated the ability to defend against a particular specified threat.¹⁰ (It is worth noting that the United States itself does

⁸ For a useful discussion, with initial illustrative calculations of possible impacts of these synergies on accelerating achievement of some threat reduction goals, see Leonard S. Spector, "Missing the Forest for the Trees: U.S. Nonproliferation Programs in Russia," *Arms Control Today* (June 2001; available at http://www.armscontrol.org/act/2001_06/specjun01.asp as of February 5, 2003).

⁹ Although Nunn-Lugar is often thought of as a weapon dismantlement effort, and it has paid for the dismantlement of many missiles, bombers, and submarines, it has never paid for the dismantlement of a single nuclear warhead – because so far Russia has not been willing to allow inspections to confirm that such warheads are in fact being dismantled. Nunn-Lugar has paid for thousands of warheads to be transported to central storage or dismantlement facilities, and the HEU purchase agreement has provided a financial incentive to dismantle warheads and extract their HEU for sale – but it remains unclear how much of the warhead dismantlement that has occurred would have happened in the absence of these efforts.

not do especially well by this metric: U.S. nuclear power plants fail to defend against the threat they are required to be able to cope with roughly half the time in performance tests, and the nuclear weapons facilities of the Department of Energy (DOE) reportedly have a similar record in defending against the larger threat they are required to be able to fend off.¹¹⁾

Unfortunately, for nuclear warheads and materials in the former Soviet Union, such data does not yet exist. The best publicly available surrogate, at this point, is the fraction of material that is at sites with two defined levels of security and accounting equipment upgrades installed – “rapid” upgrades and “comprehensive” upgrades. Rapid upgrades include items such as installing nuclear material detectors at the doors, putting material in steel cages that would take a considerable time to cut through, bricking over windows, and counting how many items of nuclear material are present. “Comprehensive” upgrades represent the installation of complete modern security and accounting systems, designed to be able to protect the facility against at least modest insider and outsider theft threats.

The fraction of material with particular types of upgrades installed, however, is at best a partial measure, as it ignores the many intangibles in changing the way the job of securing and accounting for nuclear material in these states is done,

which are critical to long-term success, but are very difficult to measure. The fraction of material with certain types of equipment installed understates progress in the sense that an enormous amount of work has been done that has national impact – improving regulations, providing training, and developing the infrastructure for supporting modern safeguards and security. At the same time, it overstates progress, in the sense that sites with these kinds of equipment installed may still not be adequately secured if procedures are not followed, equipment is not maintained and improved, and the like – that is, if the overall way that this job is done by the thousands of people involved has not changed for the better, in a way that will last. The Material Protection, Control, and Accounting (MPC&A) program has taken what should be considered a first cut at the complex task of developing appropriate metrics to assess the real state of progress toward achieving sustainable security at these sites for the long term¹² – but much more can and should be done to develop performance measures that adequately reflect the real state of progress, but are simple enough to be useful to policymakers.

Nuclear material in the former Soviet Union: fraction secured. Within the former Soviet Union, as of the end of fiscal year (FY) 2002, some 37% of the vulnerable weapons-usable nuclear material outside of warheads had rapid upgrades

¹⁰ This demonstration could be through realistic performance testing, where exercises are run in which insiders attempt to smuggle something out, or outsiders attempt to break in and steal something (such exercises are required at major nuclear facilities in the United States and some other countries), or through other means of rigorously assessing overall system vulnerabilities.

¹¹ David N. Orrik, testimony in “A Review of Enhanced Security Requirements at NRC Licensed Facilities,” House Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, 107th Congress, 2nd Session, April 11, 2002 (available at <http://energycommerce.house.gov/107/hearings/04112002Hearing532/Orrik908.htm> as of January 21, 2003). Also, see Project on Government Oversight (POGO), *U.S. Nuclear Weapons Complex: Security at Risk* (Washington, D.C.: Project on Government Oversight, October 2001; available at <http://www.pogo.org/nuclear/security/2001report/reporttext.htm> as of December 16, 2002).

¹² DOE, *MPC&A Program Strategic Plan*, op. cit. For assessing progress toward sustainable security over time, plausible metrics might include the fraction of sites with MPC&A systems that are performing effectively (as judged by performance tests, regulatory inspections, or other forms of expert review); the fraction of sites with long-term plans in place for sustaining their MPC&A systems, and resources budgeted to fulfill those plans; the priority the Russian government was assigning to the task (measured by senior leadership attention and resources assigned to the effort); the presence of stringent MPC&A regulations that were effectively enforced (assessed by expert reviews); and the presence of an effective infrastructure of personnel, equipment, organizations, and incentives to sustain MPC&A (again assessed by expert reviews, given the difficulty of quantification).

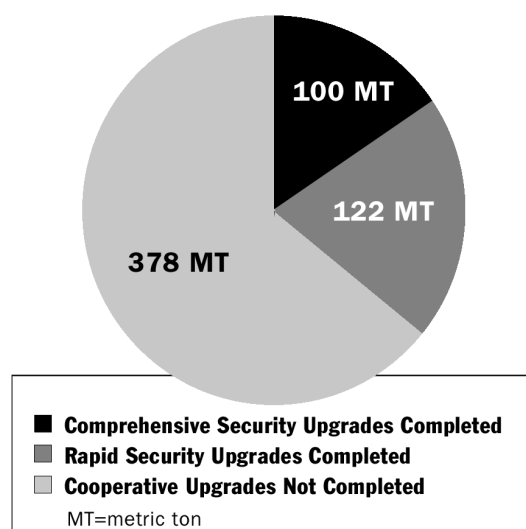
of security installed under the DOE's MPC&A program.¹³ (See Figure 5.1.)

This level of rapid upgrades falls far short of expectations: in early 2002, the program projected that rapid upgrades on 42% of the nuclear material would be completed by the end of FY 2002.¹⁴ The difference is accounted for by much slower than expected progress in completing rapid upgrades in the defense complex of Russia's Ministry of Atomic Energy (MINATOM), where most of Russia's nuclear material resides. (See Figure 5.3 for a breakdown of progress in accomplishing upgrades by the different categories of facilities covered in the program.) While 37% of the material had rapid upgrades completed, only 17% had comprehensive upgrades installed.¹⁵

Several caveats for these percentages should be kept in mind:

■ **Sites vs. materials.** If one judges not by the fraction of material covered by upgrades, but by the fraction of sites, more than half of the job is done. This is because the program focused on upgrading the small, vulnerable sites first – sites

Figure 5.1 – Status of Security Upgrades on Russian Weapons-Usable Nuclear Material

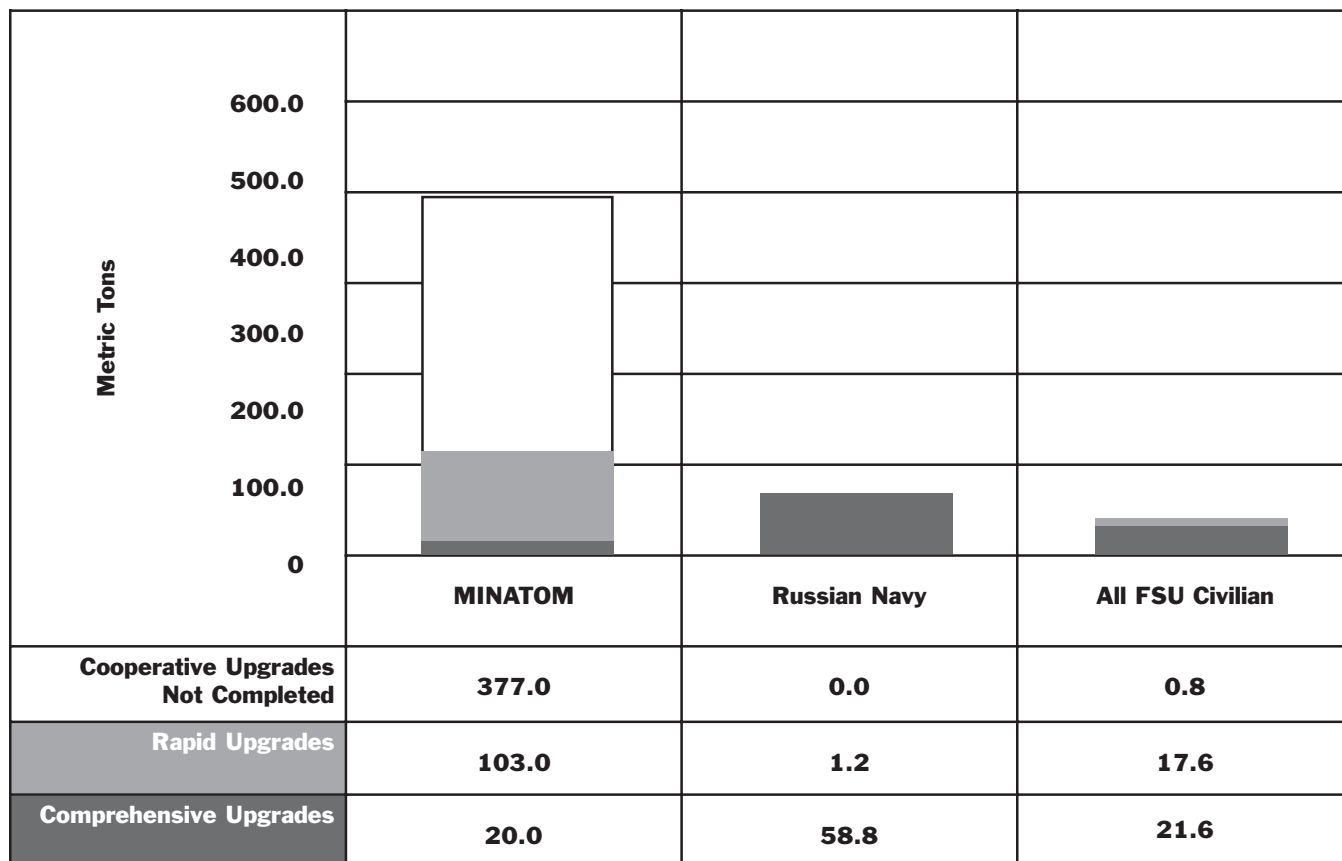


that probably posed the most urgent proliferation threats. The upgrades at these sites reduced a substantial fraction of the proliferation threat, but the contribution they made to the figures above on the total amount of material covered was minor, since these completed facilities have

¹³ The 37% figure is the program's latest assessment. (Personal communication from DOE official, March 2003). All figures on upgrades for nuclear materials in the text and figures are derived from figures offered in DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation* (Washington, D.C.: DOE, February 2003; available at <http://www.mbe.doe.gov/budget/04budget/content/defnn/nn.pdf> as of February 5, 2003), updated by this personal communication. The budget justifications reported that rapid upgrades had been completed for 20% of the 500 tons of potentially vulnerable weapons-usable nuclear material in the Ministry of Atomic Energy (MINATOM) defense complex, 100% of the 60 tons of material in the Navy complex, and 98% of the 40 tons of material in the civilian complexes in Russia and the other former Soviet states. Since those justifications were prepared, the estimate of the fraction of MINATOM defense complex material with rapid upgrades completed has increased. For a detailed discussion of the MPC&A program, see Matthew Bunn, "Material Protection, Control, and Accounting," *Controlling Nuclear Warheads and Materials* (available http://www.nti.org/e_research/cnwm/securing/mpca.asp as of March 12, 2003).

¹⁴ DOE, *FY 2003 Detailed Budget Justifications—Defense Nuclear Nonproliferation* (Washington, D.C.: DOE, February 2002; available at <http://www.mbe.doe.gov/budget/03budget/content/defnn/nuclnonp.pdf> as of February 5, 2003), pp. 22, 118–120. In our previous report, in May 2002, we reported that rapid upgrades for roughly 40% of the potentially vulnerable nuclear material in the former Soviet Union had been completed. We based this on interviews with program personnel at the time, and on this 42% projection from the DOE budget justifications. Similar estimates – though scaled back to an expectation of 40% of material with rapid upgrades completed by the end of FY 2002, were included in U.S. Department of Energy, "The MPC&A Scorecard: Nuclear Material," presented in 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). Indeed, the program has been scaling back its estimates of the level of upgrades completed for years: for example, the program told the General Accounting Office that rapid upgrades had been completed for 32% of the potentially vulnerable nuclear material in Russia in February 2001 – more than the program now believes had been completed by October 2001. See U.S. Congress, General Accounting Office, *Nuclear Nonproliferation: Security of Russia's Nuclear Material Improving; Further Enhancements Needed*, GAO-01-312 (Washington, D.C.: GAO, February 2001; available at <http://www.gao.gov/new.items/d01312.pdf> as of February 25, 2003).

Figure 5.2 – Status of Security Upgrades for Different Categories of Former Soviet Facilities



small amounts of material. Indeed, for judging both the fraction of the risk reduced and the fraction of the total work done (in dollars or person-hours), the number of buildings completed is a far better metric than the percentage of material covered – but unfortunately the program has not publicly provided recent data at the building level. (The program has reported, however, that by October 2002, its consolidation effort had succeeded in cleaning out the vulnerable nuclear material entirely from 21 of 55 buildings in Russia from which it hopes to remove such material – out of over 250 such buildings that exist in Russia.¹⁶) Comprehensive upgrades have already been completed at all of the facilities with weapons-

usable nuclear material in the non-Russian states of the former Soviet Union, and within Russia, “rapid upgrades” have been completed for nearly all of the known civilian facilities with weapons-usable nuclear material, and “comprehensive upgrades” for 98% of the material at these sites are expected to be completed in FY 2003.¹⁷ (See Figure 5.5 for the number of sites where comprehensive upgrades have been completed; site-level data on completion of rapid upgrades is not publicly available.)

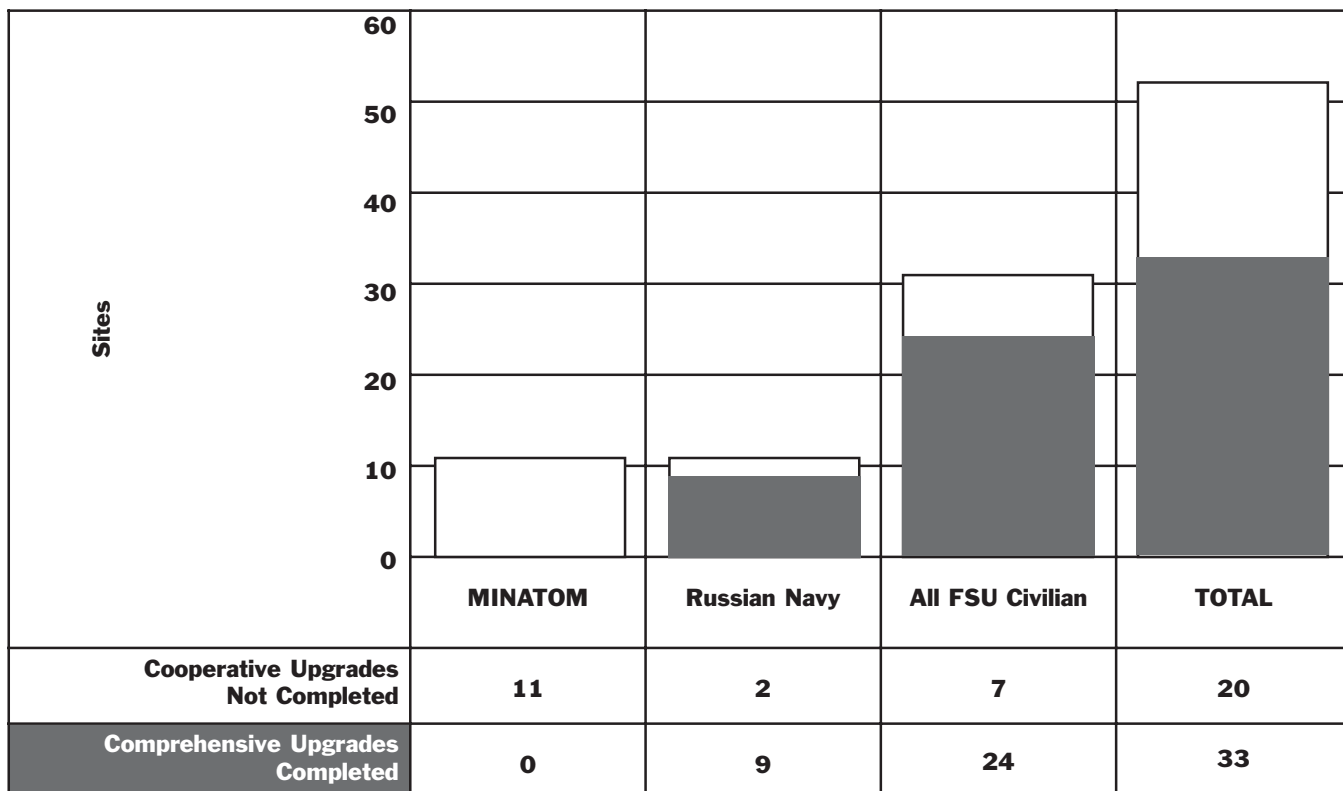
■ **Protection of material not yet covered.** An obvious question is: how secure is the 63% of the material not yet covered by upgrades? It is

¹⁵ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 624, updated by personal communication with DOE official, March 2003.

¹⁶ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 647; the over 250 total is from GAO, *Nuclear Nonproliferation: Security of Russia’s Nuclear Material Improving; Further Enhancements Needed*, op. cit.

¹⁷ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 644.

Figure 5.3 – Status of Security Upgrades for Sites with Weapons-Usable Material within the Former Soviet Union



certainly possible that Russia, by its own efforts, has managed to provide protection for some of this material that is as good or better than what exists for some of the material that has been covered in the cooperative upgrade program. If so, that would not increase the number of security upgrades U.S. programs could take credit for, but it would decrease the amount of the total job left to be done, increasing the fraction represented by the work already accomplished. The overwhelming majority of this not-yet-covered material is at large nuclear weapons complex sites – in particular, the four nuclear warhead assembly and disassembly facilities in Russia, and the two facilities where plutonium and HEU weapons components were fabricated. At those buildings and facilities where the United States and Russia have agreed on procedures for access and assurances that the U.S.-funded work is being done appropriately, upgrades have at least begun. As of October 2002, upgrades were underway for an additional 43% of

Russia's potentially vulnerable nuclear material – leaving only 20% with no cooperative upgrades at all yet underway.¹⁸ This “underway” category is very broad, however, including everything from sites where work has only just begun and no significant reductions in risk have yet been accomplished, to areas where rapid upgrades will soon be complete. The material for which upgrades are not even underway is largely in buildings that U.S. experts have not yet been allowed to visit, and so little is known about the specifics of the security and accounting arrangements at these buildings. On the one hand, the nuclear weapons complex facilities where most of this material resides are all protected by armed troops and multiple layers of fences; they would not be easy targets for terrorist teams attempting to shoot their way in. On the other hand, at every facility where U.S. and Russian experts have cooperated on MPC&A to date, including nuclear weapons complex facilities and nuclear weapon storage facilities, they have

¹⁸ Personal communication from DOE official, January 2003.

agreed that major upgrades were needed, including both better protection against covert insider theft, and upgraded measures to protect against armed attack by outsiders (ranging from better intrusion detectors to means for guards to communicate with each other and hardened positions for them to fight off attackers from). The short answer is that we simply do not know how well protected this not-yet-covered material is.

■ **Sustainability.** Installation of effective equipment is necessary but not sufficient for providing good security and accounting. As noted earlier, success in improving security and accounting for nuclear materials requires success in changing the way the people who manage and guard these materials do their business day to day, and that is both difficult to do and difficult to measure. A recent Russian survey of more than a dozen sites participating in the MPC&A program provides some suggestive indication that there is much more to be done on sustaining security for the long haul: all of the sites that responded expressed doubts about their ability to maintain adequate security once U.S. assistance phases out in the future, and all were relying on continued U.S. funds to buy effective tamper-indicating seals and to operate their computerized accounting systems.¹⁹ Hence, a rating based solely on the fraction of material equipped with upgrades is inevitably an overestimate of the fraction of the total work that has been accomplished, since it ignores the work above and beyond the initial installation of equipment.

■ **Adequacy in defeating plausible threats.** The systems being installed in the MPC&A program are intended to defeat rather modest threats – a single insider, a small number of well-trained and well-armed outsiders, or both working together. Against larger threats – several insiders

working together, or a large terrorist attacking force (such as the one that seized a theater in Moscow in late 2002), they would not be likely to be sufficient. If a policy decision were made that systems able to defeat larger threats should be installed, then the fraction of the job that could be judged as “done” would be greatly reduced.

Nuclear material in the former Soviet Union: rate of progress.

In the year following the September 11 attacks, the United States and Russia made substantial efforts to accelerate their cooperation in security and accounting for nuclear materials. The U.S. and Russian Presidents agreed to give “urgent attention” to the matter; the U.S. Secretary of Energy and the Russian Minister of Atomic Energy agreed to work together to accelerate the effort; a new access agreement was signed that cleared the way for work to resume or begin at several sensitive locations; and new initiatives were launched to speed the processing of contracts, begin consolidating material at large sites into central storage facilities, and undertake comprehensive, rather than building-by-building approaches to upgrading security and accounting at some of Russia’s largest facilities. Nevertheless, in the fiscal year immediately following the September 11 attacks, according to DOE’s own data, rapid upgrades were completed on only an additional 9% of Russia’s potentially vulnerable nuclear material (going from 28% to 37%), and comprehensive upgrades were completed on only 2% of this material (going from 15% to 17%).²⁰ During that year, in fact, DOE significantly scaled back its projections of the rate of future progress: as of April 2002, the program was projecting that rapid upgrades would be completed for 77% of the potentially vulnerable nuclear material in Russia by the end of FY 2004, while by February 2003 this figure had been scaled back to 58%.²¹ Only 26% of the material is

¹⁹ See Gennadi Pshakin, Vladimir Samsonov, and Victor Erastov, *U.S.-Russian Collaboration on Nuclear Materials Protection, Control, and Accounting* (Obninsk, Russia: Analytical Center on Nonproliferation, Institute for Physics and Power Engineering, 2002).

²⁰ Figures derived from figures provided for MINATOM defense, naval, and civilian facilities in DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., pp. 633–644, updated by personal communication with DOE official, March 2003.

²¹ See “The MPC&A Scorecard: Nuclear Material,” op. cit.; and DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., pp. 633–644.

expected to have comprehensive upgrades in place by then. Yet DOE has not changed its goal, established soon after September 11, of completing comprehensive upgrades for all potentially vulnerable nuclear material in the former Soviet Union by the end of 2008. Clearly a dramatic acceleration of the effort is needed to achieve that goal – still more, if the shorter timetables recommended in this report are to be met.

Nuclear warheads in the former Soviet Union: fraction secured. As of the end of FY 2002, sites containing nearly all of the estimated 4,000 naval warheads in the former Soviet Union (one-fifth of the estimated 20,000 total warheads that still exist) had had “rapid upgrades” of security and accounting systems put in place, in DOE’s MPC&A program (see Figure 5.4).²² In addition, “quick fix” security fencing had been installed at 47 of over 120 other warhead bunkers, as part of the Department of Defense’s Cooperative Threat Reduction warhead security effort.²³ If the non-naval warheads were spread evenly among these bunkers, this would represent almost 40% of the roughly 16,000 non-naval warheads (see Figure 5.5). The total would then be roughly half of Russia’s nuclear warheads that have had some substantial form of initial security upgrades installed. In fact, however, the 47 bunkers where quick-fix fencing is installed are mostly not at the major national storage sites where most of Russia’s nuclear weapons are stored, so the actual number of warheads secured is probably less than this one-half figure. Progress on comprehensive upgrades has been much slower: these

have been completed for some 40% of the naval warheads,²⁴ and none of the remaining warheads – in large part, for the non-naval warheads, because of disputes over access to these sensitive sites. Hence, only 8% of Russia’s total stockpile of warheads yet has comprehensive upgrades installed.

Like the figures for materials, these estimates of “fraction covered” provide only a very rough estimate of how much of the job has been done, subject to numerous caveats. As in the material case, there are serious issues related to whether the security provided by these upgrades is sufficient to meet post–September 11 threats, and whether it will be sustained for the long haul. But as in the case of nuclear materials, there is also an enormous amount of work that has been done that is not reflected in these figures – including extensive programs focused on improving security during warhead transport, the establishment of a national training and equipment testing center, the provision of equipment for personnel screening, real-time computerized accounting of warheads, and emergency response, and more. Nevertheless, the fraction of warheads provided with security upgrades provides as good a metric of overall progress as is currently available.

Nuclear warheads in the former Soviet Union: rate of progress. Progress in securing Russia’s naval warheads has been quite rapid – effectively all of these warheads were provided with rapid security upgrades in the first three years of the effort. Sixty percent of them are expected

²² See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 634, and U.S. Department of Energy, “The MPC&A Scorecard: Russian Navy Nuclear Warheads,” presented in Caravelli, Sheely, and Waud, “MPC&A Program Overview,” op. cit.

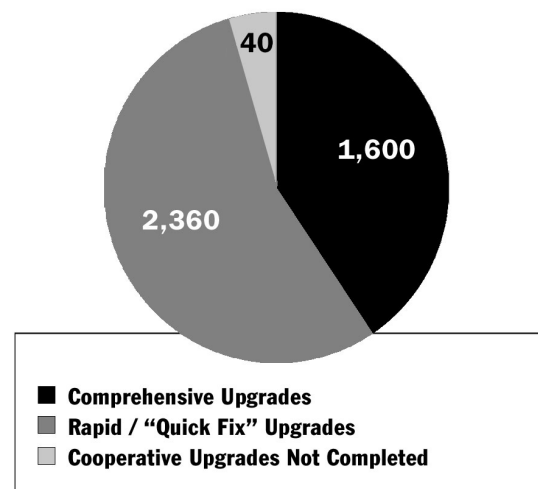
²³ This was the figure for quick fix systems installed and operation provided to the Department of Defense by the Russian Ministry of Defense in April 2002. See Defense Threat Reduction Agency, “Site Security Enhancements (Quick Fix),” (available at http://www.dtra.mil/ctr/project/projrur/ctr_quickfix.html as of February 5, 2003, last updated January 6, 2003). For detailed discussions of warhead security upgrade efforts, see Matthew Bunn, “Warhead Security,” *Controlling Nuclear Warheads and Materials* (available at www.nti.org/e_research/cnmw/securing/warhead.asp as of March 12, 2003); Charles L. Thornton, “The Nunn-Lugar Weapons Protection, Control, and Accounting Program: Securing Russia’s Nuclear Warheads,” in *Proceedings of the 43rd Annual Meeting of the Institute for Nuclear Materials Management, Orlando, Florida, June 23–27, 2002* (Northbrook, Illinois: INMM, 2002); and William Moon, “CTR Russian Weapons of Mass Destruction (WMD) Security Program,” (paper presented at the National Defense Industries Association National Security Division, Reston, Virginia, June 27, 2002; available at <http://www.dtic.mil/ndia/2002security/moon.pdf> as of February 5, 2003).

²⁴ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 624.

to be in facilities with comprehensive upgrades by the end of FY 2003, and 90% by the end of FY 2004; comprehensive upgrades are expected to be completed in 2006.²⁵ Progress on upgrades at the storage sites for the remaining warheads, however, has been nearly at a standstill for years – though the problems that have created that roadblock may now be on the road to resolution.²⁶ The completion date for upgrades at these non-naval sites will depend on progress in resolving these roadblocks, and on the number and capabilities of Russian firms that can be contracted to do the upgrade work – but comprehensive upgrades at warhead storage facilities are not expected to be complete until 2012.²⁷ The same DOE-funded national laboratory team that has been implementing upgrades for Russian naval warhead sites is now beginning to work at Strategic Rocket Forces sites; conceivably, that work may expand to other warhead sites and contribute to accelerating completion of upgrades at these facilities.²⁸ Clearly in this case, as well, a drastic acceleration will be needed if the goals outlined in this report are to be achieved.

Nuclear material outside the former Soviet Union: fraction secured or removed. As described earlier, there are also large numbers of facilities outside the former Soviet Union where nuclear materials may be inadequately secured. Defining metrics for assessing progress here is even more difficult, as efforts to address this issue are dispersed and focus on widely varying goals, from converting HEU-fueled research reactors to use low-enriched uranium, to reviewing and upgrading security at individual facilities.²⁹ Perhaps the most useful metric is the fraction of those facilities that the U.S.

Figure 5.4 – Status of Security Upgrades for Russian Naval Warheads



government itself has identified as the most vulnerable facilities from which HEU or plutonium should simply be removed, where this has in fact been accomplished. The U.S. government sponsored three such nuclear material removal operations by the end of 2002 – Project Sapphire, which airlifted nearly 600 kilograms of HEU from Kazakhstan to secure storage in Tennessee in 1994; Project Auburn Endeavor, which removed several kilograms of HEU from Georgia to the United Kingdom in 1998; and Project Vinca, which removed 48 kilograms of 80% enriched HEU from a vulnerable facility in Yugoslavia in 2002.³⁰ The U.S. government has identified 24 additional sites that it believes are high proliferation risks from which material should be removed.³¹ By this metric, with three of the most vulnerable sites completed and 24 more to go, just over 11% of the job has been accomplished.

²⁵ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 624. As with nuclear material, DOE has become notably less optimistic about near-term progress in the last year – as of April 2002, the projection was that comprehensive upgrades would be completed for 75% of the warheads by the end of FY 2003, not 60%. See “The MPC&A Scorecard: Russian Navy Nuclear Warheads,” op. cit.

²⁶ See discussion in “Warhead Security,” op. cit.

²⁷ See Defense Threat Reduction Agency, “Site Security Enhancements,” December 30, 2002 (available at http://www.dtra.mil/ctr/project/projrus/ctr_site_security.html as of February 5, 2003).

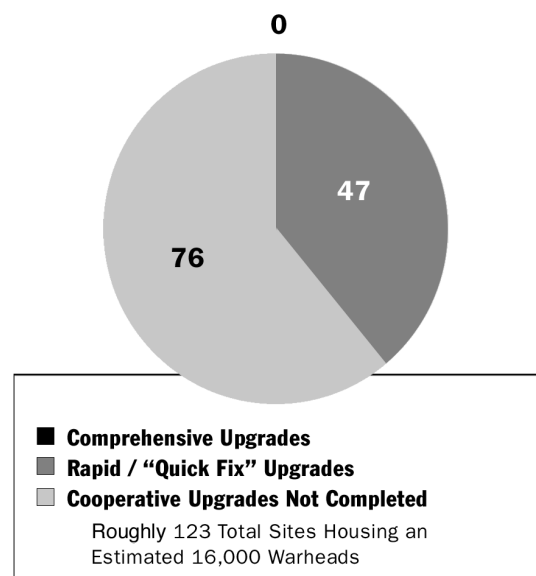
²⁸ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., pp. 637–638.

²⁹ See discussions in 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), and 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).

Here, too, there are important caveats to note. First, security has been at least modestly upgraded in cooperative programs – some bilateral, some under International Atomic Energy Agency (IAEA) auspices – at a number of sites around the world where material has not been removed, and these are not counted in the above total. Second, material has been removed from dozens of research reactors that once had HEU, when those reactors converted to use LEU fuel; while those facilities may not have made it onto the list of most vulnerable facilities around the world, nonetheless, removing the HEU from them and eliminating the need for additional shipments of fresh HEU to them has significantly reduced nuclear proliferation and terrorism risks. Third, two of the three operations to remove material from high-risk sites that have been conducted so far were actually within the states of the former Soviet Union, and a number of the 24 additional sites are believed to be also – so if the focus were kept strictly on facilities outside the former Soviet Union, the number accomplished would be only one, but the total number remaining to be accomplished would be smaller than 24. Fourth, there are dozens of facilities around the world where either substantial security upgrades or removal of the warheads or materials are needed, which are not included on the U.S. government’s list of the 24 most urgent facilities.

Nuclear material outside the former Soviet Union: rate of progress. To date, removals of nuclear material from the most vulnerable sites have been occurring at the rate of one every four years (one in 1994, one in 1998, and one in 2002). At that rate, it would take almost a century to clean out the remaining 24 identified high-risk facilities. Under a new U.S.-Russia-IAEA tripartite initiative to bring vulnerable Soviet-supplied material back to Russia, this rate might increase significantly. DOE projects that HEU from one additional site (a research reactor in Uzbekistan) will be sent back to Russia in FY 2003, and as much as 100 kilograms of fresh and spent HEU fuel would be sent back to

Figure 5.5 – Status of Security Upgrades for Russian Non-Naval Warhead Bunker Sites



Russia by the end of FY 2004.³² No specific target date for completing this effort has been announced. If the rate continued at an average of one site per year, it would still require a quarter century to finish the job. Hence, we recommend the creation of a “Global Cleanout” program focused on removing all nuclear material from the world’s most vulnerable sites as rapidly as practicable, with the goal of removing all nuclear material from the world’s most vulnerable sites within a few years.³³

Interdicting Nuclear Smuggling

Developing metrics for the goal of interdicting nuclear smuggling is difficult, as there are many elements to accomplishing the job – providing adequate capabilities to detect nuclear materials being smuggled across borders, establishing appropriate police and intelligence units in the relevant countries trained and equipped to deal with nuclear smuggling cases, creating stronger legal infrastructures so that nuclear thieves and smugglers face a

³⁰ See discussion of these cases in Bunn, “Removing Nuclear Material From Vulnerable Sites,” op. cit.

³¹ Robert Schlesinger, “24 Sites Eyed for Uranium Seizure,” *Boston Globe*, August 24, 2002.

³² See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 596.

³³ See “Global Cleanout,” p. 143.

greater chance of a larger punishment, expanding international intelligence and police cooperation focused on the nuclear smuggling threat, carrying out stings and other operations designed to break up nuclear smuggling rings and make it more difficult for thieves and buyers to reliably connect with each other – the list goes on.

Two steps that are necessary but not sufficient to accomplishing the goal are:

- to ensure that at least the most critical border crossings in the key source and transit states for nuclear material have personnel trained, and equipment designed, to detect smuggled nuclear materials; and
- to ensure that major ports and other locations shipping cargo to the United States, and major ports and other entry points into the United States, are equipped to be able to detect smuggled nuclear weapons or materials.

Measuring progress in these two areas makes it possible to assess how much of at least the initial steps in addressing nuclear smuggling has been accomplished. This should not be misinterpreted, however, to suggest that the job would be done when each of these figures reached 100%; even more than with the previous metrics, there are a huge number of complications and other aspects to consider in forming a complete judgment of how completely and how well this job is getting done. As just one example, consider the problem of corruption, endemic in border control and customs forces in much of the relevant region: a good

nuclear detector and training in how to use it will not do much good if the customs inspector will look the other way for a bottle of vodka. (Fortunately, many nuclear smuggling interdiction efforts are designed to take such factors into account – for example by sending video and readings from the nuclear detector to a central post as well as to the guard who is with the detector and available to be bribed.)

Key border posts trained and equipped to detect nuclear smuggling: fraction accomplished. As of the end of FY 2002, roughly one-third of the 60 border crossings within Russia itself that had been identified as most critical had been provided with appropriate training and equipment to address nuclear smuggling, as part of DOE's Second Line of Defense program.³⁴ The Department of Energy, however, has now estimated that a much larger total number of border points – 393 sites in Russia and 21 other nearby countries – will ultimately require installation of similar equipment.³⁵ Anti-nuclear smuggling efforts sponsored by the Departments of Defense and State have provided training and equipment for key law enforcement and border control personnel, including installation of radiation detection equipment at additional sites.³⁶ Installation of equipment at border crossings, however, has not been as central a focus of these programs – and similar data on the number of border crossings covered by these efforts is not publicly available.³⁷ Overall, it appears very likely that the fraction of the identified set of border crossings that have been equipped with appropriate equipment and trained personnel is under 15 percent.

³⁴ The Department of Energy has been the lead federal program for installing radiation detection equipment inside Russia. It originally targeted 60 sites for upgrades in the Second Line of Defense program; see U.S. General Accounting Office (GAO), *Nuclear Nonproliferation: U.S. Assistance Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning*, GAO-02-426 (Washington, D.C.: GAO, May 2002; available at <http://www.gao.gov/new.items/d02426.pdf> as of January 29, 2003), p. 6. For the figure of 20 sites completed by the end of FY 2002, see DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., pp. 658.

³⁵ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 658. This figure represents the total set of sites that are to be equipped with radiation detection equipment – though there are some additional border crossings in these key countries that are not included. Interviews with DOE officials, February 2003.

³⁶ As a measure of consolidation and efficiency, DOE's Second Line of Defense program has taken over the maintenance and improvement of the radiation detection equipment previously installed at border crossing in State-Department funded programs, which exists in 19 different countries outside Russia. See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 659. Second Line of Defense is concentrating its own efforts in Russia, Ukraine, and Kazakhstan.

Key border posts trained and equipped to detect nuclear smuggling: rate of progress. In most cases, U.S. nuclear smuggling interdiction programs have had excellent cooperation with recipient states,³⁸ and have therefore been providing training and installing equipment as fast as they had the funding to do so. DOE's Second Line of Defense program intends to equip another 37 sites – roughly an additional 10% of the identified total – during FY 2003 and FY 2004.³⁹ Data on the pace at which other U.S. and international programs intend to equip additional sites during that period is not publicly available, but the total pace all programs in installing radiation detection equipment at border points may amount to roughly twice the pace of the DOE effort alone. No estimated completion date for these programs has been published. Within the U.S. government, a comprehensive interagency plan assistance to counter nuclear smuggling, including a section on assistance for radiation detection at borders, is reportedly nearing completion.⁴⁰

Sites shipping to the United States trained and equipped to detect nuclear smuggling: fraction accomplished. For nuclear contraband, it is important not to rely on inspections after cargo and baggage have already arrived at U.S. ports, airports, or border crossings, as a bomb set off there, before inspectors could get to it, could have devastating consequences (especially in a U.S. harbor or airport).

Hence, under the U.S. Customs Service's Container Security Initiative, the United States plans to cooperate with other countries to put in place nuclear inspection capabilities at the major ports that ship cargo to the United States, so that it can be inspected before it leaves. (Equipment and expertise for this effort is coming from DOE's Second Line of Defense program.) This will take some time to accomplish, however; to date, none of the sites shipping cargo to the United States have such nuclear inspection capabilities and procedures in place.⁴¹

There are a substantial number of customs posts within the United States that have at least some equipment and training to detect nuclear materials, but much of this equipment has modest capabilities: the "radiation pagers" worn by many customs inspectors, for example, would do very well in detecting intensely radioactive material for a "dirty bomb," but would have no chance of detecting the very weak radiation from HEU for a nuclear bomb, with even as much shielding as the lead bags used to protect film going through a scanner.⁴² Indeed, by chance the depleted uranium that ABC News smuggled into the United States in an experiment was in one of the few large cargo containers entering the United States that was inspected – but the uranium, enough for a bomb had it been highly enriched, was not detected in

³⁷ For discussions of the main U.S. and international programs to assist states in improving their capabilities to stop nuclear smuggling, see Anthony Wier, "Interdicting Nuclear Smuggling," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/interdicting.asp as of March 12, 2003).

³⁸ In part, this is because the customs and border control agencies in recipient countries have a financial incentive to make effective use of this equipment – in stark contrast to the financial drag represented by maintaining high security at nuclear sites. This is because the radiation detection capabilities allow them to detect radioactive materials whose export would have been legitimate, but whose characteristics have been inaccurately described and value under-reported, in an attempt to avoid duties – allowing these agencies to generate additional revenues from duties and fines on such items. As a result, prospects for sustainability of this equipment are also believed to be good, since the recipient agencies have an incentive to maintain it and see that it is effectively used. (Interviews with Customs and DOE officials, 2001 and 2002.)

³⁹ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 658.

⁴⁰ Interviews with State Department and Department of Energy officials, February 2003. The General Accounting Office had previously criticized the government for lacking such a comprehensive plan. See GAO, *Nuclear Nonproliferation: U.S. Assistance Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning*, op. cit.

⁴¹ For a useful discussion, see JayEtta Z. Hecker, General Accounting Office, "Container Security: Current Efforts to Detect Nuclear Materials, New Initiatives, and Challenges," testimony to the House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, November 18, 2002 (available at <http://www.gao.gov/new.items/d03297t.pdf> as of January 21, 2003).

the inspection.⁴³ As of the end of FY 2002, the U.S. Customs Service had deployed 101 “large-scale x-ray and gamma ray systems that assist inspectors in screening cargo containers and conveyances for potential terrorist weapons, including nuclear weapons and radiological materials.”⁴⁴ Customs was also planning to install some 400 portal monitors – radiation detectors that would be capable of scanning entire cars, trains, or cargo containers – but as of the end of FY 2002, none of these were yet in place at U.S. border entry points.⁴⁵

Sites shipping to the United States trained and equipped to detect nuclear smuggling: rate of progress. The U.S. Customs Service has only just begun the process of negotiations with other states with ports and sites that ship cargo to the United States, and testing of equipment for cargo inspection is under way now. It is therefore too early to judge how long it will take to ensure that sites shipping large quantities of cargo to the United States have personnel appropriately trained and equipped to detect nuclear smuggling.

Stabilizing Employment for Nuclear Personnel

Developing metrics for assessing how much progress has been made in stabilizing the personnel with access to nuclear weapons, materials, and expertise is complicated by the fact that these programs have a number of quite different goals, and the emphasis among them has shifted over the years. Initially, the idea was to provide short-term grants on an emergency basis to make sure that key weapons scientists did not become desperate enough to sell their knowledge during what

was expected to be a short-term crisis before Russia got back on its feet. The mission of providing short-term grants to ease desperation (and to fund desirable research) continues to be an important one – but as time went on after the collapse of the Soviet Union, it became clear that the emphasis had to shift to two new missions: reducing Russia’s weapons complexes to sizes appropriate to their post–Cold War missions, affordable for Russia to sustain over the long haul; and providing permanent, non-subsidized jobs to thousands of weapons of mass destruction scientists and workers who were no longer needed. Given the very difficult economic picture in Russia since the collapse of the Soviet Union, and the many disagreements that have emerged between the United States and Russia over closing nuclear, chemical, and biological facilities, both of these two tasks have proved to be extremely challenging.

Key nuclear weapons scientists given short-term grants: fraction accomplished. Although it took some time for key programs such as the International Science and Technology Centers (ISTC) to get up and running on a large scale – and Russian nuclear weapons scientists endured some extremely difficult times in the interim – the mission of easing desperation for key nuclear weapons scientists was largely accomplished in the mid- and late-1990s. It is impossible to assess exactly what fraction of the most proliferation-sensitive nuclear weapons scientists who may have been in need of additional funding for non-weapons research in fact received it, because Russia and the United States have never cooperated to compile a list of who the people with the most critical weapons knowledge are. Nevertheless, from anecdotal information, including discussions with Russian weapons experts

⁴² See John P. Holdren and Matthew Bunn, “Technical Background: A Tutorial on Nuclear Weapons and Nuclear Explosive Materials,” *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/overview/technical.asp as of March 12, 2003).

⁴³ See Christopher Paine, “Preventing Nuclear Terrorism,” testimony to the House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, 107th Congress, 2nd Session, September 24, 2002 (available at http://www.house.gov/reform/ns/schedule_107th_2nd_session/paine_sept_24.htm as of January 21, 2003).

⁴⁴ Testimony by Jayson P. Ahern, U.S. Customs Service, testimony to the House Committee on Government Reform, Subcommittee on National Security, Veterans Affairs, and International Relations, November 18, 2002 (available at http://reform.house.gov/ns/schedule_107th_2nd_session/ahern_nov_18.htm as of February 6, 2003).

⁴⁵ Hecker, “Container Security,” testimony, op. cit.

regarding which of them participated in ISTC or similar projects, it appears that in the nuclear sector at least, these projects reached a large fraction of those most in need of them – perhaps 70–80%.⁴⁶ It may well be that a large number of serious proliferation incidents were averted as a result.

Key nuclear weapons scientists given short-term grants: rate of progress.

On this metric (if not on others) the effort in the nuclear sector has more or less stabilized. No clear target for ending the effort has been identified. Today, in any case, Russian nuclear weapons scientists are being paid on time, and paid enough to live on – the degree of potential desperation (at least for those who will continue to have employment in the weapons complex) has been substantially reduced.⁴⁷ Excess nuclear weapon scientists and workers provided sustainable civilian work: fraction accomplished. Over the next several years, Russia plans to reduce the workforce in its nuclear weapons programs by 35,000 people, nearly half of the total.⁴⁸ Thousands of these nuclear weapons scientists and workers are likely to retire, thousands more are likely to find other work without help, and thousands more are likely to be re-employed in civilian nuclear projects or other conversion projects sponsored by MINATOM. The remaining need may be in the range of 15,000–20,000 jobs. To date, U.S. programs have had real but modest success in creating sustainable, long-term civilian jobs for Russian weapons experts – and the degree of this success is difficult to judge because adequate data is not available. In the case of the Nuclear Cities Initiative (NCI), for example, only about 400 jobs have been created in specific NCI-sponsored projects, but the European Bank for Reconstruction and Development

(EBRD), after NCI helped the bank establish offices in several of the nuclear cities, has given out almost a thousand small business loans there, which have probably created several thousand jobs – though no one has attempted to count them. Similarly, ISTC and the Initiatives for Proliferation Prevention (IPP) program have each resulted in the establishment of commercial enterprises employing many hundreds of people, but data is not publicly available on how many of these are former nuclear weapons scientists or workers (both of these programs address chemical, biological, and aerospace experts as well, and these commercial enterprises, once fully established, presumably hire whoever is best for their jobs, regardless of whether the new hires were once associated with weapons of mass destruction or not). Even if one assumes that, counting the EBRD loans, these programs have created 4,000 jobs that all went to former nuclear weapons scientists and workers (surely an overestimate of the actual degree of success), this would still represent some 20% of the need.⁴⁹

Other U.S.-funded programs not directly focused on job creation have also led to the creation of large numbers of jobs. The most important of these is the U.S.-Russian HEU Purchase Agreement. Several thousand Russian nuclear experts and workers are directly employed on the various steps of fulfilling this contract – and are therefore not included among those for whom other U.S., Russian, or international programs have to provide other employment. The total number of jobs specifically for nuclear experts and workers created by this means is probably larger than the combined total from all the programs specifically focused on job creation. Moreover, MINATOM officials have

⁴⁶ The fraction is likely much less in the chemical and (especially) biological areas, where the sensitivities were even higher; some key biological facilities have not yet been opened to the West, and therefore the scientists who still work at these facilities have not been eligible to participate in programs such as ISTC.

⁴⁷ For discussion, see Matthew Bunn, “The Threat in Russia and the NIS,” *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/threat/russia.asp as of March 12, 2003).

⁴⁸ Oleg Bukharin, Frank von Hippel, and Sharon K. Weiner, *Conversion and Job Creation in Russia's Closed Nuclear Cities: An Update Based on a Workshop Held in Obninsk, Russia, June 27–29, 2000* (Princeton, N.J.: Princeton University, November 2000; available at <http://www.princeton.edu/~globsec/publications/pdf/obninsk1.pdf> as of January 21, 2003).

⁴⁹ For a similar (though even more pessimistic) assessment of the degree of success to date in job creation, see J. Raphael della Ratta, “A Strategy for the Redirection of the Russian Nuclear Complex,” in *Reshaping U.S.-Russian Threat Reduction*, op. cit.

indicated that the funding for MINATOM's own roughly \$50 million per year conversion program in its nuclear weapons complex comes primarily from the HEU purchase – as does funding for dealing with nuclear waste from dismantled submarines, and for cleanup in MINATOM's nuclear complex⁵⁰ – and they have estimated that from 1998 through 2001, this conversion program had created over 8,000 jobs in Russia's nuclear complex.⁵¹ Since Russia has funded this program itself – choosing to use revenue from the HEU purchase for that purpose – we have not counted these jobs toward the total created by U.S.-funded programs, but to the extent that they turn out to be sustainable, long-term jobs, they substantially reduce the total requirement for jobs to be created by U.S. or other internationally funded efforts. Other U.S.-funded programs, such as the MPC&A program and programs to develop new monitoring technologies and procedures, are also employing hundreds, if not thousands, of Russian nuclear experts and workers, at least for now, and if regulations, procedures, and other approaches are put in place that result in Russia maintaining a substantial level of effort in these areas after U.S.-funded programs phase out, some of these jobs will be sustainable ones. No data on the number of these jobs, or the fraction judged likely to be continued after U.S. funding phases out, is publicly available.

As noted earlier, jobs directly created in projects sponsored by U.S. programs may not be the most accurate metric: if U.S. programs assist, for example, in improving the business climate and promoting general economic development in Russia's nuclear cities, this may lead to natural growth of jobs that will absorb large numbers of former nuclear weapons workers. For example, the International Development Centers established in Zheleznogorsk and Snezhinsk are helping with local and regional economic planning, business training, matching of businesses to foreign partners, and a wide range of services for new or expanding businesses. But

these centers employ very few people themselves, and their impact on other job creation is difficult to assess quantitatively. As noted earlier, appropriate metrics have not been developed for measuring the contribution of U.S. programs to the business climate in the areas where nuclear workers and experts must be re-employed; moreover, beyond these development centers, U.S.-funded programs focused on improving the general business climate in these locations have been extremely modest, and had limited impact.

Excess nuclear weapon scientists and workers provided sustainable civilian work: rate of progress. Some programs, such as IPP, are now reaching a point where past investments in pre-commercial projects are reaching the point of commercialization, increasing the number of jobs created. No data is publicly available on the total number of jobs provided for former nuclear weapons scientists and workers in the last year or two years, but it appears unlikely to have been more than 5% of the total need per year. DOE expects, however, that the combination of NCI and IPP will have created 6,000 jobs for nuclear experts and workers by the end of FY 2004.⁵² No planned date for completing these programs has been established.

Nuclear weapons infrastructure eliminated: fraction accomplished. Only one U.S. program, NCI, is specifically focused on closing down excess nuclear weapons infrastructure in Russia. While other facilities are closing without U.S. help, the only facility closed for nuclear weapons work and opened for civilian work under NCI is a portion (some 40%) of the “Avangard” nuclear weapons assembly and disassembly facility in the city of Sarov. Avangard is the smallest of Russia's four nuclear weapons assembly and disassembly facilities; even if it had been as large as the others, 40% of it would amount to some 10% of Russia's total nuclear weapons assembly and disassembly

⁵⁰ See, for example, remarks by then-First Deputy Minister of Atomic Energy Lev Ryabev, quoted and discussed in Bukharin, von Hippel, and Weiner, *Conversion and Job Creation in Russia's Closed Nuclear Cities*, op. cit.

⁵¹ See Ministry of Atomic Energy, *Major Results of Conversion in Defense Complex Enterprises of MINATOM, Russia in 1998–2001* (Moscow: MINATOM, Summer 2002, translated from the original Russian). This represented somewhat more than half the planned figure.

⁵² See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 664.

floor space – and a much smaller fraction of the total floor space of all the different facilities in Russia’s nuclear weapons complex.

Nuclear weapons infrastructure eliminated: rate of progress. The reduction of less than 10% of Russia’s nuclear weapons infrastructure represented by the Avangard project required several years. There is as yet no agreement for the United States and Russia to cooperate on closing down more of Russia’s nuclear weapons complex (though Russia plans to close other facilities on its own). Nevertheless, by the end of FY 2004, DOE hopes to have met more than half of unspecified “nuclear complex reduction targets” at six Russian nuclear weapon facilities, and to have accomplished its complex reduction goals completely at two of those.⁵³ No specific target date for completing this effort has been announced.

Monitoring Nuclear Stockpiles and Reductions

The obvious metric for judging how much progress is being made in monitoring nuclear warheads and materials is the fraction of these stockpiles that is subject to monitoring. In some cases it is possible to arrange for voluntary declarations of stockpiles even before monitoring is possible, so the fraction of the warhead and materials stockpiles subject to declarations provides an additional preliminary metric. In most cases, U.S.-Russian discussions of formal arrangements for monitoring or declarations have made little progress.

Nuclear weapons and materials subject to declarations: fraction accomplished. Progress on this metric depends in part on how you count. For example, since Russia has agreed to sell the United States 500 tons of HEU from dismantled nuclear weapons, it has effectively declared that it has at least 500 tons of HEU. But it would not be accurate to count this entire 500 tons as “subject to declarations,” since no information has been provided as to where this material now is, how many of these weapons have already been dismantled versus how many remain to be dismantled in the future, and the like. This report includes only

those stockpiles for which specific declarations including quantities and locations have been made. None of Russia’s nuclear warheads fall into this category. For nuclear materials, every year there is another 30 tons of HEU that is blended down, and becomes subject to declarations (and monitoring, as described below) as part of that process; there are some 35 tons of civilian separated plutonium, on which Russia makes declarations to the IAEA each year; and there are some 5–10 tons of plutonium in storage at the sites of Russia’s remaining plutonium production reactors, declared (though not released publicly) under the terms of the plutonium production reactor shutdown agreement, for a total of 70–75 tons, roughly 7% of Russia’s stockpile of weapons-usable nuclear materials.

Nuclear weapons and materials subject to declarations: rate of progress. As material is loaded into the now nearly completed Mayak Fissile Material Storage Facility, it will effectively come under declarations, since the United States will be informed of how much material is present in the facility; thus, over the next few years, 50 tons of plutonium should be added to the amounts just described. Beyond that, progress in bringing additional weapons or materials under declarations is minimal. There are no current plans or negotiations relating to declarations of warhead stockpiles. The only additional nuclear materials likely to come under a declarations regime soon are the 34 tons of weapons plutonium covered by the U.S.-Russian plutonium disposition agreement. No date for completing monitoring and declarations regimes has been established.

Nuclear weapons and materials subject to monitoring: fraction accomplished. As with declarations, no warheads are currently subject to monitoring. The only materials currently subject to monitoring arrangements that are actually being implemented are the 30 tons of HEU being down-blended each year. (In 2002, U.S. experts were permitted to visit and count the cans of plutonium produced in recent years in Russia’s plutonium production reactors, but as of the end of 2002 had not yet been permitted to take measurements

⁵³ See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 672.

there as specified by the plutonium production reactor agreement.⁵⁴)

Nuclear weapons and materials subject to monitoring: rate of progress. As noted earlier, there are no current plans for monitoring or declarations on warhead stockpiles. For material stockpiles, the rate of increase in the amounts of materials subject to monitoring has been painfully slow. As just noted, 50 tons of plutonium is slated to be loaded into the Mayak Fissile Material Storage Facility over the next few years, and if all goes well, this will be subject to some form of transparency; similarly, U.S. government experts hope and expect that monitoring for the plutonium at the production reactors will begin to be fully implemented. Over the longer term, monitoring of plutonium being burned as fuel in the plutonium disposition effort would begin – though most of the 34 tons covered by the existing disposition agreement would come from the 50 tons to be stored in Mayak, so these amounts cannot be added. No date for completing monitoring arrangements for warheads and materials has been established.

Ending Production

Stopping production of fissile material: fraction accomplished. The metric here is very simple: the reduction in the rate of fissile material production resulting from U.S. sponsored programs. So far, U.S.-funded programs have not affected this production rate. Russian production of HEU for weapons ended, and most of Russia's plutonium production reactors were shut, before cooperative threat reductions programs began. The plutonium production rate at the last three production reactors has been reduced because of reductions in their permitted peak power imposed by Russia's nuclear safety regulatory agency, but this was not the result of U.S. programs intended to reduce plutonium production. U.S.-funded efforts to end production of plutonium at these last three reactors have shifted from focusing on shutting these reactors by providing

alternative heat and power sources, to converting these reactors to a new fuel cycle that would no longer produce weapons plutonium, and back to shutting them down. As a result, though the United States and Russia agreed in 1994 that these reactors would be shut by the year 2000, they are still operating, and are expected to operate through 2008–2011.⁵⁵ At the same time, the Bush administration has dropped Clinton-era efforts to negotiate an end to Russia's continuing separation of civilian weapons-usable plutonium. As a result, tons of additional weapons-usable separated plutonium continue to accumulate in Russia.

Stopping production of fissile material: rate of progress. Because of the shifts in approach just mentioned, a variety of U.S.-Russian disagreements, and interagency disputes within the United States, progress in this effort has been meager in recent years. Plutonium production is expected to continue at its current rate until the reactors are finally shut down in 2008–2011. Here, too, we believe a substantial acceleration of the effort is needed, and would be possible with sustained high-level attention to overcoming the obstacles.

Reducing Nuclear Stockpiles

Dismantling warheads: fraction accomplished. Although Nunn-Lugar is often thought of as a weapons dismantlement effort, the fact is that the United States has never paid for the dismantlement of a single Russian nuclear warhead – because Russia and the United States have never been able to agree on the kind of monitoring measures the United States would require to ensure that the dismantlements it was paying for were really occurring. Nunn-Lugar routinely pay for the dismantlement of nuclear missiles, bombers, and submarines, but not for dismantlement of the warheads themselves.

Nevertheless, Russia has dismantled thousands of nuclear warheads since the collapse of the former Soviet Union. Under the Department of Defense's

⁵⁴ Interview with State Department official, November 2002.

⁵⁵ See Matthew Bunn, "Plutonium Production Reactor Shutdown," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/ending/plutonium.asp as of March 12, 2003). The current planned shutdown dates are in See DOE, *FY 2004 Detailed Budget Justifications—Defense Nuclear Nonproliferation*, op. cit., p. 713.

nuclear warhead transportation program, by April 2002 the United States has provided assistance for shipping some 2,000–3,000 warheads to dismantlement plants or central storage facilities, indirectly contributing to dismantlement.⁵⁶

The U.S.-Russian HEU Purchase Agreement has also provided a financial incentive to dismantle warheads, by arranging for the commercial sale of uranium blended from the HEU warheads contain. By the end of 2002, 171 tons of HEU had been blended down under this agreement, the equivalent of more than 8,500 nuclear warheads.⁵⁷ One might argue that counting this in the assessment of both the number of warheads dismantled with U.S. help and the amount of HEU destroyed with U.S. help amounts to double counting – but one could also argue that this purchase agreement has a double effect, providing an incentive both for weapon dismantlement and for destruction of HEU.

Presumably a large fraction of the warheads transported to dismantlement facilities with U.S. assistance were the same as warheads dismantled to provide HEU for the HEU Purchase Agreement, and hence these figures should not be added together. What is unknown, however, is (a) how much of the HEU blended down to date was from warheads dismantled even before the HEU Purchase Agreement was negotiated (whose dismantlement the agreement therefore could not take credit for), and (b) how many warheads Russia had when the agreement began. By some public estimates, Russia had some 32,000 warheads in 1993, when the HEU Purchase Agreement began, and has since

reduced this figure to some 20,000.⁵⁸ If all of the HEU blended to date came from warheads dismantled in part as a result of this HEU deal (a generous assumption), then it could be argued that U.S. programs have contributed to the dismantlement of more than a quarter of the total stockpile of nuclear warheads that Russia had when the agreement began.

Dismantling warheads: rate of progress.

Today, some 30 tons a year of HEU is being blended down under the HEU Purchase Agreement, representing the equivalent of some 1,500 warheads per year, roughly an additional 5% each year of the warheads Russia had when the HEU Purchase Agreement began. The HEU Purchase Agreement is currently scheduled to end in 2013. As there is no program in place to directly fund Russian warhead dismantlement, there is no planned completion date for such an effort.

Reducing HEU stockpiles: fraction accomplished.

As just noted, by the end of 2002, 171 tons of HEU had been destroyed (by blending it to low enriched uranium reactor fuel) as part of the U.S.-Russian HEU Purchase Agreement. This represents some 16% of the over 1,000 tons of weapon-grade HEU equivalent Russia was believed to possess when the HEU deal began.⁵⁹

Reducing HEU stockpiles: rate of progress.

As already described, an additional 30 tons of HEU is currently being destroyed each year, representing roughly an additional 3% of the original Russian HEU stockpile. The program is currently

⁵⁶ Defense Threat Reduction Agency, “Nuclear Weapons Transportation,” no date (available at http://www.dtra.mil/ctr/project/projrur/ctr_transportation.html as of January 21, 2003).

⁵⁷ U.S. Enrichment Corporation (USEC), “Status Report: U.S.-Russian Megawatts to Megatons Program” (Bethesda, Md.: USEC, September 2002; available at http://www.usec.com/v2001_02/HTML/Megatons_status.asp as of January 21, 2003). USEC, using the IAEA “significant quantity” number of 25 kilograms of HEU per warhead, describes the 171 tons as the equivalent of 6,856 warheads; a lower figure of 20 kilograms per warhead would lead to an estimate that this represents more than 8,500 warheads.

⁵⁸ See, for example, Robert S. Norris and William M. Arkin, “NRDC Nuclear Notebook: Global Nuclear Stockpiles, 1945–2000,” *Bulletin of the Atomic Scientists* 56, no. 2 (March/April 2000; available at <http://www.thebulletin.org/issues/nukenotes/ma00nukenote.html> as of January 21, 2003).

⁵⁹ For discussion, see David Albright, Frans Berkhout, and William Walker, *Plutonium and Highly Enriched Uranium 1996: World Inventories, Capabilities, and Policies* (Oxford: Oxford University Press for the Stockholm International Peace Research Institute, 1997). Their central estimate of the Russian inventory of HEU prior to the beginning of blend-down is 1,050 metric tons of weapon-grade equivalent material; this is subject to an uncertainty of as much as plus or minus 300 tons.

scheduled to end in 2013, after 500 tons – just under half of the original stockpile – has been blended. To address a larger fraction of the stockpile more quickly, the blend-down of HEU should be substantially accelerated, and expanded well beyond the 500 tons initially agreed.⁶⁰ If the HEU Purchase Agreement were simply extended to cover an additional 300 tons of material at the current blend-down rate, the effort would not be completed until 2023.

Reducing plutonium stockpiles: fraction accomplished. As noted earlier, international cooperative efforts to reduce stockpiles of excess weapons plutonium have so far focused on laying the groundwork: no substantial amounts of excess weapons plutonium have yet been used as reactor fuel or otherwise transformed into forms unsuitable for weapons use. Hence, the fraction accomplished to date is zero.

Reducing plutonium stockpiles: rate of progress. To date, the annual rate of progress in reducing excess plutonium stockpiles is also zero. Current plans are to begin destroying approximately two tons per year of Russian excess weapons plutonium in approximately 2008, though that schedule is likely to slip somewhat.⁶¹ Once a rate of two tons a year has been achieved, it is to be increased to four tons per year. Russia will carry out disposition of approximately 38 tons of separated plutonium under the agreement, including 34 tons of excess weapons plutonium and 4 tons of

reactor-grade plutonium with which it will be blended, to maintain the confidentiality of the precise isotopic mix in Russia's weapons plutonium. If operations in fact began in 2008, and the four ton per year rate were achieved quickly, disposition of the material covered by this initial agreement could be completed in 2018–2020; if the program remained at two tons per year, disposition of this material would not be completed until 2027, even if it began in 2008. The 38 tons of material covered in this agreement, however, represents less than one-quarter of Russia's total stockpile of roughly 170 tons of separated plutonium (counting both weapons plutonium and weapons-usable civil plutonium).⁶² Indeed, as Russia's plutonium production reactors continue to produce plutonium, and Russia continues to separate weapons-usable civilian plutonium as well, if these are not stopped in a timely way, a two-ton-per-year disposition program would effectively be running in place – eliminating as much plutonium every year as is produced every year.⁶³ If production were stopped, but disposition of all 170 tons of Russia's stockpile except the amount needed to sustain a stockpile of 10,000 warheads were included in the program, at four tons a year, completion of the plutonium disposition effort would stretch to 2040 (or beyond 2070 at two tons per year).

Summary: How Much of the Job is Done?

Figure 5.6 summarizes what fraction of the job has been accomplished, when judged by the metrics

⁶⁰ For discussion, see “Reducing HEU Stockpiles – An Accelerated Blend-Down Initiative,” p. 194.

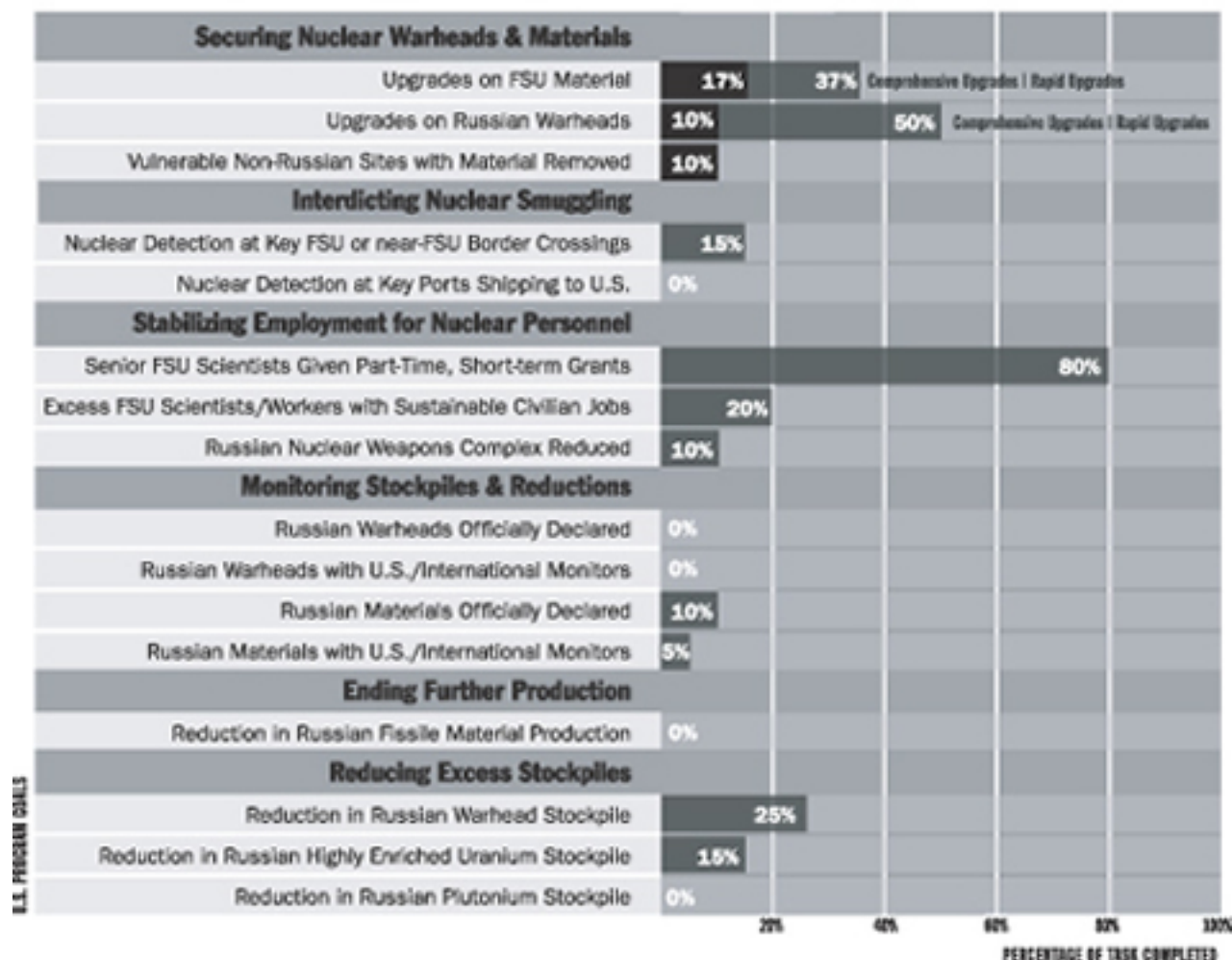
⁶¹ These dates and rates are specified in the *Agreement Between the Government of the United States of America and the Government of the Russian Federation Concerning the Management and Disposition of Plutonium Designated as No Longer Required for Defense Purposes and Related Cooperation* (signed September 2000; available at <http://www.nti.org/db/nisprofs/russia/fulltext/plutdisp/pudispft.pdf> as of January 21, 2003). For discussion, see “Russian Plutonium Disposition,” *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/reducing/rpdispose.asp as of March 12, 2003).

⁶² Albright, Berkhout, and Walker, *Plutonium and Highly Enriched Uranium 1996*, op. cit., estimate 131 tons of military plutonium (with an uncertainty of plus or minus 25 tons) as of the end of 1993; since then, roughly 6–8 tons of additional weapons plutonium has been produced in Russia's remaining weapons plutonium production reactors. Russia has also declared that it has 32.5 tons of separated civilian plutonium, bringing the total to the range of 170 tons. See International Atomic Energy Agency (IAEA), “Communication Received from Certain Member States Concerning Their Policies Regarding the Management of Plutonium,” INFCIRC/549/Add.9/4 (Vienna, Austria: IAEA, September 11, 2002; available at <http://www.iaea.org/worldatom/Documents/Infircs/2002/infirc549a9-4.pdf> as of January 21, 2003).

⁶³ The plutonium production reactors continue to produce in the range of a ton of plutonium per year, and Russia's declarations of separated civilian plutonium have increased, on average, by 1.3 tons per year for the past several years. Thus, the total increase in separated plutonium stocks is in the range of 2.0–2.5 tons per year.

Figure 5.6

Controlling Nuclear Warheads & Materials: How Much Work Has Been Completed?



described above for each of the six categories of effort. All of the ratings have been rounded to the nearest 5%, which still exaggerates, in many cases, the degree of precision in these estimates (exact figures on rapid and comprehensive security upgrades for nuclear material in the former Soviet Union are actually provided, because the Department of Energy has actually published such numbers). Overall, it is clear that while much has been accomplished in these efforts, across a broad range of metrics, much less than half of the job has yet been done, after more than a decade of threat reduction efforts. In most cases, the rate

of progress even after the September 11 attacks, if continued on its present course, would still mean that it would be many years before these urgent security threats to U.S., Russian, and world security were fully addressed. For most of the metrics, no planned completion date is available – because the relevant programs have not prepared a strategic plan laying out the total picture of what they plan to accomplish, and when they plan to complete their missions.

In short, an enormous gap remains between the urgency of the threat and the scope and pace of

U.S. efforts to address it. If nuclear weapons, materials, and expertise are to be prevented from falling into the hands of terrorist groups or hostile

states, a substantially accelerated effort will be needed, focused on addressing the highest security priorities first.

6. Applying the Office of Management and Budget's Assessment Approach

The Bush administration's Office of Management and Budget (OMB) has made assessing the performance of government programs and integrating those assessments into the government's budgeting and planning system a top priority. OMB designed, with input from other executive branch agencies, a set of questions and ratings intended to provide a consistent method for assessing the performance of all government programs – the Program Assessment Rating Tool (PART).¹ The FY 2004 budget request includes assessment of one-fifth of all federal programs, using the PART.² To supplement the previous discussions of inputs and outputs for the mission of controlling nuclear warheads, materials, and expertise (as well as the program-by-program assessments provided in this report's on-line companion), we have applied this OMB assessment tool to evaluate the overall U.S. effort to accomplish this mission. While OMB has used the PART only to evaluate individual programs working to solve specific aspects of a given problem, we believe that one of the greatest challenges the current U.S. effort to control nuclear warheads, materials, and expertise must face is the need to plan and manage all the relevant efforts as an integrated, prioritized endeavor – and we have therefore applied the PART to the overall effort, rather than to each individual program.³ This should be considered an initial evaluation; further discussion and exploration can and will refine and improve the assessment in the future.

The PART asks a series of questions about the program in order to gauge (1) whether the program has a clear objective and is well-designed to meet

that objective; (2) whether the program has strong strategic planning to maximize its ability to meet its objective; (3) how well the program is managed, particularly with respect to financial management and orderly expenditure of funds; (4) what results the program has demonstrated toward meeting its objective. Questions in the first three categories may be answered only with a Yes or No (or a Not Applicable), with the burden of proof nearly always resting more heavily on providing a Yes answer. Questions related to program results rely on a four-point scale, to reflect partial achievement of goals and evidence of partial results. On the four-point scale, answers can receive full credit, two-thirds credit, one-third credit, or no credit at all; on the Yes/No questions, it is all or nothing.

Once assigned, scores on the various questions are weighted to create a final numerical grade – ranging from 0 to 100 – gauging the overall effectiveness of the program. OMB has then weighted the ratings in each of the four categories – with the heaviest weighting on actual demonstrated results – to reach an overall rating for each program: effective, moderately effective, adequate, or ineffective.

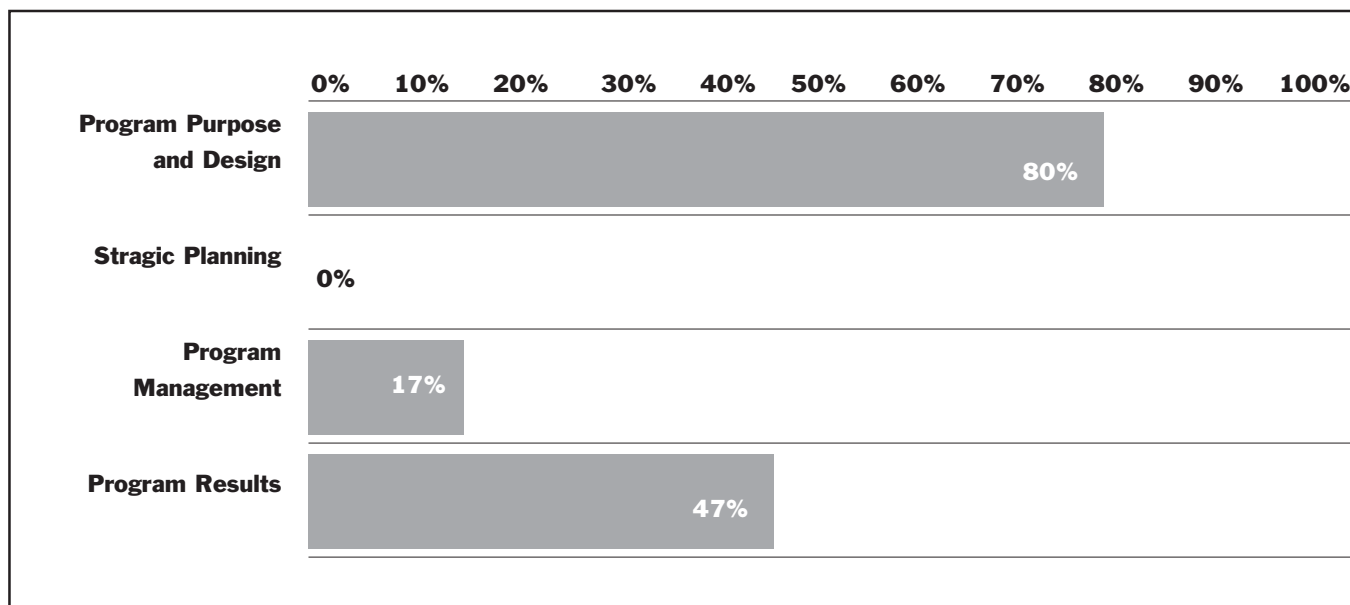
As shown in Figure 6.1, the results of the PART exercise reveal a very mixed picture. The effort scores well on program purpose – is clearly addressing an urgent need, and most of the programs required to meet that need exist, in one form or another. The effort scores very poorly on

¹ See U.S. Office of Management and Budget (OMB), "Instructions for the Program Assessment Ratings Tool," July 12, 2002 (available at http://www.whitehouse.gov/omb/budintegration/part_guidance_instructions.doc as of January 22, 2003).

² See OMB, "Performance and Management Assessments," February 3, 2003 (available at <http://www.whitehouse.gov/omb/budget/fy2004/pma.html> as of February 7, 2003).

³ Only one of the threat reduction programs we discuss in this report, the Material Protection, Control, and Accounting MPC&A) program, was among the one-fifth of federal programs assessed by OMB in the current cycle. It received a rating of "effective," the highest possible. We would argue that several of the OMB ratings within the PART were excessively generous, and that therefore a rating of "moderately effective" would be more appropriate.

Figure 6.1 – Assessment of Overall U.S. Effort to Control Nuclear Warheads and Materials



strategic planning, because for the overall effort there is no integrated strategic plan in place, no measurable milestones set, and no government-wide mechanism for planning and budgeting. (The fact that the rating here is exactly zero is an artifact of the PART methodology, which only allows yes or no, 100% or zero, answers to the questions in this category.) With respect to program management, the overall effort again scores badly, as there are no government-wide mechanisms for regularly collecting performance information and using it to manage the effort and hold participants accountable for performance – and in most parts of the program, there have been repeated problems with timely obligation of appropriated funds (largely because of difficulties in reaching agreement on particular projects with Russia and the other recipient states). Finally, the effort receives a middling rating on results: as described in the previous chapter, the effort is showing notable results across a broad spectrum of effort – but the

job done fast enough when judged against the urgency of the threat, and the potentially catastrophic consequences of even a single failure.⁴

Based on these numerical figures, the overall rating for the effort is “adequate.” But for a program that the President has publicly described as his government’s “highest priority,” for which he has publicly pledged that the government will do “everything in our power,” adequate is simply not good enough. The Bush administration needs to put in place, for this crucial effort, the management and planning approaches it has itself identified as crucial to the effectiveness of government programs. By putting in place a single leader, creating an integrated, prioritized plan, and launching the initiatives described in the remainder of this report, President Bush and his administration could transform the effort to keep nuclear weapons, materials, and expertise out of terrorist hands into one that was truly “effective.”

⁴ In rating the results of the overall effort, we have been more generous than the PART requires: since specific performance measures have not been set for the overall effort, the PART indicates that that worst possible ratings should be given for meeting performance goals. Instead, we have given the effort credit for the progress that has been made.

7. Why the Gap between Threat and Response?

This report is by no means the first time this alarm has been sounded. In the decade since the collapse of the Soviet Union, there have been dozens of cogent analyses calling for urgent action to improve controls over nuclear warheads and materials. Yet the gap between the threat and our response remains; many of the steps available to reduce this danger have not yet been taken. Why? More than a decade after the collapse of the Soviet Union, and more than a year after the September 11 attacks, why are the United States and its partners in the struggle against terrorism still running a serious risk that terrorists will win the race between their efforts to get nuclear weapons and U.S. and international efforts to stop them? We have no definitive answers – but we believe the following five factors are key pieces of the puzzle.¹

Lack of understanding of the threat. Many officials in the U.S. government and other key players in the policy community in the United States, Russia, Europe, and Japan still do not fully understand the scope and urgency of the threat. Many believe that it would be extraordinarily difficult, verging on impossible, for terrorists to make a nuclear bomb, even with highly enriched uranium (HEU) – envisioning an effort almost on the scale of the Manhattan Project as being required. Unfortunately, that is simply wrong – with enough HEU for a gun-type bomb, making at least a crude nuclear explosive is distressingly straightforward. Similarly, many believe that while there was a serious problem with insecure nuclear material in the early 1990s, that

problem has since been largely resolved, and it would be extremely difficult for enough material for a bomb to be stolen and fall into terrorists hands. A senior Clinton administration nonproliferation official, for example, recently told a reporter that the chances of terrorists acquiring nuclear weapons were “very, very slim,” because of the enormous difficulty of getting hold of the needed nuclear material.² Unfortunately, this too is wrong – the reality is that there are hundreds of sites with HEU and plutonium in countries around the world that would not be able to defend against either the kinds of insider thefts that have already occurred at some nuclear facilities, or the scale of outsider attack that terrorists have already accomplished at other sites.

Lack of understanding of the response.

Misunderstanding of the current scope and effectiveness of the response is equally widespread. In a number of private meetings since September 11, senior government officials have expressed the view that everything that needs to be done is already being done, and that most of the nuclear material that was vulnerable a decade ago is already secured. Both of these views are incorrect, as this report has demonstrated. Part of the problem is the incentives structured into the government system. Every program manager has an incentive to report to more senior officials that everything in his or her area of responsibility is going well, and if only more money were provided, would be going even better; thus, senior officials, unless they have very effective means for getting unvarnished information from other sources, often

¹ Previously, we discussed “five myths” that have constrained support for a more comprehensive and effective response. See 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. 9–13.

² Frank Gardner, “Al-Qaeda Was Making ‘Dirty Bomb’,” *BBC News*, January 31, 2003 (available at http://news.bbc.co.uk/2/hi/uk_news/2711645.stm as of February 10, 2003). The substance of this story, if correct, also provides alarming confirmation of al Qaeda’s continuing work on radiological and nuclear weapons.

hear only the good-news side of the story. As a result, it is easy for senior officials to get the impression that much more has already been accomplished or covered under existing plans than is actually the case.

In 1995, for example, when two of the present authors (Holdren and Bunn) briefed President Clinton on a secret study on efforts to secure nuclear material in the former Soviet Union, it was clear that Clinton had not previously realized the urgency of the threat and the limited nature of the programs then in place to address it. When confronted with that information, Clinton immediately directed that a series of steps be taken to strengthen the U.S. response. Indeed, acknowledging that there were major gaps in the U.S. response would mean acknowledging that some one had not been adequately doing their job, and that goes against the incentives of almost everyone in the system.³

An opposite form of lack of understanding of the response – the belief that nothing can be done that will significantly reduce the threat – also poses a substantial barrier to action. The reality, as documented in this report, is that much has already been done: thousands of nuclear weapons and hundreds of tons of nuclear material are demonstrably better secured, enough nuclear material for thousands of nuclear weapons has been permanently destroyed, and thousands of weapons scientists have received grants to employ them on civilian work. These efforts have offered more “bang for the buck” in improving U.S. and world security than virtually any other investment in the U.S. budget.

Lack of a constituency for the response.

While there is considerable public concern over the threat of nuclear terrorism, there is very little pub-

lic knowledge of the specifics of the threat or the response, and programs to address this threat have no real constituency. No President, and no member of Congress, believes that his or her re-election depends substantially on what is done with respect to these programs. There is probably no commercial firm with assets of more than \$1 billion that makes more than 5% of its profits from these programs; thus, when members of Congress or the administration are hearing from industry about their concerns, they are not hearing about these efforts. There are few large grass-roots groups lobbying for action.⁴ Indeed, the entire lobbying effort in Washington devoted to this subject is limited to the equivalent of one or two full-time people – in contrast to the dozens or hundreds working issues with a commercial impact, such as taxes and business regulations, or even other “public goods” issues, from handgun controls to environmental protection. Hence, these issues rarely rise to the top of the administrative, legislative, or media agenda.

Lack of any institutional home for the response. As noted above, there is no senior official in charge of leading all of these myriad efforts anywhere in the U.S. government. Nor is there any cabinet department or major agency that sees them as central to their core mission, and is prepared to fight, day-in and day-out, to move them forward. They are, in essence, an add-on to other missions (sometimes seen as a distraction from those other, more important missions) at the Department of Defense, and a somewhat more important add-on at the smaller Departments of State and Energy. Thus, when the Secretary of Defense decides to terminate the Crusader artillery piece, a large institutional infrastructure within the Army, the contractors, and the Congress swings into action to attempt to overturn the decision; but there is no comparable institutional framework for promoting efforts to control nuclear warheads and materials.⁵

³ It is often easy to acknowledge past error when an administration changes and the error can be blamed on the previous team. Unfortunately, in this case that opportunity was largely missed, as many officials on the Bush team came to office skeptical of threat reduction efforts and seeking to cut several of them back, rather than looking for areas the Clinton team had not pursued with sufficient energy.

⁴ The only large grass-roots group pressing for action on this agenda is the Vietnam Veterans of America, which has launched a “Nuclear Threat Reduction Campaign,” available at <http://www.nuclearthreatreduction.org>.

Lack of an orientation toward achieving security through cooperation. The traditional way in which the United States has sought to protect itself from attack has been through a strong military. In this case, little that the United States can accomplish by force of arms will help very much in reducing the threat: the threat can only be seriously addressed with in-depth cooperation with a wide variety of countries around the world. Many of the senior officials of the Bush administration came to office with a clear presumption that security was mainly achieved through force of arms, and a clear belief that agreements, cooperative arrangements, and international institutions could not be relied on to provide real security. The list of rejected arms agreements is long, from the Anti-Ballistic Missile (ABM) Treaty to the Comprehensive Test Ban (CTB) Treaty, from the

compliance protocol to the Biological Weapons Convention to the frequent dismissal of the prospects for effective inspections in Iraq. Thus, in identifying priorities in the “war on terrorism,” there is a tendency to focus on those elements that can be fought and won as a war – rather than those that can only be accomplished through cooperation that takes place far from any battlefield or terrorist redoubt.

We believe that if the American people understood the full dimensions of the threat, and the opportunities available to address it, they would demand action. The purpose of this report, therefore, is to help overcome the first two of these key obstacles – lack of understanding of the threat, and of the response – and thereby to help build the constituency for action.

⁵ The closest analog is the ability of the U.S. nuclear laboratories to convince their Senators and Representatives to support programs – including nuclear threat reduction programs – in which they have an interest.

Part III: Recommendations for the Future

Oak Ridge National Laboratory



Metal shavings from a Russian HEU weapon component.

The gravest danger our Nation faces lies at the crossroads of radicalism and technology. Our enemies have openly declared that they are seeking weapons of mass destruction, and evidence indicates that they are doing so with determination.... History will judge harshly those who saw this coming danger but failed to act.

– PRESIDENT GEORGE W. BUSH, INTRODUCTION TO THE
NATIONAL SECURITY STRATEGY OF THE UNITED STATES,
SEPTEMBER 2002

8. Summary of Recommendations

Bold new steps are needed to close the gap between the threat that nuclear weapons, materials, and expertise could fall into the hands of terrorists or hostile states, and the U.S. and international response to that threat.

That is the clear conclusion to be drawn from this report's discussion of the threat the U.S. faces and from its measures of progress by the U.S. response to reduce that threat. It is also the overarching lesson from the examination of the progress of and prospects for each of the current threat reduction programs focused on controlling nuclear weapons, materials, and expertise provided in the on-line companion to this report.

The rest of this volume is devoted to providing a first draft of a comprehensive, integrated plan to match the scope and effectiveness of the U.S. and international response to the urgency and seriousness of the threat. Of course, neither a small group at one university nor anyone else can identify every action that will be needed as new challenges arise, and new obstacles loom that must be overcome. Once the government prepares an overall integrated plan for this mission, it will undoubtedly be different in important respects from the first draft of such a plan we provide here – and it will have to be designed with the flexibility to adapt to changing threats, obstacles, and opportunities.

If there was intensive, sustained leadership focused on this mission from the highest levels of the U.S. government; a single senior leader in the White House with full-time responsibility and accountability for leading the effort; an integrated and prioritized plan to accomplish the goal; and an effectively functioning global coalition of nations working together to keep nuclear weapons out of terrorist hands, all the rest of what needs to be done – including the application of the resources needed to do the job – would follow.

Within such an integrated, comprehensive plan, the highest priority must be placed on those steps that have the highest immediate leverage in reducing the probability that terrorists or hostile states will be able to acquire and use stolen nuclear weapons, or the materials and expertise to make them.

The first and most urgent priority is to address the nuclear material at the most vulnerable sites around the world – in Russia and elsewhere. In many cases, the fastest and most effective means to address these vulnerable, small sites will be to remove the nuclear material from them entirely.

The second priority, given the huge stockpiles that exist in Russia, and the continued need for significant improvements in their security, should be a substantially accelerated partnership with Russia to ensure that all of its nuclear weapons and materials are effectively secured and accounted for as rapidly as possible.

Third should be an effort to forge sensitive security partnerships with other key nuclear states – particularly Pakistan, where the continued presence of heavily armed remnants of al Qaeda (and other extreme terrorist groups), combined with the deep sympathy for the Taliban and al Qaeda among some insiders in Pakistan's nuclear establishment, create serious security concerns.

Fourth should be an effort to put in place, as rapidly as possible, effective global standards for nuclear security that each nation with nuclear weapons and materials should meet – on its own, or with assistance from the members of the new G-8 “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction,” announced in June 2002.

Fifth should be new arrangements to secure, monitor, and dismantle the most dangerous warheads – particularly those that are easily portable and not equipped with modern versions of electronic locks to

prevent unauthorized use. Sixth should be expanded support for the International Atomic Energy Agency (IAEA), allowing it to better support the effort to keep nuclear weapons and materials out of terrorist hands around the world, and strengthen its global system of nuclear safeguards.

Expanded and reformed efforts to interdict nuclear smuggling, stabilize employment for nuclear personnel, reduce nuclear stockpiles, and put effective monitoring and data exchanges in place for these dangerous stockpiles are also needed, as next priorities. In some cases – such as an expanded blend-down of highly enriched uranium – efforts in these categories may offer the potential for large enough reductions in the threat, and enough leverage in other areas, to deserve high priority as well. (See “Progress on the Seven Steps,” p. 94.)

In what follows below, we focus first on the cross-cutting recommendations for organizing the effort, from which the other steps would flow. Then, we suggest a set of specific actions that a comprehensive plan for expanded and accelerated action should include – including the priorities just identified – in each of the six categories of programs focused on controlling nuclear warheads, materials, and expertise we have identified. We begin with an attempt at clearly and succinctly stating the goal in each category of effort, followed by summaries of each of our recommendations for achieving that goal, in one or two sentences. Subsequent chapters on each of the categories of effort then explain each recommendation in more detail.

Ultimately, the government itself should regularly prepare reports of this kind – reporting to the American people and their elected representatives on the danger that terrorists might get and use nuclear weapons, the government’s overall plan for protecting America from that danger, what has been accomplished in implementing that plan so far, and how fast the remaining work can be accomplished. Such action plans and report cards would provide critically needed transparency and accountability in the efforts to combat this threat to America’s homeland security. And by allowing the public and its representatives to better understand the threat and the possible responses, they

would help build the constituency for action – as we hope that this report will do.

Controlling Warheads and Materials: Crosscutting Steps

OVERALL GOAL: Reduce as much as possible, as rapidly as possible, the chance that terrorists or hostile states could get stolen nuclear weapons or weapons-usable materials.

- 1. Recommendation:** Focus sustained attention from the highest levels of government on reducing the chance that terrorists or hostile states could get stolen nuclear weapons or weapons-usable materials.
- 2. Recommendation:** Appoint a senior, full-time official, with direct access to the President, to lead the entire array of efforts focused on keeping nuclear weapons and materials out of the hands of terrorists or hostile states – seizing opportunities for rapid action, overcoming obstacles, filling gaps, exploiting synergies, and eliminating overlaps.
- 3. Recommendation:** Encourage Russia to appoint a comparable senior full-time official to lead Russian efforts to keep nuclear weapons and materials out of the hands of terrorists or hostile states, including working with the United States and other nations as part of the needed global coalition.
- 4. Recommendation:** Prepare an integrated and prioritized plan for keeping nuclear weapons and materials out of the hands of terrorists and hostile states that outlines specific goals to be achieved, means by which they will be achieved, cost estimates for implementing the needed programs, target dates for achieving both interim milestones and final goals, metrics for assessing progress toward each goal, and exit strategies for ensuring that results will be maintained after the programs phase out.
- 5. Recommendation:** Build the G-8 “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction” announced

PROGRESS ON THE SEVEN STEPS

In May 2002, we proposed seven steps that needed to be taken as quickly as possible to reduce the threat posed by insecure nuclear warheads and materials. The following is a brief summary of the progress in the last year on fulfilling those recommendations.

STEP ONE: Forge a Global Coalition to Secure Weapons of Mass Destruction

Because weapons of mass destruction (WMD) and their essential ingredients are located in countries all over the world, this problem can only be resolved through effective global cooperation. The leaders of the Group of Eight (G-8) industrialized nations took the essential first step at their June 2002 summit, launching a new “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction,” and pledging \$20 billion over 10 years to efforts focused on controlling and destroying WMD. Much remains to be done, however, to build this initiative into the fast-paced global effort to secure nuclear and other WMD stockpiles around the world that is urgently needed. (See “The G-8 Global Partnership,” p. 61.)

STEP TWO: Appoint One U.S. and One Russian Senior Official to Lead Efforts to Secure Nuclear Weapons, Materials, and Expertise

As described elsewhere in this report, a single leader is urgently needed to move the myriad efforts focused on controlling warheads and materials forward as rapidly as possible. No significant action has been taken on this recommendation in the last year.

STEP THREE: Accelerate and Strengthen Security Upgrades for Warheads and Materials in Russia

We recommended that the United States and Russia forge a new partnership approach designed to accelerate and strengthen their nuclear security cooperation, setting a target of completing “rapid upgrades” for all nuclear warheads and materials within two years, and comprehensive upgrades within four. Even before we made this recommendation, Presidents Bush and Putin agreed to give “urgent attention” to this effort, the U.S. Secretary of Energy and the Russian Minister of Atomic Energy had directed their staffs to accelerate the cooperation, and a new accord on access to sensitive facilities needed to facilitate the cooperation had been signed. Unfortunately, however, a genuine partnership approach has not yet been established, and the progress of upgrades remains far slower than would be needed to accomplish the objectives we outlined.

STEP FOUR: Launch a “Global Cleanout and Secure” Effort to Eliminate or Secure Stockpiles of Weapons-Usable Nuclear Material Worldwide

We recommended a fast-paced global effort to remove weapons-usable nuclear material entirely from the world’s most vulnerable facilities, coupled with cooperation to upgrade security where nuclear weapons and weapons-usable materials will remain. One important step was taken in August 2002, when 48 kilograms of 80% enriched highly enriched uranium (HEU) – enough for 2–3

in June 2002 into an effective, working partnership to take all the actions necessary to keep nuclear weapons and weapons-usable materials from being stolen and falling into the hands of terrorists or hostile states. This would include a key role for Russia, and a shift in approach from a donor-recipient relationship to a genuine partnership to improve nuclear security, involving Russian experts and resources from start to finish.

6. Recommendation: Provide resources sufficient to ensure that the pace at which the threat of nuclear weapons terrorism is reduced is not limited by resources.

7. Recommendation: Focus key U.S. government and international resources on providing the information and analysis needed to pursue a fast-paced, prioritized program to keep nuclear weapons and materials out of the hands of terrorists or hostile states – including

implosion-type bombs – was airlifted from a vulnerable site in Yugoslavia. Working with Russia and the International Atomic Energy Agency (IAEA), the Bush administration is pursuing a tripartite initiative to ship Soviet-origin HEU from other vulnerable sites back to Russia. The Senate, in its defense authorization bill, acted to provide broader authorities for removing vulnerable nuclear material around the world, but those provisions were dropped in the House-Senate conference. There remains a need to establish a single office with the resources, authority, and expertise to remove weapons-usable nuclear material from facilities around the world – including negotiating packages of incentives targeted to the needs of each facility to convince them to give up this material.

STEP FIVE: Lead Toward Stringent Global Nuclear Security Standards

We recommended that the United States join with other major nuclear states in making a political commitment to meet a stringent, agreed standard for security and accounting for all their nuclear material and facilities. The June 2002 G-8 Global Partnership announcement took the critical first step in this direction, committing each participant to providing “appropriate” and “effective” security for its nuclear stockpiles, and assisting other states to do the same. The next step would be a further statement outlining what specific standards the participants agree they will meet.

STEP SIX: Accelerate the Blend-Down of Highly Enriched Uranium (HEU)

We recommended that the United States and Russia reach an agreement under which the United

States would pay Russia to blend additional excess HEU and keep the blended material in monitored storage until the nuclear fuel market was prepared for it to be sold. At their May 2002 summit, President Bush and President Putin agreed to establish a working group on “expanded disposition” of HEU and plutonium. While the Russian participants were not yet prepared to discuss the large-scale accelerated blend-down we had recommended, as soon as a joint report on several smaller-scale options had been completed, Russia’s Ministry of Atomic Energy agreed to study such large-scale options with the private Nuclear Threat Initiative (NTI) and that study is still ongoing. The Bush administration has requested \$30 million in its fiscal year (FY) 2004 budget request to begin implementing the limited additional purchases and blend-downs proposed in the initial joint report from the summit working group.

STEP SEVEN: Create New Revenue Streams for Nuclear Security

We recommended that new revenue streams for funding nuclear security efforts be created, such as through “debt for nonproliferation” swaps, or agreements to set aside a portion of the revenues from future Russian spent fuel imports. The G-8 Global Partnership announcement officially endorsed the concept of debt for nonproliferation swaps, and legislation creating a mechanism for such swaps was passed and signed into law. The Bush administration did not request funds to implement such swaps in its FY 2004 budget request, however, and there has been little movement on setting aside funds from Russian spent fuel imports to finance nonproliferation and arms reduction activities.

information on what nuclear materials exist where, under what kinds of security conditions.

8. Recommendation: Get in-depth independent analysis and advice on programs to keep nuclear weapons and materials out of the hands of terrorists or hostile states, by making such analysis a key part of the mandate of the new Homeland Security Institute, and by establishing independent advisory panels for each of the most important programs in this area.

Securing Nuclear Warheads and Materials

GOAL: Ensure that all nuclear weapons and weapons-usable nuclear material worldwide are secure and accounted for.

1. 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.

- 2. Recommendation:** Accelerate and strengthen nuclear security and accounting upgrades in Russia, with a partnership-based approach.
- 3. Recommendation:** Forge nuclear security partnerships with other key nuclear states, including Pakistan, India, and China.
- 4. 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.
- 5. 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).
- 6. 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.

Interdicting Nuclear Smuggling

GOAL: Maximize the chances of recovering stolen nuclear material and stopping nuclear smuggling.

- 1. Recommendation:** Develop and implement a comprehensive strategic plan specifying what institutions in what countries are to be provided with what capabilities by when, with what resources.
- 2. Recommendation:** This plan should include, among other steps:
 - a. Providing effective nuclear detection capabilities at ports shipping cargo to the United States and at key entry points into the United States;
 - b. Strengthening U.S. and international nuclear emergency search and response capabilities;

- c. Establishing units of the national police in each relevant country trained and equipped to deal with nuclear smuggling cases;
- d. Identifying the most critical border crossings that may be routes for nuclear smugglers, and providing training and equipment to detect nuclear materials at those points;
- e. Providing regional capabilities for forensic analysis of seized nuclear materials, to attempt to determine where they came from (with increased exchange of data on the properties of materials produced at particular facilities);
- f. Greatly expanding the sharing of intelligence and police information (including through international organizations such as Interpol) related to nuclear theft and smuggling;
- g. Strengthening intelligence efforts focused on identifying and disrupting nuclear theft and smuggling organizations, including sting operations and other means to make it more difficult for smugglers and buyers to connect;
- h. Putting in place severe legal penalties for theft and smuggling of weapons-usable nuclear material in all the relevant countries; and
- i. Providing resources to the IAEA to allow it to help track and analyze nuclear smuggling and help states improve their nuclear smuggling interdiction capabilities.

Stabilizing Employment for Nuclear Personnel

GOAL: Ensure that nuclear scientists, workers, and guards are not desperate enough to want to steal nuclear weapons and materials or sell nuclear knowledge, and close unsustainable and unnecessary nuclear facilities.

- 1. Recommendation:** Establish a broader and higher-level dialogue with Russia on steps that Russia and other governments need to take to ease the transition to a smaller nuclear complex in Russia, and avoid proliferation risks in that process.

2. Recommendation: Pursue a much broader approach to fostering re-employment for Russia's nuclear experts and workers, including such measures as:

- a. Tax and other incentives for firms to locate or expand operations in Russia's nuclear cities, and to employ former employees of Russia's nuclear weapons complex;
- b. Increased reliance on private sector capabilities in matching technological capabilities from Russia's nuclear cities to market needs and investors;
- c. Providing incentives for people with real business management and marketing expertise to lead enterprises in or near Russia's nuclear cities;
- d. Providing start-up capital for new or expanding enterprises in or near Russia's nuclear cities;
- e. Assigning a small fraction of the unclassified R&D sponsored by the U.S. government in key areas such as counterterrorism, nonproliferation, nuclear cleanup, and energy to be done by experts from Russia's nuclear weapons complex – getting the U.S. government's work done for less while providing large numbers of jobs employing the skills of Russia's nuclear weapons experts.

3. Recommendation: Cooperate with Russia to ensure a secure retirement for nuclear experts and workers (including possible early buy-outs), reducing the job creation requirement.

4. Recommendation: Undertake a more focused approach to assisting Russia in closing or converting excess nuclear weapons complex facilities, and other unneeded nuclear facilities.

Monitoring Stockpiles and Reductions

GOAL: Put in place sufficient monitoring and data exchanges to build confidence that nuclear stockpiles are secure and accounted for, agreed reductions are being implemented, and assistance funds are being spent appropriately.

1. Recommendation: Offer Russia and other partners with whom the United States is negotiating transparency arrangements substantial incentives – strategic, financial, or other – to do the hard work of overcoming decades of nuclear secrecy. As one necessary but not sufficient step, offer reciprocal information about and access to U.S. nuclear activities.

2. Recommendation: Seek Russian agreement to exchange data on stockpiles of nuclear weapons and weapons-usable materials, beginning with completing lab-to-lab efforts to prepare a full accounting of Russia's plutonium stocks and past production, comparable to the U.S. declaration published in 1996.

3. Recommendation: Build “bridges” among the different transparency initiatives now being pursued – such as transparency for the U.S.-Russian Highly Enriched Uranium (HEU) Purchase Agreement, the Mayak Fissile Material Storage Facility, the Plutonium Production Reactor Shutdown Agreement, and the Plutonium Disposition Agreement – by reaching agreement on implementing tags, seals, and other monitoring measures to ensure continuity of knowledge as material moves from one regime to the next.

4. Recommendation: Conduct a series of joint monitoring experiments to develop and demonstrate procedures for confirming warhead dismantlement and secure storage of warheads and materials without unduly compromising sensitive information.

5. Recommendation: Carry out monitored storage and dismantlement of the excess warhead covered by the reciprocal warhead security and dismantlement initiative recommended above.

6. Recommendation: Take a flexible approach to providing assurances that taxpayer funds are being spent appropriately at particularly sensitive facilities, combining direct on-site access at some locations with other measures such as photographs and videotapes of installed equipment.

Ending Production

GOAL: Stop further production of nuclear weapons and weapons-usable nuclear materials.

- 1. Recommendation:** Complete the program to provide alternative heat and power and shut down Russia's plutonium production reactors as quickly as possible.
- 2. Recommendation:** Complete negotiations of a long-term U.S.-Russian moratorium on separation of plutonium from civilian spent fuel.
- 3. Recommendation:** Put in place agreed monitoring measures to confirm U.S. and Russian statements that they are no longer producing HEU.
- 4. Recommendation:** Carry out joint U.S.-Russian demonstrations of approaches to verifying that older reprocessing plants are not separating plutonium for weapons – a key element of a proposed international fissile cutoff treaty.
- 5. Recommendation:** Continue seeking to put in place an international moratorium on production of plutonium or HEU for weapons, and continue negotiations toward a verifiable international treaty banning further production of nuclear materials for weapons.
- 2. Recommendation:** Reach agreement with Russia on an "accelerated blend-down" initiative, paying Russia a fee to blend additional HEU to non-weapons-usable levels and store it for later sale when the market is ready.
- 3. Recommendation:** Move ahead with the currently planned approaches to disposition of excess weapons plutonium.
- 4. Recommendation:** Seek to reach agreements by the end of 2003 on a financing and management arrangement, and a step-by-step work plan, for disposition of Russian excess weapons plutonium.
- 5. Recommendation:** Begin now to discuss going beyond the 34 tons of plutonium on each side covered by the U.S.-Russian Plutonium Disposition and Management Agreement.
- 6. Recommendation:** Begin now to plan in detail for maintaining very high levels of security and accounting throughout the disposition process.
- 7. Recommendation:** Continue exploring complements or alternatives to the current approach to plutonium disposition, including:
 - a. Initiate discussions of a "plutonium swap" approach, using existing plutonium fuel fabrication facilities and reactors already burning civilian plutonium fuel, which could burn weapons plutonium fuel instead.
 - b. Pursue options for burning part of Russia's excess plutonium in reactors outside of Russia, including through leasing arrangements.
 - c. Restart development of plutonium immobilization technologies.
 - d. If advanced reactors and fuel cycles are developed and built for other purposes, consider their use for disposition of whatever excess plutonium remains at that time.
 - e. Consider options for purchasing Russian excess plutonium stockpiles.

Reducing Stockpiles

GOAL: Drastically reduce the massive existing nuclear stockpiles, so that unneeded stockpiles do not have to be guarded forever.

- 1. Recommendation:** Maintain and stabilize implementation of the U.S.-Russian HEU Purchase Agreement, including purchasing a stockpile of blended material to cover interruptions in deliveries, and leaving open the option to designate additional executive agents if necessary.

9. Crosscutting Steps to Organize the Response

Fundamentally, to get any job as large and complex as this one done, three basic components are required:

- someone in charge;
- an effective plan; and
- the needed resources.

Because this problem is so urgent, the number of impediments to rapid progress so large, and the consequences of failure so high, the most critically needed resource is sustained political engagement from the highest levels, focused on moving the effort forward as quickly as possible, and overcoming obstacles as they arise. In addition, because nuclear weapons or their essential ingredients exist in dozens of countries around the world, an effective plan will inevitably have to include forging a global coalition to secure all the world's nuclear warheads and materials, wherever they may be.

Sustained White House Engagement

If efforts to keep nuclear weapons out of terrorist hands are to succeed, a sea-change in the level of sustained leadership from the highest levels of the U.S. government will be needed. Such a sea-change is required to reinvigorate these efforts with new initiatives, to make them work as a package, to coordinate, prioritize, and integrate them into a strategic plan, to forge a global coalition to pursue these objectives around the world, and to negotiate specific measures with Russia and other participants in the global coalition. If, in fact, keeping weapons of mass destruction out of terrorist hands is President Bush's "highest priority," then it needs to be treated as such.

The bottom line is that if President Bush and the senior officials of his government put this mission at the top of their agenda, focusing on it day-

in and day-out, the organizational changes and policy initiatives recommended below probably will follow: someone will be put in charge, an effective plan will be devised, the necessary resources will be provided, and concrete steps to improve the security of American citizens against nuclear attack will be taken. If that senior engagement and leadership is absent, and the response is left to subordinates and the established order, then the gap between threat and response, between consequences and prevention, will not be closed.

In particular, these efforts need to be at the very top of the U.S. agenda with Russia and the other relevant states, not merely an item to remember to include as one line in each summit statement. The United States should make clear that quick progress in this area is a fundamental requirement, something to be emphasized at every level on every occasion until the problem is adequately addressed. The United States should also work to convince other leading nuclear powers to take a similar approach in their interactions with Russia and the other relevant states.

Recommendation: Focus sustained attention from the highest levels of government on reducing the chance that terrorists or hostile states could get stolen nuclear weapons or weapons-usable materials.

A Single Leader

As we recommended in our previous report, President Bush needs to appoint someone in the White House, who reports directly to him, who has no other mission but this – some one tasked to wake up every morning thinking "What can I do to keep nuclear weapons out of terrorist hands today?"¹ This official would be responsible for leading and coordinating the entire panoply of related efforts, setting priorities, eliminating overlaps, seizing opportunities for synergy, and – just

as important – for keeping the mission of moving these programs forward on the front burner at the senior levels of the White House every day. Installing a single senior leader at the White House would create an important institutional wellspring that would be constantly reinvigorating and refocusing high-level attention on this essential national security task. At the same time, if this official were given the resources and authority to do the job effectively, the President – and the public and its representatives in Congress – could reasonably hold this one person accountable for rapid progress in reducing the threat that terrorists could get their hands on nuclear weapons.

This appointment should have several key characteristics. First, it needs to be full-time. Simply giving the job to the Vice President or the National Security Advisor is not good enough, as they are necessarily distracted by a thousand other responsibilities. Second, this official needs to have the full confidence of the President, the Vice President, and the National Security Advisor, and direct access to them when necessary – both to give him or her the ability to rapidly raise key policy matters for immediate resolution when necessary, and to keep their attention on these issues. Third, to be effective in this role, the official needs presidentially mandated authority to ensure that agencies follow White House direction, and to guarantee this official's ability to review agency budgets collaboratively with the White House Office of Management and Budget. Fourth, this official would need an effective staff, sufficient to monitor and lead the many disparate parts of this effort.

Fifth, this official would have to play a leading role in working with Russia and other states participating in a global coalition to accomplish these objectives.

It may be that the best approach would be to create another Deputy National Security Advisor, with accompanying staff and resources, focused specifically on this mission.² At the same time, however, it would be important to put in place an institutional arrangement by which such an official could be accountable not only to the President but to the Congress – as the head of the Office of Science and Technology Policy is, who in most administrations is both the President's science and technology adviser and the head of a legislatively mandated institution, whose appointment is confirmed by the Senate, and who regularly testifies before Congress on key science and technology policy issues.³

It is often said in Washington that "czars never work," but this is largely because czars are given problems that are fundamentally insoluble. Here, the problem is large, complex, and urgent – but finite, and soluble. The reality is that the mechanism of establishing a senior full-time official focused on a particular problem has repeatedly succeeded in improving strategic planning, interagency coordination, and the level of sustained, White House leadership focused on that problem.

This report is only one of countless studies over the past decade that have made similar recommendations for a senior leader in the White House

¹ The need for such a single leader in the case of nuclear weapons and materials is clear and compelling. Chemical and biological weapons pose issues that are quite different, but in some respects equally challenging. A decision would need to be taken as to whether it made more sense to have the single leader focus only on nuclear issues – our focus here – and have others manage chemical and biological issues, or whether to have a single leader focused on keeping all weapons of mass destruction out of terrorist hands. Our previous report also recommended the appointment of such a single leader. See 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. 31–34.

² For discussion, see, for example, Laura Holgate, testimony to the Senate Committee on Governmental Affairs, Subcommittee on International Security, Proliferation, and Federal Services, November 14, 2001 (available at http://www.nti.org/c_press/holgate_Nov14.pdf as of January 17, 2003).

³ Traditionally, the National Security Advisor and the rest of the NSC staff have been accountable only to the President, and do not testify before Congress. The Bush administration took the same approach when Tom Ridge headed the Office of Homeland Security in the White House, resisting requests for Congressional testimony by Ridge.

for this mission.⁴ President Bush has said that keeping weapons of mass destruction out of terrorist hands is his “highest priority.” The time has come to put someone in place with the power, access, resources, and responsibility to see that the job gets done. There is no other single step that would do more to reduce the danger of a nuclear terrorist attack.

The appointment of a single senior official charged with managing this entire agenda is equally critical in Russia, where the government process for resolving interagency disputes, overcoming obstacles to central government objectives, and developing effective government-wide plans is even more unwieldy. (As one senior U.S. official put it in conversation: “If there were an Olympics for bureaucracy, Moscow would take home most of the gold medals.”) Russian Prime Minister Mikhail M. Kasyanov has taken personal control of ensuring that the G-8 Global Partnership commitments are implemented.⁵ But given the myriad distractions at the head of a national government, it is likely to be essential to put in place a *full-time* leader for these efforts – and some senior Russian experts have also recommended this as “the most important step” toward overcoming the impediments to accelerated progress.⁶ If the new G-8 Global Partnership is to succeed, sustained central leadership in Moscow, focused on overcoming the myriad obstacles posed by Russian laws, regulations, and policies, will be essential.

Recommendation: Appoint a senior, full-time official, with direct access to the President, to lead the entire array of efforts focused on keeping nuclear weapons and materials out of the hands of terrorists or hostile states – seizing opportunities for rapid action, overcoming obstacles, filling gaps, exploiting synergies, and eliminating overlaps.

Recommendation: Encourage Russia to appoint a comparable senior full-time official to lead Russian efforts to keep nuclear weapons and materials out of the hands of terrorists or hostile states, including working with the United States and other nations as part of the needed global coalition.

An Integrated, Prioritized Plan

Eleven years after such efforts began, and a year and a half after the September 11 attacks, the United States still has no single, integrated plan for the effort to keep nuclear weapons out of terrorist hands – despite the recent issuance of the administration’s overall strategy for dealing with weapons of mass destruction.⁷ There is no one document anywhere that describes what actions all the various parts of the federal government plan to take this year, or over the next five years, to make sure that terrorists do not take possession of insecure nuclear weapons, material, or expertise.

⁴ See, for example, John P. Holdren, “The Threat from Surplus Nuclear-Bomb Materials,” testimony to the U.S. Senate Foreign Relations Committee, Subcommittee on Europe, 104th Congress, 1st Session, August 23, 1995. In his testimony, Holdren summarizes the results of a secret study by a panel of the President’s Committee of Advisers on Science and Technology. See also *The Defense Against Weapons of Mass Destruction Act of 1996*, Public Law 201, 104th Congress (September 23, 1996), Title XIV (commonly referred to as Nunn-Lugar-Domenici, which attempted to direct that such an official be appointed); John Deutch, chair, *Combating Proliferation of Weapons of Mass Destruction: Report from the Commission to Assess the Organization of the Federal Government to Combat the Proliferation of Weapons of Mass Destruction* (Washington, D.C.: Deutch Commission, July 1999; available at <http://www.fas.org/spp/starwars/program/deutch/11910book.pdf> as of January 13, 2003); Howard Baker and Lloyd Cutler, co-chairs, *A Report Card on the Department of Energy’s Nonproliferation Programs with Russia* (Washington, D.C.: U.S. Department of Energy, Secretary of Energy Advisory Board, January 10, 2001; available at <http://www.hr.doe.gov/seab/rusrpt.pdf> as of January 13, 2003); and John P. Holdren and Nikolai P. Laverov, *Letter Report From the Co-Chairs of the Joint Committee on U.S.-Russian Cooperation on Nuclear Non-Proliferation* (Washington, D.C.: The National Academies, December 4, 2002; available at <http://www4.nationalacademies.org/news.nsf/isbn/s02052003?OpenDocument> as of February 25, 2003).

⁵ Remarks by Russian officials, conference on “Protecting Against the Spread of Nuclear, Biological, and Chemical Weapons,” sponsored by the Center for Strategic and International Studies and the International Institute for Strategic Studies, London, January 20, 2003.

⁶ See Holdren and Laverov, *Letter Report From the Co-Chairs of the Joint Committee on U.S.-Russian Cooperation on Nuclear Non-Proliferation*, op. cit.

To accomplish a job as big and complex as this one, as rapidly as the job needs to be done, a prioritized plan for the entire mission is essential. Such a plan would:

- Clearly identify the goals to be accomplished, and the priorities among them;
- Set target dates for the achievement of measurable milestones on the path toward those goals;
- Assign responsibilities and resources for meeting those targets;
- Outline “endgame” strategies by which key aspects of the job could be completed and U.S. investment phased out, along with target dates by which these final goals would be achieved;
- Identify and correct both gaps and overlaps in existing programs, while seizing synergies among them; and
- Identify mechanisms for modifying the plan, to learn from experience and adapt to new challenges and opportunities as they arise.

Such an integrated plan should include the entire set of threat reduction steps that contribute to blocking the terrorist pathway to the bomb, including securing nuclear warheads and materials; interdicting nuclear smuggling; stabilizing the lives of the personnel with access to nuclear weapons, materials, and expertise; monitoring these stockpiles (and reductions in them); halting further production; and reducing these stockpiles and the nuclear complexes within which they exist to sustainable sizes appropriate for their post-Cold War missions. Moreover, it should be integrated with the efforts being made in the war on terrorism and in preparations for homeland security that also contribute to blocking the terrorist pathway to the bomb, as described earlier in this report.

To successfully guide all of the relevant programs in the multiple cabinet agencies, such an inte-

grated plan will need to address four overarching issues: setting priorities, improving coordination, creating synergies, and fostering partnership.

Setting Priorities

Not everything that is worthwhile can be done with equal energy all at once. Today, priorities are often set largely on the basis of which program managers or assistant secretaries are most effective in fighting for funds and forcing their issues to the top of the agenda. The task of setting priorities will require the development of criteria for doing so, based on the overall objective of the plan. These criteria should be focused on a single question: how much would implementing this project reduce the threat that a nuclear weapon or the nuclear material and expertise to make one would fall into the hands of a terrorist group or hostile state – over the next year, the next five years, the next 10 years, and the next twenty years? If the answer is “not very much,” then that project deserves relatively modest priority.

In making more detailed judgments about what priorities to set and what goals to aim to achieve, it may also be useful to develop a small number of scenarios that the systems being put in place must be able, at a minimum, to address. This is analogous to the “two major regional contingencies” model used for many years for military force planning. For example, in the case of programs designed to interdict nuclear smuggling, nuclear detectors that can detect extremely radioactive material for a “dirty bomb” represent some progress, but a system that could not reliably detect several kilograms of highly enriched uranium (HEU) shielded with a few millimeters of lead – whether smuggled in airline baggage, in a car or train crossing a border checkpoint, in container cargo, or in the mail – would be a system that was not good enough. The ability to beat standard threats of that kind can be a crucial metric by which the effectiveness of programs can be judged.

⁷ This strategy document is a very broad statement of overall goals, and does not provide details for the specific cooperative actions that should be taken with Russia or other nations to counter the threat that terrorists might obtain insecure nuclear material. President George W. Bush, *National Strategy to Combat Weapons of Mass Destruction* (Washington, D.C.: The White House, December 2002; available at <http://www.whitehouse.gov/news/releases/2002/12/WMDStrategy.pdf> as of February 26, 2003).

Improving Coordination

Today, the many programs focused on different aspects of this problem are each proceeding largely independently, in their own “stovepipes.” Despite the Bush administration’s overall review of threat reduction programs, conducted in 2001, there is no consistent process for identifying and correcting gaps in the U.S. effort, or overlaps between programs. Cases of lack of coordination among the many related programs are too numerous to name.⁸ Programs often take different approaches to basically similar problems in implementing threat reduction programs – on matters ranging from access to liability to contracting procedures – with little attempt at a comprehensive view. Many are dealing with the same Russian nuclear institutions and facilities, often with the same individuals. Thus, mistakes made by one program will color Russian attitudes and affect other programs, just as good will generated by one program may make it easier for another to get in the door. While each of these programs has its own unique circumstances, all of them face the common problems and obstacles endemic to nuclear security cooperation with Russia.

As one example, consider the many different U.S. approaches to which kinds of plutonium to secure or eliminate. The Material Protection, Control, and Accounting (MPC&A) program at the Department of Energy (DOE) seeks to address all separated plutonium, because it is all usable in nuclear weapons. But because the original purpose of the Mayak storage facility being constructed with Department of Defense (DOD) assistance was to facilitate weapons dismantlement, it is intended only for “weapons origin” plutonium – even if other plutonium is dangerously insecure, it cannot be moved to the secure Mayak facility. The plutonium reactor shutdown agreement, implemented first by DOD and then by DOE, focuses on “weapons grade” plutonium. And DOE’s plutonium disposition program focuses on weapons grade plutonium “withdrawn from nuclear weapons programs.” Each of these characteriza-

tions of the type of plutonium targeted is being interpreted as requiring somewhat different monitoring measures to confirm, requiring separate technical development and separate negotiations with Russia. Each of these may have made sense with respect to that particular program when viewed in isolation – but the plethora of different approaches begs the question of which kinds of plutonium the U.S. government is worried about, and why.

Creating Synergies

The potential for synergy if these programs were forged into an integrated effort is enormous. Some programs require nuclear experts to design and build systems to secure, monitor, and reduce nuclear stockpiles; other programs are seeking to provide jobs for nuclear experts. Some programs require facilities to process plutonium or uranium; other programs are seeking to convert plutonium and uranium processing facilities once used for the weapons program to new missions. Programs that may make it possible to clean out the weapons-usable nuclear material from certain facilities entirely – such as efforts to consolidate HEU at fewer sites, to convert research reactors to use low-enriched uranium (LEU) fuel, and to assist Russia’s plans to shut down weapons assembly and disassembly at two of its four facilities that do those jobs – could substantially reduce the cost of securing material at the remaining sites.

Fostering Partnership

It is crucial that the preparation of such an integrated plan not be done solely in Washington, in isolation from the countries on whose soil most of the plan will be implemented. Rather, the plan must be developed in full partnership with Russia and with the other states most involved, with their experts playing central roles in each stage, from conception and design to implementation. A “made in America” plan is a sure recipe for rejection and delay.

⁸ For an account in the particular area of interdicting nuclear smuggling, see U.S. General Accounting Office (GAO), *Nuclear Nonproliferation: U.S. Assistance Efforts to Help Other Countries Combat Nuclear Smuggling Need Strengthened Coordination and Planning*, GAO-02-426 (Washington, D.C.: GAO, May 2002; available at <http://www.gao.gov/new.items/d02426.pdf> as of January 13, 2003).

The United States will not achieve its security goals as fast as it is practicable to do so until those goals are well defined, and the available programs put in harness together to achieve them. Developing an integrated and prioritized plan must be an early job of a new single leader for these efforts.

Recommendation: Prepare an integrated and prioritized plan for keeping nuclear weapons and materials out of the hands of terrorists and hostile states that outlines specific goals to be achieved, means by which they will be achieved, cost estimates for implementing the needed programs, target dates for achieving both interim milestones and final goals, metrics for assessing progress toward each goal, and exit strategies for ensuring that results will be maintained after the programs phase out.

An Effective Global Partnership

Insecure nuclear weapons and materials anywhere pose a threat to everyone, everywhere. Yet stockpiles of weapons of mass destruction (WMD) – not just nuclear weapons but chemical and biological ones as well – and their essential ingredients exist in dozens of countries throughout the world, in both the military and civilian sectors. Hence this is a problem that can only be solved through cooperation on a global scale – through a global alliance to keep WMD out of terrorist hands.⁹ Former U.S. Assistant Secretary of Defense Graham T. Allison and former Russian Deputy Minister of Defense and National Security Advisor Andrei Kokoshin have dubbed such a global cooperative effort to control WMD “the new containment.”¹⁰

The agreement to establish a new “Global Partnership Against the Spread of Weapons and

Materials of Mass Destruction” at the summit of the Group of Eight (G-8) industrialized democracies in June 2002 provides the essential foundation for such a global effort. (Former Senator Sam Nunn, Senator Richard Lugar (R-IN), and experts associated with the Nuclear Threat Initiative and the Preventive Defense Project of Harvard and Stanford universities played a key role in making the case for the establishment of this Global Partnership.) The urgent task today is to build from this foundation to create a truly effective global coalition that is able to move quickly to ensure that all nuclear warheads and materials worldwide are secure and accounted for, that major paths for nuclear smuggling are blocked, and that critical potential leaks of nuclear expertise are plugged.

U.S.-Russian Leadership in the Global Partnership

To succeed in addressing these global threats, the partnership will require sustained, collaborative leadership from the Presidents of both the United States and Russia. As the two states with by far the world’s largest stockpiles of weapons of mass destruction and related materials – and the largest-scale participants in threat reduction cooperation efforts to date – the United States and Russia bear a special responsibility to lead, first by working together to secure their own WMD and related materials, and then in working with other states around the world to ensure that their stockpiles are secured as well.¹¹ In this effort, rather than being a passive recipient of assistance, Russia could be a major leader and partner, working with the United States and others to help states around the world improve security and account-

⁹ For a discussion of the agenda for such a partnership, see Robert J. Einhorn and Michèle Fluornoy, eds., *Protecting Against the Spread of Nuclear, Biological, and Chemical Weapons: An Action Agenda for the Global Partnership* (4 Vols.) (Washington, D.C.: Center for Strategic and International Studies, 2003; available at http://www.csis.org/pubs/2003_protecting.htm as of February 23, 2003). The need for such a global partnership is discussed at some length in our previous report, Bunn, Holdren, and Wier, *Securing Nuclear Warheads and Materials*, op. cit. pp. 25–30. Former Senator Sam Nunn and Senator Richard Lugar have taken the lead in making the case for such a global coalition; see, for example, their statement from the Moscow conference on the topic sponsored by the Nuclear Threat Initiative in May 2002: Nuclear Threat Initiative, “Nunn & Lugar Call for a Global Coalition Against Catastrophic Terrorism” (report on a Conference sponsored by the Nuclear Threat Initiative, Moscow, Russia, May 27, 2002; available at http://www.nti.org/c_press/c_index.html as of January 13, 2003).

¹⁰ Graham Allison and Andrei Kokoshin, “The New Containment,” *National Interest*, no. 69 (Fall 2002).

ing for their stockpiles of WMD and related materials.

A decade after the collapse of the Soviet Union, Russia, its President, and its relationship with the United States are ready for this partnership role. President Putin and President Bush have forged an extraordinary level of U.S.-Russian cooperation in the war on terrorism, and agreed soon after September 11 that “our highest priority is to keep terrorists from acquiring weapons of mass destruction.”¹²

Putin has personally identified terrorism as the most severe threat to Russia’s national security, and warned of the terrible danger to Russia should terrorists acquire weapons of mass destruction. Like the United States, Russia has experienced large-scale terrorism in its capital city and elsewhere; Russia has large stocks of WMD that must be secured; Russia has considerable expertise to bring to bear in helping other nations secure their stockpiles; and Russia has a range of political relationships with key states (including states the United States has little or no relationship with, from Iran to Libya) that can be crucial in building their cooperation in this effort to secure global stockpiles.

A substantial shift from a donor-recipient mode to a partnership approach to threat reduction will require changes in policy in both Washington and Moscow – but such changes could both accelerate progress in efforts to secure nuclear warheads and materials, and make them more effective and lasting.¹³

Fulfilling the Partnership’s Promise

The difficulty of forging an effective coalition to secure all the world’s stockpiles of WMD and related materials should not be underestimated. Strong partnerships will have to be built in areas

that each country involved regards as highly sensitive. Cooperation with states with emerging nuclear weapons programs, such as Pakistan and India, outside the current G-8 partnership will be needed, but such collaboration will have to be handled with extreme care, in order to address the proliferation issues effectively while assuaging important sensitivities on all sides. In many cases, bilateral (and possibly even secret) cooperation will be more effective than trying to involve a large number of countries. Dealing with the WMD stockpiles in states not likely to participate in such a coalition – such as Iraq or North Korea – will be particularly challenging. Given these difficulties, there should be no doubt that sustained engagement from the White House – including the focused attention of a full-time leader for this effort, and personal engagement by the President – will be essential to success.

Indeed, the record of past G-8 efforts in such areas is not impressive, and highlights the pitfalls that must be avoided this time. Past commitments by the previous U.S. President and other G-8 leaders have been made with great fanfare, and then never fulfilled. Consider, for example, the fate of two initiatives launched at the G-8 Nuclear Safety and Security Summit in Moscow in 1996. In the statements from that summit, the assembled leaders called for quick action to reduce stockpiles of excess weapons plutonium. After the summit, an experts group to consider plutonium disposition met several times, and a process was initiated to try to reach agreement on sharing the cost of reducing Russia’s excess weapons plutonium stockpile. Today, over six years later, that same process is still continuing and has not yet reached a conclusion. Every year, the G-8 summit statement would again emphasize the importance the leaders attached to disposition of excess plutonium – every year, that is, until the year when they

¹¹ For a useful discussion of the need for the United States and Russia to lead an “Alliance Against Nuclear Terrorism” with these aims, see Allison and Kokoshin, “The New Containment,” op. cit. See also the extensive discussion in Einhorn and Flournoy, eds., *Protecting Against the Spread of Nuclear, Biological, and Chemical Weapons*, op. cit., and the discussion in Siegfried S. Hecker, Testimony to the Senate Committee on Foreign Relations, April 23, 2002.

¹² The White House, Office of the Press Secretary, “President Announces Reduction in Nuclear Arsenal: Press Conference by President Bush and Russian President Vladimir Putin” (Washington, D.C., press release, November 13, 2001; available at <http://www.whitehouse.gov/news/releases/2001/11/20011113-3.html> as of January 3, 2003).

¹³ See discussion in Bunn, Holdren, and Wier, *Securing Nuclear Warheads and Materials*, op. cit.

had committed to actually have an agreed plan in place. That year the failure to reach a conclusion became so manifest that the staff preparing the leaders' statement decided to leave out any mention of plutonium disposition altogether. Then, in the June 2002 G-8 Global Partnership statement, plutonium disposition was again listed among the priority items, much as it was six years earlier in Moscow.

Similarly, the 1996 Moscow summit established a G-8 led program to combat nuclear smuggling, with a wide range of specific areas of cooperation outlined. While this did lead to a substantial number of additional countries joining up in principle to the program, and to increased scientific exchanges on means to determine where seized nuclear materials might have come from, the reality is that the total scope of additional activities resulting from this agreed G-8 program was very modest. As a result, the G-8 in June 2002 again had to state that it was committing to develop effective border controls and international law enforcement coordination to detect and interdict WMD smuggling.¹⁴

There remains an enormous amount of work to do to transform the general statement of June 2002 into the kind of effective, action-oriented Global Partnership that is urgently needed – and to avoid repeating the experience of these past G-8 initiatives.¹⁵ Concerned citizens in all the G-8 countries must press their governments to fulfill the goals of the June 2002 statement. A important aspect must be accountability: establishing means to monitor the degree to which each participant is living up to the agreed commitments, and the degree to which the key threats the initiative focuses on are in fact being reduced.

The G-8 leaders will meet again in France in June 2003. The time between now and then is critical. If

the initial statement has not been transformed into a functioning partnership that is actually beginning to take specific, concrete actions by then, it will be extraordinarily difficult after that to overcome the forces of inertia and regain momentum. The opportunity to build the kind of partnership that can in fact protect our countries from the threat of terrorism with weapons of mass destruction, in short, may be fleeting. Former Senator Sam Nunn has laid out a useful set of goals for the partnership to accomplish by the next G-8 summit:¹⁶

By then, we should expect to see them turn these principles into a clear set of priorities, to establish a timeline to guide their work based on a risk-based analysis of the threats, and to dramatically increase funding to reflect the risk that catastrophic terrorism presents to the health, economy and security of every nation. Specifically, we should expect to see:

- A plan and timeline for an urgent effort to secure the most vulnerable nuclear materials through short-term emergency upgrades – either by greater protection or consolidation or both.
- An agreement on how much money each country is committing and when.
- The appointment of a very senior official in each government responsible for programs against catastrophic terrorism.
- A plan to secure material and convert research reactors that use HEU.
- A plan with a timeline and cost estimates for blending down all the world's excess HEU – storing what cannot be absorbed by commercial markets.

¹⁴ 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/globparten.asp> as of February 26, 2003).

¹⁵ For a useful discussion of progress toward this end in the first few months of the effort, see U.S. Senate Committee on Foreign Relations, *A Progress Report on 10 + 10 Over 10: A Hearing*, 107th Congress, 2nd Session, October 9, 2002 (transcript available on LexisNexis Congressional Information Service, Bethesda, Maryland).

¹⁶ Sam Nunn, remarks to the Carnegie Endowment for International Peace International Nonproliferation Conference, Washington, D.C., November 14, 2002 (available at http://www.nti.org/c_press/speech_samnunn_1114.pdf as of January 13, 2003).

- A plan for expanding the G-8 Partnership to include all nations with something to safeguard and something to contribute to safeguarding it.
- A plan for establishing global norms and standards for the handling of dangerous biological pathogens to prevent these materials from being controlled and used by terrorists.
- A plan for international standards for the physical protection of nuclear material. There is currently no international standard or requirement for the physical protection of nuclear material within a state.
- Finally, we have to come to an agreement for how we can take full advantage of the skill and experience of the International Atomic Energy Agency. It is the only international institution of global scope devoted to controlling access to weapons-usable material. If it didn't exist, we would have to create it. Now that it does exist, we ought to fund it and expand it.

These are ambitious objectives – but they are the kinds of objectives that must be met if the terrorists' ambitions to gain control of the world's deadliest technologies are to be thwarted.

Recommendation: Build the G-8 “Global Partnership Against the Spread of Weapons and Materials of Mass Destruction” announced in June 2002 into an effective, working partnership to take all the actions necessary to keep nuclear weapons and weapons-usable materials from being stolen and falling into the hands of terrorists or hostile states. This would include a key role for Russia, and a shift in approach from a donor-recipient relationship to a genuine partnership to improve nuclear security, involving Russian experts and resources from start to finish.

Resources Sufficient to the Task

If nuclear weapons and materials are to be kept out of terrorist hands, adequate resources must be provided to get the job done. Today, the most critically needed resources are sustained high-level

political engagement, a senior official to lead the effort, an integrated plan, and partnerships with the key countries that must cooperate for the goals to be achieved, each of which is discussed above. Next on the list are money and people – which would likely become available if the previous items were put in place.

The post–September 11 world simply cannot afford – if it ever could – to allow progress in securing nuclear weapons and materials to be slowed by lack of funds or personnel devoted to the task. It is crucial that the United States and the other countries involved provide the financial and personnel resources needed to secure the world's stockpiles of nuclear weapons and materials, and to accomplish the other steps needed to block the terrorist pathway to the bomb, as rapidly as these jobs can be done. As noted earlier, the available budgets are now large enough, and the non-monetary obstacles substantial enough, that simply adding money to existing programs, while making no other changes, would in most cases do little to strengthen or accelerate these efforts. But more money *would* be needed to finance the new initiatives recommended below, and to implement accelerated programs if other changes succeeded in overcoming the non-monetary obstacles.

How much the needed efforts would ultimately cost is open to debate – depending on factors such as how much security is to be provided (protecting against only small threats, or against large ones such as the September 11 threat of several groups of well-trained terrorists attacking at once), what stockpiles are to be addressed (nuclear, chemical, biological, and other means terrorists might use for causing large-scale destruction), and how efficiently the money is expected to be spent. In early 2001, an expert panel chaired by former White House Counsel Lloyd Cutler and former Tennessee Senator Howard Baker tentatively outlined a \$30 billion investment over 10 years in securing and reducing Russia's nuclear stockpiles and nuclear complex, and controlling its nuclear expertise.¹⁷ Presumably if one focused on an approach as comprehensive as the one envisioned in the Baker-Cutler study, expanded it to all the world's stockpiles and not just Russia's, and included the billions of dollars required to secure and destroy the

world's chemical weapons stockpiles, control deadly biological pathogens, find and control the most dangerous materials that could be used in radiological "dirty bombs," destroy or convert chemical and biological weapons infrastructure, and re-employ non-nuclear former weapons experts, the cost would be higher still – perhaps as high as \$50 billion for a fully comprehensive effort. But \$50 billion over 10 years would still represent less than 2% of the U.S. annual defense budget – an extraordinarily small price for measures that could dramatically reduce some of the most serious threats to the security of the United States (and other countries around the world).

In our judgment, the most urgent parts of the job can be done for much less. Indeed, in some specific areas described below, a few tens of millions of dollars a year for a few years could make a significant difference.

Whatever donor states are willing to spend, another critical task, beginning immediately and growing over the longer term, will be ensuring that Russia itself allocates the necessary resources to make its own contributions to securing and reducing its WMD stockpiles and complexes – and can afford to secure them indefinitely once international assistance phases out. Russia has recently pledged that it will provide \$2 billion over 10 years as part of the \$20 billion Global Partnership – an extraordinarily important and welcome step.¹⁸ The largest part of making this possible will come from ongoing improvements in Russia's economy, tax base, and federal budget picture, and from the Russian government's increasing understanding of the need to allocate some of these resources to

actions to address potential terrorist threats. At the same time, however, given the continued instability in Russia's economic picture, the likely high continuing costs of securing Russia's stockpiles, and the fact that international donors are unlikely to pay for some of the key needed steps (such as making sure nuclear guards get paid and upgrading security at sites too sensitive to allow foreigners to visit) it makes sense to continue to pursue concepts that could create new revenue streams focused on nuclear security but under Russia's control.

Two such concepts are debt-for-nonproliferation swaps, and setting aside a portion of the revenue from future imports of spent nuclear fuel.¹⁹ In both cases, the idea would be to set aside funds that were Russia's money, but had been made available as a result of decisions by Western countries, in auditable accounts intended to pay for agreed non-proliferation and arms reduction projects.

Debt-for-Nonproliferation Swaps

In 2002, President Bush signed into law the "Debt Reduction for Nonproliferation Act," sponsored by Senators Richard Lugar (R-IN) and Joseph Biden (D-DE).²⁰ The act authorizes a debt swap, in which the United States would cancel a portion of Russia's debt to the United States, in return for Russia paying similar amounts into an auditable fund to support threat reduction projects. The June 2002 G-8 Global Partnership statement held out the possibility that some of the \$20 billion committed could come in the form of debt swaps, rather than direct government expenditures. Russia has taken a generally positive view of the

¹⁷ Baker and Cutler, *A Report Card on the Department of Energy's Nonproliferation Programs with Russia*, op. cit. A study by one of the present authors was more optimistic (and did not envision going as far in some areas), calling for \$5–\$8 billion in investment over five years. See Matthew Bunn, *The Next Wave: Urgently Needed New Steps to Control Warheads and Fissile Material* (Washington, D.C.: Carnegie Endowment for International Peace and the Project on Managing the Atom, Harvard University, April 2000; available at http://bcsia.ksg.harvard.edu/BCSIA_content/documents/FullNextWave.pdf as of January 31, 2003), p. 77.

¹⁸ See, for example, Russian Ministry of Foreign Affairs, "Russian-French Declaration on Strategic Issues," February 10, 2003.

¹⁹ Both of these approaches are discussed in our previous report, Bunn, Holdren, and Wier, *Securing Nuclear Warheads and Materials*, op. cit., pp. 74–78.

²⁰ See, for example, Daniel Horner, "Congress Oks Bill Boosting IAEA, But Impasse Threatens Funding," *Nucleonics Week*, October 31, 2002.

idea, with Russia's chief debt negotiator highlighting the legislation as "a very important aspect of solving Russia's debt problem," which would allow money that would otherwise be used for debt payments to go to destroying "chemical, bacteriological, and other weapons."²¹ Under Secretary of State John Bolton has thanked the Congress for providing this authority and testified that "we intend to pursue it."²²

The basic concept of such a debt-for-nonproliferation swap is modeled on the "debt-for-environment" swaps of the past, some of which have been highly successful. In such a swap, a portion of Russia's debt would be canceled – and Russia would agree that instead of debt service on that debt, it would pay into an auditable fund to finance agreed nonproliferation and arms reduction initiatives.²³ For the creditor countries, a debt swap makes it possible to get something positive (in this case, crucial investments in international security) out of contentious debt negotiations. For the debtor country, a debt swap means being able to make payments in local currency, to be spent within the domestic economy, rather than sending hard currency abroad in debt payments. Depending on the specific arrangements of the particular swap, the amount paid into the fund is also sometimes smaller than the amount of debt forgiven.

Debt-for-environment swaps have been successful in many countries. In 1991, for example, the creditor nations of the Club of Paris agreed to a substantial debt-for-environment swap with Poland, in which a portion of Poland's debt was cancelled, and in return, Poland made contributions to a

newly established independent foundation, the Ecofund, so that the expenditure of the money on the agreed environmental purposes could be easily verified. The Ecofund now has over \$570 million available through 2010 from debt swaps with several countries (with the United States the biggest donor), and has been a leading force in improving the environment in Poland and stimulating the Polish market for environmental goods and services.²⁴ The amount of money Poland puts into the Ecofund and how that money is spent are fully auditable, and all expenditures must be approved by a board that includes both Polish and donor-country representatives. Moreover, the creation of the Ecofund, with its Polish managers and staff, has helped build in-country capacity to finance and manage large environmental projects that would not have existed if the same funds had been applied in more traditional forms of aid.

Similar approaches could potentially be taken with a debt-for-nonproliferation fund in Russia. Given the enormous burden of Russia's foreign debt – half of it incurred by the Soviet government, not the democratic Russian governments that succeeded it – even swapping a few percent of the government-to-government debt held by the Paris Club of creditor countries could create a fund that would be worth billions of dollars. As one element of the 10 + 10 over 10 initiative, that would be a potentially very important complement to regular Nunn-Lugar expenditures. Much of the Russian debt is held by European countries (particularly Germany and Italy) – but as in the case of the EcoFund, U.S. leadership and contributions are likely to be crucial to unlocking broader participation.

²¹ Victor Sokolov, "Victor Supyan: 'The U.S. Could Set a Serious Precedent in Solving the Problem of Russia's Debts,'" *Strana.ru*, January 31, 2002.

²² John Bolton, Under Secretary of State for Arms Control and International Security Affairs, testimony in U.S. Senate Committee on Foreign Relations, *A Progress Report on 10 + 10 Over 10: A Hearing*, 107th Congress, 2nd Session, October 9, 2002 (transcript available on LexisNexis Congressional Information Service, Bethesda, Maryland).

²³ In fact, there are also more complex approaches than outright cancellation, including buybacks by the creditor, sale of the debt instruments to a third party who then cancels or restructures them, and so on. For a useful discussion of the concept of debt for nonproliferation swaps with Russia, and the precedent set by debt for environment swaps, see James Fuller, "Debt for Nonproliferation: The Next Step in Threat Reduction," *Arms Control Today* (January/February 2002; available at http://www.armscontrol.org/act/2002_01-02/fullerjanfeb02.asp as of January 13, 2003).

²⁴ For more on the Ecofund and its success, see its website; available at <http://www.ekofundusz.org.pl/us/index.htm> as of January 13, 2003, and *Swapping Debt for the Environment: The Polish Ecofund* (Paris: Organization for Economic Cooperation and Development, March 1998).

It is critical, however, that any U.S. funding for debt swaps should be *in addition to*, not instead of, continuing appropriations for cooperative nonproliferation assistance. Reducing appropriations for ongoing programs in order to put money into a debt swap mechanism just being established would almost certainly slow, rather than accelerate, progress toward the goal of ensuring that stockpiles of weapons of mass destruction are secure and accounted for.

Yet another advantage of a debt-for-nonproliferation swap is that the mechanism effectively transfers the financing discussion from negotiating groups focused on nonproliferation – for whom a billion dollars is vast sum – to negotiating groups focused on international finance and the global economy, where officials routinely deal in units of tens of billions of dollars. Such a change of venue could significantly improve the prospects for arranging large-scale additional funding for threat reduction.

Spent Fuel Storage

Russia has modified its laws to allow the import of foreign spent nuclear fuel for long-term storage and reprocessing in Russia. Russia's Ministry of Atomic Energy (MINATOM) projects that it might be possible to earn \$20 billion in gross revenue from importing 20,000 tons of spent fuel over 10–20 years.²⁵ This idea has been hugely controversial in Russia, however, with polls typically showing 80–90% of Russians opposing imports of other countries' spent nuclear fuel. Since the passage of the new law allowing such imports, Russia has taken only modest actions to begin

implementing it on a large scale, suggesting that large-scale spent fuel imports may no longer have as much high-level support as they did when the law was passed.

If such an effort does go forward, though, the United States has substantial leverage that it could use to convince Russia to spend a portion of the revenue on agreed nonproliferation and arms reduction needs: because a very large fraction of the fuel Russia would like to import originated in the United States or was irradiated in U.S.-origin reactors, the United States has a veto over whether it can be shipped to Russia.

Russia's offer to serve as host for other countries' spent fuel raises a complex set of safety, security, economic, political, and policy issues. Such a facility could make a substantial contribution to international security and would deserve support *if*.²⁶

- Effective arrangements (including independent regulation) were in place to ensure that the entire operation achieved high standards of safety and security;
- Negotiation over the project provided an opportunity to effectively resolve the proliferation risks posed by Russian nuclear cooperation with Iran;
- A substantial portion of the revenues from the project were used to fund disarmament, nonproliferation, and cleanup projects that were agreed to be urgent, such as securing nuclear material and eliminating excess plutonium stockpiles;

²⁵ Valentin B. Ivanov, then-First Deputy Minister of Atomic Energy, *Technical-Economic Basis for the Law of the Russian Federation: "On the Proposed Amendment to Article 50 of the Law of the RSFSR 'On Environmental Protection'"* (Moscow, Russia: Ministry of Atomic Energy, 1999, leaked and translated by Greenpeace International). How much of this gross revenue would be profit has been the subject of some dispute.

²⁶ For more extensive discussions of the issues surrounding the Russian spent fuel import concept and other proposals for international spent fuel storage facilities, see Matthew Bunn, John P. Holdren, Allison Macfarlane, Susan E. Pickett, Atsuyuki Suzuki, Tatsujiro Suzuki, and Jennifer Weeks, *Interim Storage of Spent Nuclear Fuel: A Safe, Flexible, and Cost-Effective Approach to Spent Fuel Management* (Cambridge, Mass.: Project on Managing the Atom, Harvard University, and Project on Sociotechnics of Nuclear Energy, University of Tokyo, June 2001; available at <http://ksgnotes1.harvard.edu/BCSIA/Library.nsf/pubs/spentfuel> as of January 13, 2003), Chapter 4; Matthew Bunn, "Russian Import of Foreign Spent Fuel: Status and Policy Implications," in *Proceedings of the 42nd Annual Meeting of the Institute for Nuclear Materials Management, Indian Wells, Cal., July 15–19, 2001* (Northbrook, Illinois: INMM, 2001); and Matthew Bunn, "Prospects for Russian Spent Fuel Import: Insights from the Harvard-Tokyo Study and Beyond," in *Proceedings of the Institute for Nuclear Materials Management Spent Fuel Seminar XIX, Washington, D.C., January 9–11, 2002* (Northbrook, Illinois: INMM, 2001).

- The project did not in any way contribute to separation of additional unneeded weapons-usable plutonium, or to Russia's nuclear weapons program; and
- The project had gained the support of those members of the public likely to be affected by it, through a democratic process that included giving them ample opportunity to ensure that their concerns were effectively addressed.

Whether an arrangement that meets these criteria can be put in place in Russia – and what the reaction will be if a proposal advances which meets the first four criteria but not the fifth – remains to be seen.

The principal obstacle now standing between MINATOM and \$10–\$20 billion in revenue is the U.S. government's permission, because most of the spent fuel Russia might import cannot be shipped to Russia without U.S. approval. This gives the United States potentially huge leverage in negotiations over the spent fuel import issue. Under Section 123 of the Atomic Energy Act of 1954, as amended, the U.S. government cannot give its permission without a formal agreement for nuclear cooperation. To date, the U.S. government has not been willing to negotiate such an agreement with Russia because of Russia's ongoing nuclear cooperation with Iran.²⁷ In September 2002, U.S. Secretary of Energy Spencer Abraham and Russian Minister of Atomic Energy Alexander Rumiantsev discussed initiating negotiations on a Section 123 agreement, with the explicit understanding that this would require a deal on Russia's nuclear cooperation with Iran.²⁸ However, with the revelation that Iran is building both a gas centrifuge enrichment plant and a heavy

water production plant, both of which are believed by the United States to incorporate Russian technologies, U.S.-Russian agreement on Russia's nuclear cooperation with Iran seems farther away than ever.²⁹

If the spent fuel import initiative is to move forward, the United States should seek to use its leverage not only to address the Iran issue, but also to gain Russian agreement to set aside a portion of any revenues from spent fuel imported with U.S. approval in a fund for securing and destroying stockpiles of weapons of mass destruction.

One example of such an approach has been put forward by a U.S. group known as the Nonproliferation Trust. In their proposal, 100% of the profit earned from Russia's spent fuel import would be controlled by auditable non-profit trusts based in the United States, which would spend the money – more than \$10 billion by their estimate – on nonproliferation, arms reduction, and cleanup projects in Russia.³⁰ While it appears unlikely that Russia would ultimately agree to devote *all* of the profits from such a venture to these purposes, there is nonetheless an opportunity for negotiating an arrangement that would provide large sums – potentially billions of dollars – to finance nonproliferation and arms reduction.

In short, there are opportunities to establish new revenue streams that would help Russia meet its responsibilities to contribute to financing both urgent and continuing costs of securing and destroying its weapons of mass destruction and related materials.

Recommendation: *Provide resources sufficient to ensure that the pace at which the threat of nuclear weapons terrorism is reduced is not limited by resources.*

²⁷ Robert J. Einhorn and Gary Samore, "Ending Russian Assistance to Iran's Nuclear Bomb," *Survival* 44, no. 2 (Summer 2002).

²⁸ See, for example, Mark Hibbs, "U.S.-Russian Talks May Table Swapping Iran Reactors for Reprocessing Consent," *Nuclear Fuel*, September 30, 2002.

²⁹ See, for example, David Sanger, "U.S. Says Russia Helped Iran in Nuclear Arms Effort," *New York Times*, December 16, 2002. For a discussion of these facilities, see David Albright and Corey Hinderstein, "Iran at a Nuclear Crossroads" (Washington, D.C.: Institute for Science and International Security, February 20, 2003; available at <http://www.isis-online.org/publications/iran/crossroads.html> as of February 26, 2003).

³⁰ The Nonproliferation Trust proposal is described in Joseph Egan, *The Nonproliferation Trust Project: Frequently Asked Questions* (Washington, D.C.: Nonproliferation Trust, 2000).

The Information Needed to do the Job

The United States, other governments participating in the Global Partnership, and international organizations such as the International Atomic Energy Agency (IAEA) should each take steps to collect the information needed to target threat reduction programs most effectively:

- In the United States, DOE and its laboratories, working with other agencies as appropriate, should put in place a department-wide team to collate available information on vulnerable nuclear sites around the world. This information should be compiled into profiles of each known facility where nuclear weapons or weapons-usable nuclear materials are located, with tentative priority ratings assigned to each based on the quantity and quality of the nuclear material at that site, the level of security for it, and the threats that exist in the area. Comparable teams might be established at DOE or at other agencies (such as Customs or State) to address other elements of the task of blocking the terrorist pathway to the bomb – compiling information needed to set priorities for interdicting nuclear smuggling, stabilizing employment for nuclear personnel, monitoring nuclear stockpiles, and reducing these stockpiles. While the intelligence agencies can and must provide information to support these efforts, for a variety of reasons – including minimizing the impression in other countries that this effort to upgrade nuclear security is just a disguised spying operation – it makes sense to have a key collection of the relevant information done by the policy implementation agencies, and not only by the intelligence community.
- Nevertheless, the U.S. intelligence community's approach to nuclear intelligence should be substantially reformed, to focus the highest priority on those areas that could result in terrorists gaining access to nuclear weapon capabilities, or other areas which hold the potential for major

strategic surprise that could substantially threaten the United States. The President should instruct the Director of Central Intelligence to focus substantial resources on providing intelligence support to efforts to secure nuclear warheads and materials around the world, to interdict nuclear smuggling, and to the other essential elements of blocking the terrorist pathway to the bomb. In particular, he should direct that an intelligence center with substantial staffing (perhaps at CIA headquarters, perhaps at one of the national laboratories) be created to focus on these issues. Congress, in overseeing the intelligence community's budget, should mandate that the community devote substantial resources to the multifaceted aspects of the nuclear terrorism problem. Specifically, Congress should require that the administration prepare a classified annual report detailing what is known about which facilities in the world hold warheads, plutonium, or HEU, in what quantities and forms, how well secured and accounted for the materials are at these facilities, and what other information is available about the general level of threat at each facility. Such a legislative reporting requirement would begin to put such issues on a priority level comparable to arms control compliance and other nuclear intelligence priorities.

- A dramatic expansion is needed in confidential sharing of information about each country's nuclear security practices, and sharing of intelligence and police information on attempts to steal, smuggle, or buy nuclear weapons and materials. As noted above, United States should work closely with the participants in the Global Partnership and other interested countries to share such information. This can and should be a key part of the partnership's priority-setting function.
- The IAEA should continue and accelerate its current efforts to improve its nuclear smuggling database, so as to provide more information support to programs to interdict nuclear smuggling.³¹

³¹ 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).

At the same time, the IAEA should begin to prepare a confidential database on amounts and forms of nuclear material at various locations around the world, and physical protection arrangements at these sites. IAEA safeguards inspectors, who have already on occasion provided information on nuclear security problems gleaned during their safeguards inspections to the agency's Office of Physical Protection, should be provided at least basic training in assessing strengths and weaknesses of physical protection systems, and clear instructions to provide information on any urgent weaknesses they observe to the officials at the agency charged with dealing with physical protection. The United States and other IAEA member states should provide the agency with additional funds to ensure that adequate resources are available for these tasks.³² The IAEA should continue to strengthen its measures to ensure that the confidentiality of all information on nuclear security at particular sites is protected.

Recommendation: Focus key U.S. government and international resources on providing the information and analysis needed to pursue a fast-paced, prioritized program to keep nuclear weapons and materials out of the hands of terrorists or hostile states – including information on what nuclear materials exist where, under what kinds of security conditions.

Independent Analysis and Advice

It is extraordinarily difficult, in the course of the day-to-day crises involved in running a program in the administration or in struggling to oversee programs on Capitol Hill, to draw back and think strategically about how best to address these kinds of threats. Performing in-depth analysis of the costs and benefits of alternative approaches, gaming different scenarios, and other efforts to

draw back and examine the larger picture are nearly impossible in those environments.

There is an urgent need, therefore, to create increased capabilities outside government for in-depth, independent analysis of these threats and the programs to address them. In their recent report on the role of science and technology in defending the nation from terrorism, a committee of the National Academies recommended the establishment of an Institute for Homeland Security, modeled roughly on the role the RAND Corporation played for the Air Force in the 1950s.³³ The Congress, in passing the legislation establishing the Department of Homeland Security, included a provision establishing such an institute. Although the Department will focus almost exclusively on the domestic aspects of homeland security, keeping weapons of mass destruction out of terrorist hands in the first place is obviously a crucial element of defending the U.S. homeland, and would be an appropriate additional focus for this new institute. President Bush and the Congress should work together to ensure that this institute establishes a branch devoted to in-depth analysis of the most effective approaches to blocking the terrorist pathway to the bomb – including identification of gaps, reviews of existing programs, design of new or modified efforts, analysis of the most promising opportunities to pursue, and more.

In addition, experience has shown that most large programs function better when they have a regular mechanism for independent review and advice on program priorities and implementation. Indeed, the Bush administration's Office of Management and Budget has wisely included the presence or absence of a mechanism for such independent assessment as one of the key elements by which the performance of government programs should be judged.³⁴ To improve the effectiveness of the overall effort to control nuclear warheads and materials, each of the largest programs should establish

³² See "Expanded Support for the International Atomic Energy Agency (IAEA)," p. 154.

³³ Committee on Science and Technology for Countering Terrorism, National Research Council, *Making the Nation Safer: The Role of Science and Technology in Countering Terrorism* (Washington, D.C.: National Academy Press, 2002; available at <http://books.nap.edu/html/stct/index.html> as of January 13, 2003)

³⁴ Office of Management and Budget (OMB), "Instructions for the Program Assessment Rating Tool (PART)" (Washington, D.C.: OMB, 2002; available at http://www.whitehouse.gov/omb/budintegration/part_guidance_instructions.doc as of January 9, 2003), Section II, Question 5, p. 13.

an independent advisory group to provide regular oversight and advice, composed of individuals with the time and expertise to provide both strategic vision and mid-course corrections on the specifics of program implementation. A similar group of independent experts, perhaps at a more senior level, should be established to advise the new White House official appointed to lead the entire panoply of efforts.

Recommendation: Get in-depth independent analysis and advice on programs to keep nuclear weapons and materials out of the hands of terrorists or hostile states, by making such analysis a key part of the mandate of the new Homeland Security Institute, and by establishing independent advisory panels for each of the most important programs in this area.

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

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 fuel³ – 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 pro-

vided 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.

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 de 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

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://ksnotes1.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 overcome 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

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 stock-

piles 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 Longworth, *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.

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.

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-

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

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.

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.

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/millar-may02.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

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.

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 materi-

als, 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-

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).

11. Interdicting Nuclear Smuggling

By far the most important step in preventing nuclear weapons and materials from falling into the hands of terrorists or hostile states is to keep these items from being stolen in the first place. Nevertheless, the United States, in partnership with other countries and international organizations, also needs to do what it can to find and recover stolen nuclear weapons or materials, and to interdict nuclear smuggling, providing an essential second line of defense should efforts to secure nuclear weapons and materials fail.¹

A multi-layered defense is particularly important given that some nuclear material has likely already been stolen and not yet recovered. In early 2002, for example, the CIA warned:

Weapons-grade and weapons-usable nuclear materials have been stolen from some Russian institutes. We assess that undetected smuggling has occurred, although we do not know the extent or magnitude of such thefts. Nevertheless, we are concerned about the total amount of material that could have been diverted over the last 10 years.²

The problem is a huge one. Intercepting a smuggled nuclear weapon or the materials for one as they cross international borders – including the U.S. border – would not be easy. The length of these borders, the diversity of means of transport, the millions of vehicles that pass the U.S. borders every year, the isolation and vulnerability to bribery or blackmail of border control officers in many countries, and the ease of shield-

ing the radiation from plutonium or highly enriched uranium (HEU) all operate in favor of the terrorists.

The huge volume of drugs successfully smuggled into this country every year provides an alarming reference point. Finding nuclear material or a nuclear weapon that might be hidden somewhere in a major city would be no easier. Thus, while it is important to invest appropriately in building effective second lines of defense, in considering what should be done and how much should be spent, no one should expect that these back-up defenses can ever be fully effective.

The United States, other countries, and international organizations such as the International Atomic Energy Agency (IAEA) are already sponsoring a wide range of initiatives to improve international capabilities to stop nuclear smuggling, which are having some success.³ In their June 2002 Global Partnership announcement, the G-8 countries pledged that they would each “develop and maintain effective border controls, law enforcement efforts and international cooperation to detect, deter and interdict” illicit trafficking in weapons of mass destruction and related materials, and assist other states to do the same.⁴ But there is an enormous amount to be done to fulfill these pledges and put an effective second line of defense against nuclear terrorism in place. The Bush administration should continue and complete its efforts to develop a comprehensive plan to counter nuclear smuggling, integrating all the myriad U.S. efforts in this area, and specifying what

¹ One particular U.S.-funded program to counter nuclear smuggling goes by the name the “Second Line of Defense.” In using that phrase here, we do not mean to refer to this particular program, but rather to the full range of backup defenses needed should security for nuclear materials fail and nuclear materials be stolen.

² U.S. Central Intelligence Agency, *Annual Report to Congress on the Safety and Security of Russian Nuclear Facilities and Military Forces* (Langley, Virginia: CIA, February 2002; available at http://www.cia.gov/nic/pubs/other_products/icarussiansecurity.htm as of January 14, 2003).

³ See Anthony Wier, “Interdicting Nuclear Smuggling,” *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/interdicting.asp as of March 12, 2003).

entities in which countries are to be provided with what capabilities by what date, with what resources. As part of such a comprehensive effort:

- The United States should seek to ensure that every major port shipping large quantities of cargo to the United States has equipment and training to inspect this cargo for nuclear weapons and materials – *before* it arrives at U.S. shores. At the same time, the United States should invest enough to ensure that at key entry points into the United States, equipment and trained personnel are available to inspect for nuclear weapons and materials. Inevitably, though, it will only be possible to search a small sample of entering vehicles, cargo, and bags, so better intelligence on where to look and improved methods to screen and identify the highest-priority items for inspection will be particularly crucial.
- Within the United States, the capabilities of the Nuclear Emergency Search Team (NEST) should be augmented, with a focus on ensuring near-instantaneous response to any credible threat of a hidden nuclear weapon or nuclear material. Consideration should be given to making NEST personnel full-time, rather than detailing them from other work on a volunteer basis, as has traditionally been done. And a cooperative effort should be undertaken to make sure that such nuclear search capabilities are available to U.S. partners in the war on terrorism around the world, in the event of a threat arising elsewhere.
- The United States and other donor states and organizations should ensure that within 3–4 years, every relevant country has at least one unit of its national police force assigned, trained, and equipped to deal with nuclear smuggling. These units should work closely with nuclear operators and regulators in their countries to ensure that they have the best possible information on possible nuclear theft risks, and should closely monitor and attempt to disrupt criminal groups and smugglers suspected of interest in nuclear smuggling.
- The United States and other donor states and organizations should identify each of the border crossing points (or zones, where defined border crossings are not the biggest problem) that are particularly likely routes for nuclear smuggling, and should work to ensure, within 3–4 years, that at each of these points or zones, border control and customs officials are trained and equipped to be able to detect and stop nuclear materials. This effort should include putting in place equipment, procedures, and incentives to limit these officials' susceptibility to corruption by the smugglers (such as the nuclear smuggling equipment provided by some U.S. programs, which provides its information in real time both to the customs officer at the post, and to a central station, where the officials are not readily available to the smuggler to be bribed). Consideration should be given to keeping confidential the list of crossing points that have appropriate nuclear detection capabilities and those that do not.
- Effective forensic capabilities to help determine the origin of seized nuclear materials should be provided on a regional basis, the relevant science and technology should be further developed, and to the extent possible within classification restraints, databases on the properties of materials produced at particular facilities should be exchanged, to be matched against the properties of seized nuclear materials.
- International cooperation and sharing of information related to nuclear smuggling among police and intelligence agencies should be substantially expanded – including information on theft cases, smugglers and middle-men, buyers attempting to purchase such materials, and more. Just as in the larger counterterrorism struggle, because nuclear thieves, smugglers, middlemen, and buyers are operating internationally, they can only be fought effectively with a fully international effort. Unfortunately, in recent years, despite past commitments, real sharing of information on nuclear theft and smuggling among police and intelligence agencies has been extremely limited.⁵

⁴ 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).

■ The United States and other interested states should devote substantial intelligence efforts – including infiltration and covert operations – to identifying, disrupting, and destroying nuclear theft and smuggling organizations. Sting operations should be used more extensively, to make it more difficult for nuclear thieves and buyers to connect with each other, and to draw out and arrest participants in all segments of the nuclear black market.⁶

■ The United States should work with the relevant countries to ensure that their legal penalties for theft, unauthorized possession, and smuggling of nuclear weapons and weapons-usable nuclear materials are sufficiently severe. Given the potential consequences, these crimes should be punishable by penalties comparable to those for murder or treason, but this is far from the case in many countries today. Indeed, the nuclear thieves in some of the best known cases served only a few years in jail (if that much), and are now back out on the street. Presumably nuclear smugglers will be most deterred by a high probability of being caught (offered, one hopes, by the steps described above) combined with a high penalty if they are.

Recommendation: *Develop and implement a comprehensive strategic plan specifying what institutions in what countries are to be provided with what capabilities by when, with what resources.*

Recommendation: *This plan should include, among other steps:*

■ ***Providing effective nuclear detection capabilities at ports shipping cargo to the United***

States and at key entry points into the United States;

■ ***Strengthening U.S. and international nuclear emergency search and response capabilities;***

■ ***Establishing units of the national police in each relevant country trained and equipped to deal with nuclear smuggling cases;***

■ ***Identifying the most critical border crossings that may be routes for nuclear smugglers, and providing training and equipment to detect nuclear materials at those points;***

■ ***Providing regional capabilities for forensic analysis of seized nuclear materials, to attempt to determine where they came from (with increased exchange of data on the properties of materials produced at particular facilities);***

■ ***Greatly expanding the sharing of intelligence and police information (including through international organizations such as Interpol) related to nuclear theft and smuggling;***

■ ***Strengthening intelligence efforts focused on identifying and disrupting nuclear theft and smuggling organizations, including sting operations and other means to make it more difficult for smugglers and buyers to connect;***

■ ***Putting in place severe legal penalties for theft and smuggling of weapons-usable nuclear material in all the relevant countries; and***

■ ***Providing resources to the IAEA to allow it to help track and analyze nuclear smuggling and help states improve their nuclear smuggling interdiction capabilities.***

⁵ See, for example, discussion in William Potter and Elena Sokova: "Illicit Trafficking in the NIS: What's New? What's True?" *Nonproliferation Review* 9, no. 2 (Summer 2002; abstract available at <http://cns.miis.edu/pubs/npr/vol09/92/abs92.htm#pot> as of January 14, 2003).

⁶ See in particular the very useful discussion in Philip Williams and Paul N. Woessner, "Nuclear Smuggling: Adaptability, Organized Crime, and Undercover Operations," in *Measures to Prevent, Intercept, and Respond to Illicit Uses of Nuclear Material and Radioactive Sources: Proceedings of an International Conference Held in Stockholm, Sweden, May 7–11, 2001* (Vienna, Austria: IAEA, 2002)., and Rensselaer Lee, *Nuclear Smuggling and International Terrorism: Issues and Options for U.S. Policy* (Washington, D.C.: Congressional Research Service, August 17, 2002).

12. Stabilizing Employment for Nuclear Personnel

With Russia planning to reduce its nuclear weapons workforce by some 35,000 people over the next several years – roughly half of the current total – an intensive effort to work with Russia to shrink the size of its nuclear complex and reemploy the nuclear experts and workers who are no longer required is still urgently needed. This is true even though Russia's nuclear experts and workers are currently receiving a living wage, paid on time, because the time when insiders may be most tempted to steal nuclear material or sell nuclear knowledge is likely to be when they still have access to nuclear materials and secrets, but expect that they will be losing their job and their access soon. For tens of thousands of people in Russia, that most dangerous time is now.

Far-reaching reforms of U.S. efforts in this area will be needed if they are to succeed in helping Russia reduce its nuclear complex to a sustainable size consistent with its post-Cold War missions without that reduction creating desperation and instability that could lead to substantial new proliferation risks.¹ In particular, the United States and other interested governments should:

- Establish a broader and higher-level dialogue with Russia on steps that Russia and other governments need to take to ease the transition to a smaller nuclear complex in Russia, and avoid proliferation risks in that process;

- Pursue a much broader approach to fostering re-employment for Russia's nuclear experts and workers;
- Cooperate with Russia to couple this broader job-creation approach with assistance for secure retirement for older nuclear experts and workers, reducing the job-creation requirement; and
- Undertake a more focused approach to assisting Russia in closing or converting the excess infrastructure of both its nuclear weapons complex and its civilian nuclear industry.

To succeed, such a reformed effort will also require substantially more resources, perhaps coming not only from the United States and Russia, but also from the other partners in the G-8 Global Partnership. But resources without reform will not be enough to accomplish the goals – and would not be politically sustainable, in Washington or in Moscow. Therefore, we discuss each of these four reform efforts in more detail below.

A Broader and Higher-Level Dialogue With Russia

To date, much of the U.S.-Russian dialogue concerning the specifics of what should be done about Russia's nuclear weapons complex has been

¹ See Anthony Wier, "Stabilizing Employment for Nuclear Personnel," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/stabilizing.asp as of March 12, 2003). For useful recent discussions of these issues, see Oleg Bukharin, Frank von Hippel, and Sharon K. Weiner, *Conversion and Job Creation in Russia's Closed Nuclear Cities: An Update Based on a Workshop Held in Obninsk, Russia, June 27–29, 2000* (Princeton, N.J.: Princeton University, November 2000; available at <http://www.princeton.edu/~globsec/publications/pdf/obninsk1.pdf> as of January 14, 2003); *Reshaping U.S.-Russian Threat Reduction: New Approaches for the Second Decade* (Washington, D.C.: Russian American Nuclear Security Advisory Council and Carnegie Endowment for International Peace, November 2002; available at http://www.ransac.org/new-web-site/whatsnew/Reshaping_threat_reduction.pdf as of January 14, 2003); Sharon K. Weiner, "Preventing Nuclear Entrepreneurship in Russia's Nuclear Cities," *International Security*, Fall 2002; Siegfried S. Hecker, "Thoughts about an Integrated Strategy for Nuclear Cooperation with Russia," *Nonproliferation Review* 8, no. 2 (Summer 2001; available at <http://cns.miiis.edu/pubs/npr/vol08/82/heck82.htm> as of January 14, 2003); and Matthew Bunn, *The Next Wave: Urgently Needed New Steps to Control Warheads and Fissile Material* (Washington, D.C.: Carnegie Endowment for International Peace and the Project on Managing the Atom, Harvard University, April 2000; available at http://bcsia.ksg.harvard.edu/BCSIA_content/documents/FullNextWave.pdf as of January 31, 2003).

between mid-level officials of the U.S. Department of Energy (DOE) and Russia's Ministry of Atomic Energy.² The reality is that these officials simply do not have the authority or the expertise to make decisions on some of the most crucial policies for the nuclear cities' future – from tax provisions to access arrangements, from whether certain cities should be opened to what pension arrangements should be made available to retiring nuclear workers, from financial incentives for businesses to locate in these cities to infrastructure investments. As a result, many of the most important decisions Russia has made about these cities' future – for example, granting, and then taking away, special tax status for businesses that registered there – have been made with little U.S.-Russian coordination or sharing of U.S. and other Western experience.

A broader and higher-level dialogue is needed, focused on reaching specific decisions on steps the Russian government, the U.S. government, and other governments can take to ensure a stable transition toward a smaller Russian nuclear complex. Such a dialogue should seek to reach agreement on: tax and other financial incentives for businesses to employ former nuclear weapons complex employees; access arrangements that will make these cities plausible places for Russian or foreign investment, while preserving security; which parts, if any, of which cities should be opened, when, and with what approaches to maintaining security for the nuclear facilities there; how best to coordinate Russia's own conversion investments with those sponsored by the United States and other countries; what Russian government investments in infrastructure and training (in cooperation with foreign investments) are needed for business development in the nuclear cities and nearby; means to provide needed start-up capital for businesses in or near the nuclear cities; and more.

As Russia's chemical, biological, and missile complexes also feature an extensive set of closed cities, some of which face even more daunting challenges than the nuclear cities, it may make sense for this broader and higher-level dialogue to

focus on shrinking, securing, and stabilizing all of Russia's weapons of mass destruction complexes, not just the nuclear complex.

Recommendation: Establish a broader and higher-level dialogue with Russia on steps that Russia and other governments need to take to ease the transition to a smaller nuclear complex in Russia, and avoid proliferation risks in that process.

A Broader Approach To Job Creation

Thus far, U.S. and international programs have focused on two principal strategies: providing short-term R&D grants, and promoting commercialization of technologies from the former Soviet weapons institutes. Each of these approaches is important, and has had successes – but they are not likely to be sufficient. As far as the authors are aware, there is no example anywhere in the world in which the economy of a region where the principal industry had drastically declined was revitalized solely through commercializing technologies from a few institutes in that region. Rather, a much broader set of tools – investment incentives, infrastructure, education and training, and other steps to make a region economically attractive to business – have generally proved essential to success.

Indeed, given the marginal conditions for investment in new businesses in Russia, and the even more difficult conditions in Russia's closed nuclear cities, a broader definition of sustainable job creation – which could include jobs at firms primarily working on government contracts – is likely to be needed to meet the huge challenge posed by the downsizing in Russia's nuclear cities. The Bush administration should therefore establish a senior advisory group including individuals with extensive experience with what works and what does not in economic redevelopment of regions whose main industries have declined, experience in the Russian market, and experience with high-technology commercialization, to help develop such a broadened plan. To be successful, this senior advisory group must develop this plan *jointly* with Russian experts.

² There is a joint steering committee for the Nuclear Cities Initiative that includes broader representation, but it has done very little high-level heavy lifting in determining approaches to ensuring a safe and secure future for Russia's nuclear complex.

This plan should include a number of features:

- Tax and other incentives for businesses to hire former nuclear weapons complex employees. For example, the Russian, U.S., and other governments could join in providing the funds necessary to provide a significant tax break to firms for each individual employed who, as of a chosen date, had been an employee of one of a specified list of nuclear weapons complex facilities. This would give firms a substantial incentive to provide employment for these individuals, whether within the nuclear cities or elsewhere. Loan and investment guarantees, government contract set-asides, and other measures could also be considered to create such incentives.
- New approaches to marrying nuclear complex technology strengths to commercial industry needs. One of the biggest problems those attempting to commercialize technology from the Russian weapons of mass destruction complex have identified is the difficulty of matching available technologies to commercial firms (foreign or Russian) that might be interested in them. The frequent focus at these former weapons facilities is on “technology push” instead of “market pull,” that is, on attempting to market technologies that are interesting to the developers, rather than attempting to develop technologies that are what private industry wants. To date, officials from the various U.S. or internationally sponsored programs have themselves tried to find markets for the technologies being developed at Russian weapons facilities, or have relied on experts from the U.S. nuclear laboratories to do so. A broader approach is needed, drawing more fully on the technology-scouting skills available in the private sector. For example, some of the business consultants specializing in high technology that have become established in Russia could be hired to help with identifying market needs that might be met by application of the technological strengths of certain Russian weapons facilities. Alternatively, or in addition, interested governments could subsidize the establishment of a small firm focused on the jobs of identifying technological strengths that would be of interest to the private market, finding particular firms willing to invest and partner in such efforts, and forging the relevant partnerships. In return, the firm would receive a portion of the profit of successful ventures, giving it a strong financial incentive to put in the effort and creativity to make these ventures work.
- Additional approaches to providing adequate business management and marketing expertise in the nuclear cities. A recent survey of participants in efforts to commercialize technologies who had been supported by International Science and Technology Center grants found that the principal barrier was lack of appropriate business management and marketing expertise, even more than lack of capital.³ Expanded training programs will partly help fill this gap, but approaches to attracting people with real management and marketing experience to help run enterprises employing former nuclear weapons workers are also needed. These could include providing salary supplements or other financial incentives for such individuals to take on business roles in the nuclear cities, and also establishing firms (and expanding already well-managed firms) in nearby open cities that can employ former nuclear workers (see below).
- Additional approaches to providing start-up capital for new or expanded enterprises. The Nuclear Cities Initiative (NCI) has already financed the establishment of European Bank for Reconstruction and Development loan offices in the nuclear cities, which have made over a thousand loans for small and medium enterprises in these cities. The Sarov city government, in partnership with the nuclear facility there, has set up a successful fund which provides no-cost loans to local businesses, and some of the other nuclear city governments have taken similar steps. Nevertheless, new means to provide subsidized equity and loan capital for starting or expanding enterprises that would

³ Maria Douglass and Peter Falatyn, “More Than Money: Small Technology Spin-Offs of the WMD Complex,” *JRL Research & Analytical Supplement #10*, edited by Steven D. Shenfield (July 2002; available at <http://www.cdi.org/russia/johnson/6350-1.cfm> as of January 14, 2003).

employ excess nuclear weapons complex workers are needed – such as government-sponsored investment funds, tax breaks or other incentives for private investment in firms in these areas, and the like.

- **Contract research and development.** Russian weapons experts represent not only a problem but an opportunity: thousands of highly skilled scientists and engineers willing to work for very low wages, who have grappled with many of the same problems facing the U.S. nuclear complex. The U.S. government should seize the opportunity to address the problem, by setting aside a portion (perhaps 5%) of the hundreds of millions of dollars a year in unclassified U.S.-sponsored research and development in such fields as counterterrorism, nonproliferation and verification, nuclear cleanup, and energy technologies to fund work in the same areas by Russian experts from the Russian nuclear weapons laboratories, in cooperation with U.S. experts. This would be a win-win approach, creating thousands of jobs making use of the real skills of Russian weapons scientists and engineers, while getting work done for the U.S. government for less than it would otherwise cost. The technologies developed could also be deployed by the Russian government, further multiplying the benefit.

This set-aside of a few percent, however, should have a fixed life. In the meantime, NCI and other U.S. programs should be working with these scientists to help them form ongoing contract research and development enterprises (as “Sarov Labs” plans to be), competing for contracts from both governments and industry. If after several years these enterprises can win research and development business on the basis of the cost and quality of their work, rather than through a set-aside, the jobs created should be considered commercial and self-sustaining, even if nearly all of their work is on government contracts. Many U.S. commercial firms, after all, do almost all of their work for the government. These new enterprises could take part in the burgeoning global outsourcing market for software development and other science and

engineering services – including participating in global engineering teams on which firms around the world are increasingly relying for product development.⁴ This approach would create jobs for scientists (difficult to do in starting up new manufacturing enterprises), would not require difficult-to-attract major capital investments in the nuclear cities, and would not entail the costs of transporting manufactured products to distant markets from these isolated cities.

Recommendation: Pursue a much broader approach to fostering re-employment for Russia’s nuclear experts and workers, including such measures as:

- **Tax and other incentives for firms to locate or expand operations in Russia’s nuclear cities, and to employ former employees of Russia’s nuclear weapons complex;**
- **Increased reliance on private sector capabilities in matching technological capabilities from Russia’s nuclear cities to market needs and investors;**
- **Providing incentives for people with real business management and marketing expertise to lead enterprises in or near Russia’s nuclear cities;**
- **Providing start-up capital for new or expanding enterprises in or near Russia’s nuclear cities;**
- **Assigning a small fraction of the unclassified R&D sponsored by the U.S. government in key areas such as counterterrorism, nonproliferation, nuclear cleanup, and energy to be done by experts from Russia’s nuclear weapons complex – getting the U.S. government’s work done for less while providing large numbers of jobs employing the skills of Russia’s nuclear weapons experts.**

Support For Secure Retirement

Thousands of nuclear experts and workers in Russia’s nuclear weapons complex are at or near retirement age, and this number increases year by

⁴ See, for example, Zachary G. Pascal, “The Rage for Global Teams,” *Technology Review*, July/August 1998.

year. Even those with several years to go before retirement might be encouraged to retire from their weapons work – to either retire permanently or find other employment – if offered an early “buy-out” package, such as are routinely offered to excess government or corporate workers in the United States and other countries. Shifting these older experts and workers to new jobs is particularly difficult, making the option of convincing them to retire particularly attractive. Until recently, pensions available upon retirement were far too low to live on – so people stayed on at the facilities rather than retiring.⁵ If arrangements were put in place to provide these people with secure and adequate pensions, many thousands likely would retire, thus reducing the scale of job creation needed. On a per-person basis, this would likely be the cheapest way by far to address the problem of excess nuclear scientists and workers: the director of the nuclear weapons design laboratory at Sarov, for example, has estimated that 2,000 of his employees could be convinced to retire with additional pension supplements of just \$500 per year per person.⁶ Over 10 years, retiring 10,000 people from Russia’s nuclear complex might thus cost only \$50 million.

To give the retirees confidence that the money would actually be there when needed, it would likely have to be set aside in an independently managed fund, or arranged in the form of guaranteed annuities. Any such strategy would have to include provisions to ensure that the retired personnel were not returning to work at the nuclear facilities (such as giving up their security clearances and passes to the facilities, at a minimum), and that the total nuclear facility workforce was being reduced by at least the number of people

retired (rather than the retired personnel simply being replaced with younger people).⁷ In short, the U.S. and Russian governments, along with their partners in the G-8 Global Partnership should agree on an approach, primarily financed by Russia itself, to ensuring that secure and adequate pensions are provided for excess nuclear weapons scientists and workers – including an early retirement “buyout” program.

Recommendation: Cooperate with Russia to ensure a secure retirement for nuclear experts and workers (including possible early buy-outs), reducing the job creation requirement.

A Focused Approach to Shrinking the Nuclear Weapons Complex

Since its inception, the Nuclear Cities Initiative has assisted Russia in converting 40% of the floorspace of the smallest of Russia’s four nuclear weapons assembly and disassembly facilities to civilian work. But it has not focused on weapons complex downsizing elsewhere. To achieve the goal of helping Russia permanently reduce the size of its nuclear weapons complex, while avoiding proliferation risks in the process, U.S. programs will have to gain the agreements needed to work with Russia on closing or converting a much broader range of facilities. This should include measures confirming that these facilities are in fact being irreversibly closed for weapons work, along with steps to reemploy the nuclear weapons personnel who worked there.

Discussions that have already taken place suggest that if the United States were willing to undertake

⁵ By 2001, average pensions in the closed city of Sarov had reached 1,115 rubles per month (about \$37) – several times what they had been some years previously, but still less than one-fifth the prevailing wage at Sarov’s nuclear weapons design laboratory. That differential and the benefits associated with employment continued to give employees a strong incentive not to retire. See Analytical Center for Non-Proliferation Problems, “Quarterly Information Bulletin – Issue 10” (Sarov, Russia: Analytical Center for Non-Proliferation Problems, Spring 2002; available at http://npc.sarov.ru/english/bulletin/issue_10.html as of January 14, 2003).

⁶ The director outlined this possibility in discussions with Siegfried Hecker and his team at Los Alamos National Laboratory. Quoted also in Bukharin, von Hippel, and Weiner, *Conversion and Job Creation in Russia’s Closed Nuclear Cities*, op. cit., p. 34.

⁷ For a good discussion of this approach, see Bukharin, von Hippel, and Weiner, *Conversion and Job Creation in Russia’s Closed Nuclear Cities*, op. cit.; for an intriguing discussion of the advantages of a broader early retirement buyout program, see Thomas L. Neff, “Accelerating Down-Sizing of the Russian Weapons Complex” (unpublished paper, Massachusetts Institute of Technology, October 2000).

the broadened approach described above – and provide the resources needed – Russia would likely be willing to allow the United States to participate in the planned closure of the nuclear weapons assembly and disassembly facility at Zarechnyy (formerly Penza-19). The United States should also work with Russia to reach agreement on confirming and helping with the closure of the weapons component facilities at Seversk (formerly Tomsk-7), which employ thousands of people, and whose closure will be a key factor limiting Russia's ability to mass produce new nuclear weapons should political circumstances change.⁸ In essence, in return for providing more resources to assist in the transition of Russia's nuclear cities, the United States should seek agreement on measures to confirm these shutdowns in each of the cities where they are occurring. This would make it possible to argue to congressional skeptics that "for this much money, we can shut down this much weapons production capability," providing a readily quantifiable performance metric similar to the number of missiles dismantled.

At the same time, the United States and Russia should enter into a broader dialogue concerning the future of their respective nuclear complexes and stockpiles. The maintenance of a huge U.S. reserve of warheads and warhead components is justified in large part by pointing to Russian maintenance of a huge warhead and component production capa-

bility – which in part is justified by pointing to the huge U.S. warhead reserve. Particularly given the post-September 11 spirit of partnership between Russia and the United States, maintaining stockpiles of over 10,000 warheads on each side, with nuclear complexes to match, simply cannot any longer be justified. Over time, the two sides should work out a mutually acceptable plan specifying what stockpiles and production capability each side will maintain, and what will be eliminated.

Recommendation: Undertake a more focused approach to assisting Russia in closing or converting excess nuclear weapons complex facilities, and other unneeded nuclear facilities.

Resources Matched to the Challenge

Currently expected funding for the Nuclear Cities Initiative for fiscal year 2004, to take just one example, is \$17 million. There is simply no hope of having much effect on the economies of 10 entire cities, where 750,000 people live – or even of the 3 cities where NCI is focusing its initial efforts – with that amount of money. Assuming that efforts in this area are reformed as described above, with a clear set of goals and an effective strategy to meet them, substantially more resources should be provided. This should be a significant focus of the \$20 billion pledged in the G-8 Global Partnership.

⁸ See Oleg Bukharin, "A Breakdown of Breakout: U.S. and Russian Warhead Production Capabilities," *Arms Control Today* (October 2002; available at http://www.armscontrol.org/act/2002_10/bukharinoct02.asp as of January 14, 2003).

13. Monitoring Stockpiles and Reductions

In and of themselves, transparency and monitoring measures – such as declaring how many nuclear weapons and how much nuclear material a nation has, or placing portions of these stockpiles under bilateral or international monitoring – do not prevent insiders or outsiders from stealing these stockpiles.¹ But such measures, if well designed, can contribute substantially to improving security and accounting for nuclear weapons and materials, in a number of ways:

■ **Sizing the problems.** Neither Russia nor any other nuclear weapon state has ever officially confirmed how many nuclear weapons it has. Nor has Russia or most other nuclear weapon states made any statement as to how much plutonium or highly enriched uranium (HEU) they have in their stockpiles.² This lack of official information, forcing reliance on uncertain estimates from various sources, inevitably makes it more difficult to specify the scope of the problems involved in insecure nuclear weapons and materials, and to plan programs to address these problems. Official declarations related to these stockpiles could help size these problems and thereby ease the task of fixing them.

■ **Facilitating cooperation.** Being able to discuss which facilities are at issue, which buildings at those facilities have nuclear weapons or materials in them, the quantities and types of materials at these facilities, and the like is crucial to

being able to work out effective cooperation for improving security and accounting measures. Direct access to these sites is often also crucial, in order to observe the security and accounting measures already in place, and to confirm that upgrades are being done to agreed standards and that money is being spent appropriately. If information has already been exchanged, and access has already been agreed to, through some type of monitoring arrangement, other cooperative efforts are greatly facilitated. For example, because of START monitoring provisions, there have been few problems with access or information in threat reduction programs focused on dismantling nuclear missiles and bombers. But because no such monitoring arrangements had ever been agreed for warhead storage facilities, arranging the information and access needed to cooperate effectively in upgrading security for these facilities has proved to be tremendously difficult. Caution is warranted, however, because there may be some cases in which a negotiation over monitoring arrangements turns access to a particular site into a bargaining chip, making it *more* sensitive than it would have been had the monitoring negotiation never taken place.

■ **Identifying weak points.** Inspectors or visitors sometimes identify weak points in security and accounting. In several cases, reports by International Atomic Energy Agency (IAEA) inspec-

¹ An exception would be very far-reaching transparency amounting to partial ceding of sovereignty over these stockpiles and operations using them. Over the years, for example, there have been a number of proposals to require that facilities handling weapons-usable nuclear material in the civilian cycle be under international, rather than national, ownership and control – which might also mean an international guard force. One Sandia analyst has put forward a concept in which every U.S. and Russian facility where nuclear weapons or weapons-usable materials were stored would have a perimeter patrolled by both U.S. and Russian guards, and nothing could be brought out of the perimeter without joint inspection. See Robert Rinne, *An Alternative Framework for the Control of Nuclear Materials* (Stanford, Cal.: Center for International Security and Cooperation, May 1999). We believe such an arrangement would substantially improve security, but is unlikely to be acceptable to either government (or the governments of other countries where it might be applied) in the near term.

² The United States released a very detailed statement on its plutonium stockpile in the mid-1990s, but many other weapon states have not followed suit, and the United States itself has neither updated the publicly released information nor fulfilled a promise to release similarly detailed information on its production and stockpile of HEU.

tors to the IAEA Office of Physical Protection on situations in which nuclear material they inspected did not appear to be adequately secured have been followed by the IAEA successfully cooperating with the states concerned to arrange for international peer reviews and upgrades of the security arrangements.³ Similarly, to support IAEA safeguards, states must prepare their own accounting of the nuclear materials under their control, and provide this accounting regularly to the IAEA. Examination of such national reports often makes it possible to identify facilities where the quality of the measurements taken and the accounts kept needs to be improved if there is to be confidence that nuclear material has not been removed. Thus, international safeguards create a multilateral discipline in nuclear material accounting that is not present in nuclear weapon states such as the United States and Russia, or at unsafeguarded facilities in states such as Pakistan, India, and Israel. Of course, transparency measures do not have to involve formal inspection such as IAEA safeguards to fulfill this role: informal visits by U.S. personnel to Russian facilities, for example, have been the main means of identifying and agreeing on areas where security and accounting upgrades were needed.

■ **Encouraging states to fix potentially embarrassing problems.** The very process of preparing for a declaration forces a state to examine its own internal accounts and try to put them in order, so as to avoid embarrassment when the declaration is made. When South Africa, for example, was preparing to submit its nuclear program to IAEA safeguards, it made sure, to the best of its ability, that all of its accounting records for its nuclear material had been brought into balance. Once a declaration is made (for example, as part of an arms control agreement), the other parties have an opportunity to ask questions and raise concerns, which may then lead to further accounting improvements. In its first declaration under the Intermediate-range Nuclear Forces (INF) Treaty, for example, the United States neglected some aging Pershing I missiles stored in Texas; Soviet arms experts pointed out the omission, and the

United States corrected the declaration. These kinds of discussions can open the way for additional correction of embarrassing problems, or identify fruitful areas for cooperation in improving accounting. The potential arrival of inspectors at a facility creates an additional incentive to remove any potential embarrassments – cleaning up, fixing holes in fences, replacing obviously broken equipment, and the like. These very mundane, human reactions to the prospect of being held up to the scrutiny of the outside world can produce significant improvements in security and accounting arrangements.

■ **Detecting thefts – or providing confidence that they have not occurred.** In some cases, while monitoring measures cannot in themselves *prevent* thefts, they may be able to *detect* that they have occurred. IAEA safeguards, for example, are designed to be able to detect the removal of enough nuclear material for a bomb – though the removal may not be noted until days or weeks after it has occurred. Real-time monitoring – such as with security cameras uploading their data to a central station or a satellite – can provide detection of thefts in progress, triggering response forces to intercept the thieves. In the more usual case in which no theft has occurred, accurate accounting systems and inspections can confirm for all participants that this is the case.

In short, transparency measures such as declarations and monitoring have considerable importance even if considered only as part of the effort to keep nuclear weapons and materials out of hostile hands. Such measures play a crucial part in the broader arms reduction picture, as they are likely to be an essential foundation for future agreements to reduce the still huge stockpiles of nuclear warheads and materials that exist around the world.

In pursuit of these benefits, the United States should pursue a step-by-step approach toward increased transparency for warheads and fissile materials with Russia, and ultimately with other nuclear states. This approach should be designed to maximize its contribution to the theft-prevention

³ Personal communication with IAEA personnel, September 2002.

goals just outlined. Building nuclear transparency will not be easy. The United States still maintains an extensive nuclear secrecy system built up over the decades of the Cold War – a system which is still essential to keep critical nuclear information out of the hands of terrorists and hostile states. Russia's nuclear secrecy system is even more stringent, built on decades of Communist obsession with secrecy, following centuries of similar Czarist obsession. Hence, to move this agenda forward, the U.S. government will have to focus on finding a balance between the benefits and risks of transparency and of secrecy, and clearly identify what transparency measures it is willing to accept at its own facilities. The United States should then offer clear and tangible benefits – financial, strategic, or otherwise – to Russia and the other states with whom it seeks to build transparency arrangements. Otherwise, it is highly unlikely that Russian officials or those of other states will conclude that the hard work of overcoming decades of nuclear secrecy is worth doing. Reciprocity – offering the same types of transparency in the United States – is likely to be essential to success, but is not likely to be sufficient in and of itself. Offering reciprocity – rather than the “pay per view” approach the United States has sometimes taken, arguing that it is providing money to help Russia disarm, and therefore should get transparency without having to accept similar measures in the United States – will help build confidence in U.S. intentions, and impose a useful discipline on U.S. transparency demands (since for every type of sensitive information it wanted, or type of sensitive site it wanted to visit, it would have to offer reciprocal access in return). Specifically, the United States should pursue the initiatives described below.

Recommendation: Offer Russia and other partners with whom the United States is negotiating transparency arrangements substantial incentives – strategic, financial, or other – to do the hard work of overcoming decades of nuclear secrecy. As one necessary but not sufficient step, offer reciprocal information about and access to U.S. nuclear activities.

Stockpile Declarations

The United States should seek, through formal and informal channels, arrangements in which the United States and Russia tell each other how many warheads and how much plutonium and HEU they have. These would be particularly useful means of “sizing the problem.” As a first step, the United States should press to bring to fruition the current informal lab-to-lab work on a Russian “plutonium registry” – a declaration of past production and current stockpiles comparable to the one made by the United States in 1996. If such plutonium declarations were successfully completed, they could be followed with similar lab-to-lab development of detailed declarations on each country's stockpile of HEU. (In both cases, other weapon states should also be invited to prepare similar declarations.) A warhead data exchange would likely be less detailed, at least initially. The United States should offer tangible incentives for Russian participation – such as an offer to finance the dismantlement of any warheads Russia declares as excess to its military needs, or an offer to purchase 5% of whatever stockpile of HEU Russia declares it has.

In parallel, the United States and Russia should jointly demonstrate and deploy approaches to helping to confirm the accuracy of such declarations, such as exchanges and analysis of production records, “nuclear archaeology” measures to estimate the plutonium production of particular reactors from the isotopes in their structures, and spot-checks of declared amounts at particular sites (if these can be arranged without undue sensitivity). There is a need to perfect such measures not only for U.S.-Russian applications, but also for any other situation in which a declaration of past unsafeguarded nuclear material production has to be verified – from Iraq to North Korea. The United States should be prepared to finance experiments with the implementation of such measures.⁴

Recommendation: Seek Russian agreement to exchange data on stockpiles of nuclear weapons and weapons-usable materials, beginning with

⁴ Thomas W. Wood, Bruce D. Reid, John L. Smoot, and James L. Fuller, “Establishing Confident Accounting for Russian Weapons Plutonium,” *Nonproliferation Review* 9, no. 2 (Summer 2002; abstract available at <http://cns.mii.edu/pubs/npr/vol09/92/abs92.htm#wood> as of January 14, 2003).

completing lab-to-lab efforts to prepare a full accounting of Russia's plutonium stocks and past production, comparable to the U.S. declaration published in 1996.

Building Bridges Between "Islands of Transparency"

To date, most U.S.-Russian discussions of transparency related to nuclear warheads and materials have focused on transparency at a particular site or small number of sites, necessary for a particular project – creating what might be called “islands of transparency.” Thus, there is transparency for the HEU Purchase Agreement, and there are to be separate transparency measures for the Mayak Fissile Material Storage Facility, the Plutonium Production Reactor Shutdown Agreement, and Plutonium Disposition Agreement. In the long term, however, the goal should be not “islands of transparency,” but a “sea of transparency,” with only particular “islands of secrecy” protecting secrets that still cannot be exchanged. For example, one might have monitors counting how many warheads enter a nuclear weapons disassembly facility and how many plutonium and HEU components leave the facility, while the actual disassembly would remain closed, to protect weapons design information. As a first step, the United States should work with Russia to ensure that “bridges” are built between the various “islands” now being put in place. For example, plutonium placed in tagged and sealed containers in the Mayak Storage Facility should have tags and seals that can be checked as it leaves the facility and arrives at another facility for the various processes needed to turn it into reactor fuel, bringing it under the future plutonium disposition transparency arrangements.

Recommendation: Build “bridges” among the different transparency initiatives now being pursued – such as transparency for the U.S.-Russian HEU Purchase Agreement, the Mayak Fissile Material Storage Facility, the Plutonium Production Reactor Shutdown Agreement, and the Plutonium Disposition Agreement – by reaching agreement on implementing tags,

seals, and other monitoring measures to ensure continuity of knowledge as material moves from one regime to the next.

Steps Toward Monitoring Warhead Dismantlement and Nuclear Material

For some years, U.S. and Russian experts have been working together to develop procedures that could be used to confirm warhead dismantlement, and storage and disposition of nuclear material, without compromising classified information. This work should be expanded. The United States and Russia should initiate discussions toward full-scale demonstrations – “joint monitoring experiments” – of procedures to be used to monitor the removal of warheads from missiles, storage of the warheads, and their transportation to dismantlement facilities, their dismantlement, and storage and disposition of the nuclear material they contain. Each of these steps could be the subject of a separate demonstration. The United States should be willing to finance such demonstrations, and to provide other incentives for Russia to take part.⁵ Such experiments could help pave the way for the initiative on reciprocal securing, monitoring, and dismantlement of particularly dangerous nuclear weapons, described previously.

Recommendation: Conduct a series of joint monitoring experiments to develop and demonstrate procedures for confirming warhead dismantlement and secure storage of warheads and materials without unduly compromising sensitive information.

Recommendation: Carry out monitored storage and dismantlement of the excess warhead covered by the reciprocal warhead security and dismantlement initiative recommended above

Recommendation: Take a flexible approach to providing assurances that taxpayer funds are being spent appropriately at particularly sensitive facilities, combining direct on-site access at some locations with other measures such as photographs and videotapes of installed equipment.

⁵ For a recent discussion, see Oleg Bukharin and James Doyle, “Transparency and Predictability Measures for U.S. and Russian Strategic Arms Reductions,” *Nonproliferation Review* 9, no. 2 (Summer 2002; abstract available at <http://cns.miis.edu/pubs/npr/vol09/92/abs92.htm#bukh> as of January 14, 2003).

14. Ending Production

A first step in limiting the size of these stockpiles follows “the law of holes”: when you are in one, stop digging. If the United States and Russia already have far larger stockpiles of nuclear warheads, plutonium, and highly enriched uranium (HEU) than they could possibly need, they should stop making more.

In the case of nuclear warheads, both the United States and Russia have been dismantling far more warheads than they have been assembling since the end of the Cold War. But neither can stop assembling warheads entirely, because when components wear out, warheads have to be disassembled, the faulty parts replaced, and the warheads reassembled again. The most that could be hoped for at present would be a political commitment that each year the number dismantled would be larger than the number assembled, so that the trend was always down.

In the case of HEU, both the United States and Russia have formally pledged never again to produce HEU for nuclear weapons, as have Britain and France. China has indicated that it is not currently producing HEU – though this policy may change if China decides on a substantial nuclear buildup in response to U.S. missile defenses.¹ Currently, however, no verification of these commitments is in place. The United States should work with Russia to develop and implement reciprocal transparency measures at U.S. and Russian enrichment facilities to confirm that neither country is producing HEU.² These measures could provide a test-bed for approaches to verifying a future treaty cutting off production of fissile materials for nuclear weapons, at a cost likely to be in the range of \$10 million or less per year. To give Russia an incentive to agree to such measures, this could be presented as part of a larger deal

that included, for example, a U.S. or international purchase of additional HEU.

While the United States has stopped production of plutonium for weapons and does not separate plutonium for civilian fuel, Russia is still doing both. Three military plutonium production reactors are still operating (two at Seversk and one at Zheleznogorsk), not because there is any need for the plutonium they produce, but because they provide essential heat, and some power, for tens of thousands of people who live in Siberia.³ These produce something in the range of a ton of additional weapon-grade plutonium every year, adding to a Russian stockpile of weapon-grade plutonium that is likely in the range of 130–140 tons. Russia’s Mayak reprocessing complex also continues to separate civilian plutonium from spent fuel, adding something like a ton of reactor-grade plutonium a year to Russia’s 35-ton stockpile.

To stop digging this hole, the United States should:

- Provide the resources required (in both funds and high-level attention needed to overcome problems) to accelerate the program to provide alternative power sources, and shut these reactors in 2006–2007 (rather than the currently scheduled 2008–2011);
- Pursue, at the same time, extensive energy efficiency upgrades in both Seversk and Zheleznogorsk, which could cost-effectively reduce the fossil energy requirements and the cost of providing them;
- Reach agreement with Russia on how Russia will finance operation of the fossil replacement plants once they have been built;

¹ See discussion in Hui Zhang, “A Chinese View on a Fissile Material Cut-off Treaty,” *Journal of Nuclear Materials Management* 30, no. 4 (2002).

² For a useful recent discussion, see Oleg Bukharin, “U.S.-Russian Bilateral Transparency Regime to Verify Nonproduction of HEU,” *Science & Global Security* 10, no. 3 (2002).

- Work with Russia to focus an intensive job creation effort (from programs funded by Russia's Ministry of Atomic Energy (MINATOM) and U.S.-funded programs) on providing jobs for the more than 10,000 personnel who will no longer be needed once the plutonium production reactors and their associated reprocessing plants shut down;
- Renew the negotiations, which were very near agreement at the end of the Clinton administration, aimed at reaching agreement on a 20-year U.S.-Russian moratorium on separation of plutonium from civilian spent fuel, in return for assistance in providing dry storage for the fuel that would not be reprocessed, and joint research and development focused on future nuclear energy concepts posing lower proliferation risks. If employment for the reprocessing plant workers should become a key issue in sealing such a deal, the United States and other partners in the G-8 Global Partnership could offer a program to finance jobs on cleanup and other projects for these workers, as part of a broader program to close unnecessary facilities in Russia's nuclear complex and reemploy their personnel.

Finally, there is the issue of a verifiable international treaty to ban production of plutonium and HEU for weapons – known as the fissile material cutoff treaty (FMCT). Talks on this matter have been languishing with no progress for many years.⁴ While it is unlikely that the political issues

blocking progress will be resolved soon, as an initial step the United States and Russia should work together to carry out cooperative experiments to demonstrate approaches to verification that could be used at older plutonium reprocessing plants never designed for safeguards.

Recommendation: *Complete the program to provide alternative heat and power and shut down Russia's plutonium production reactors as quickly as possible.*

Recommendation: *Complete negotiations of a long-term U.S.-Russian moratorium on separation of plutonium from civilian spent fuel.*

Recommendation: *Put in place agreed monitoring measures to confirm U.S. and Russian statements that they are no longer producing HEU.*

Recommendation: *Carry out joint U.S.-Russian demonstrations of approaches to verifying that older reprocessing plants are not separating plutonium for weapons – a key element of a proposed international fissile cutoff treaty.*

Recommendation: *Continue seeking to put in place an international moratorium on production of plutonium or HEU for weapons, and continue negotiations toward a verifiable international treaty banning further production of nuclear materials for weapons.*

³ For a description of these reactors and efforts to shut them down, see Frank von Hippel and Matthew Bunn, "Saga of the Siberian Plutonium Production Reactors," *FAS Public Interest Report* 53, no. 6 (November/December 2000; available at <http://www.fas.org/faspir/v53n6.htm> as of January 14, 2003); for an update, see Matthew Bunn, "Plutonium Production Reactor Shutdown," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/ending/plutonium.asp as of March 12, 2003).

⁴ For a brief discussion with links to other sources, see Matthew Bunn, "Fissile Material Cutoff Treaty," *Controlling Nuclear Warheads and Materials* (available at http://www.nti.org/e_research/cnwm/ending/fmct.asp as of March 12, 2003).

15. Reducing Stockpiles

The United States and Russia both maintain massive stockpiles of nuclear warheads, plutonium, and highly enriched uranium (HEU) built up over the decades of the Cold War – stockpiles far beyond any conceivable remaining military need. Reducing these stockpiles is a long-term proposition that will not address the immediate threat of theft the world faces today.¹

The first priority must be to ensure that all of these stockpiles are secure and accounted for. (Indeed, unless extreme care is taken to provide high levels of security and accounting throughout, the transportation and processing of these materials involved in getting rid of them could temporarily increase proliferation risks.)

Nevertheless, reducing these stockpiles with all deliberate speed should remain a priority – both to send a signal to the world that U.S. and Russian arms reductions are intended to be permanent, and to avoid having to keep these stocks under heavy guard forever. The surest way to keep a kilogram of plutonium or HEU from being stolen and used by terrorists for a nuclear weapon is to destroy it – or transform it into a form extremely difficult to ever again use in a nuclear bomb. For these reasons, at their May 2002 summit, President Bush and President Putin instructed their experts to examine options for expanded disposition efforts for both plutonium and HEU.²

Reducing HEU Stockpiles – Maintaining the Current Agreement

The first priority in reducing HEU stockpiles must be to continue stable implementation of the existing U.S.-Russian HEU Purchase Agreement, under which the United States is purchasing 30 tons of HEU from dismantled Russian nuclear weapons each year, blended to proliferation-resistant low-enriched uranium (LEU) for use as commercial reactor fuel.

This arrangement began in 1993 (though it took some time to reach the 30-tons-per-year level); by 2013, when the current deal ends, the United States is expected to have purchased LEU from 500 tons of HEU. This is the single most important and successful U.S.-Russian cooperative effort focused on management of nuclear weapons and materials: at a single stroke, it gives Russia a financial incentive to dismantle thousands of nuclear weapons, destroys enough potentially vulnerable HEU for thousands of nuclear bombs, creates jobs for thousands of Russian nuclear workers, provides hundreds of millions of dollars a year to the hard-strapped Russian nuclear complex, and provides the United States with valuable commercial reactor fuel – all at very little net cost to the U.S. taxpayer, since it is proceeding as a largely commercial transaction. Indeed, some 10% of all the electricity used in the United States is coming from dismantled Russian nuclear weapons, since nuclear reactors provide roughly 20% of the U.S.

¹ Two additional factors strengthen this conclusion. First is the small amount of nuclear material terrorists would need to make a nuclear bomb. With only a few kilograms needed for a bomb, whether a large central storage facility contains 50 tons of plutonium or 1 ton is far less important than how well secured and accounted for the material in that facility is – and a program that reduced the total stockpiles dramatically without actually reducing the number of facilities with enough material for a bomb, or the number of people with access to these materials, might offer very little benefit in reducing the risk of nuclear theft. Second is the high levels of security that it is possible in principle to provide for excess nuclear material: most of the 34 tons of Russian excess weapons plutonium covered in the U.S.-Russian plutonium disposition agreement, for example, will be stored until disposition in the highly secure Mayak Fissile Material Storage Facility, making it some of the lowest-theft-risk plutonium in Russia.

² The White House, Office of the Press Secretary, “Text of Joint Declaration” (Moscow, Russia, press release, May 24, 2002; available at <http://www.whitehouse.gov/news/releases/2002/05/20020524-2.html> as of January 14, 2003).

electricity supply, and roughly half of their fuel is coming from the HEU Purchase Agreement.

Unfortunately, during the agreement's history, there have been a large number of delays and disagreements over its implementation. Most recently, USEC (formerly the U.S. Enrichment Corporation), the U.S. executive agent, demanded (ultimately successfully, after a long delay) that Russia accept a new pricing approach under which USEC will pay Russia a price well below the average price USEC will receive when it resells the material. This will reduce the amount paid to Russia by several tens of millions of dollars a year, compared to the previous pricing structure, and has provoked significant resentment among some Russian nuclear officials. Nevertheless, for now, deliveries are stabilized, and USEC now has a substantial profit incentive to carry out the deal as rapidly as possible, the Russian material now being by far its lowest-cost source of supply.

For the future, the reserve stockpile of LEU blended from HEU that the U.S. government has agreed to purchase over the next decade should provide a useful backup in the event of another substantial interruption of supply. In the longer term, if problems again arise with USEC as the executive agent, the U.S. government should keep the option of other executive agent arrangements open – including the possibility of designating multiple executive agents, who could compete with each other to buy the Russian material, guaranteeing Russia a fair market price by the free play of competition.³

Recommendation: Maintain and stabilize implementation of the U.S.-Russian HEU Purchase Agreement, including purchasing a stockpile of blended material to cover interruptions in deliveries, and leaving open the option to designate additional executive agents if necessary.

Reducing HEU Stockpiles – An Accelerated Blend-Down Initiative

The current 30-tons-per-year rate at which Russian HEU is being blended was set by what the market would bear, not by what the national security demands. From a security perspective, it would be highly desirable to destroy every kilogram of excess HEU everywhere in the world as rapidly as possible. Russia's uranium processing facilities are believed to be capable, with the addition of only a few pieces of equipment, of blending 60 tons of HEU each year, rather than 30. This much larger amount of material could not simply be sold on the market without crashing prices and disrupting the existing 30-tons-per-year deal. But as a security investment, the United States and the other participants in the G-8 Global Partnership could pay Russia to blend an additional 30 tons each year and keep it off the market, in monitored storage, until the existing deal is complete. We described such an accelerated blend-down approach in detail in our previous report.⁴ If the blending rate were doubled, more than a thousand bombs' worth of additional HEU would be destroyed every year – clear, measurable threat reduction for each dollar invested. Russia is thought to have begun the deal with some 1,100 tons of HEU, so selling 500 tons would leave 600 tons remaining – though Russia has been blending

³ For a discussion of the multiple agent approach, see Thomas L. Neff, "Decision Time for the HEU Deal: U.S. Security vs. Private Interests," *Arms Control Today* (June 2001); for a discussion of the virtues of having a buffer stockpile to address disruptions, see Thomas L. Neff, "Accelerated Blend-Down of HEU" (unpublished paper, Massachusetts Institute of Technology, October 2000).

⁴ See 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. 65–72; also Robert L. Civiak, *Closing the Gaps: Securing High Enriched Uranium in the Former Soviet Union and Eastern Europe* (Washington, D.C.: Federation of American Scientists, May 2002; available at <http://www.fas.org/ssp/docs/020500-heu/full.pdf> as of January 14, 2003); Jeffrey Boutwell, Francesco Calogero, and Jack Harris, *Nuclear Terrorism: The Danger of Highly Enriched Uranium (HEU)* (Washington, D.C.: Pugwash Conference on Science and World Affairs, September 2002; available at <http://www.pugwash.org/publication/pb/sept2002.pdf> as of February 25, 2003); for an earlier discussion of the concept, see Neff, "Accelerated Blend-Down of HEU," op. cit.

a modest amount of additional material in commercial deals outside the HEU Purchase Agreement, and using some in military, icebreaker, and research reactors. It seems unlikely that Russia will need more than 200 tons for its military programs, meaning that under the right circumstances, hundreds of tons will be available for blending and eventual sale.⁵

The working group that resulted from the May 2002 Bush-Putin summit quickly prepared an initial report that examined a variety of options for modestly sized additions to the current HEU purchase agreement.⁶ The most important of these was the possibility, just mentioned, of blending down a limited additional amount of material which could be stored as a “buffer stock” in the United States, to be used in the event of a disruption in the supply of LEU from the HEU deal. The Bush administration has requested \$30 million in fiscal year (FY) 2004 to finance the first year of a decade-long purchase of such a buffer stock, along with the other modest blending initiatives outlined in the joint summit report. At that time, the Russian side was not ready to officially explore a large-scale accelerated blend-down initiative. Immediately after the completion of the government-to-government study, however, Russia’s Ministry of Atomic Energy (MINATOM) agreed to move forward with a study sponsored by the private Nuclear Threat Initiative looking at options for large-scale accelerated blend-down.⁷

There are a variety of reasons why Russia’s Ministry of Atomic Energy may be less than enthusiastic about pursuing such a large-scale accelerated blend-

down initiative. These include concerns over whether it will be possible to sell the extra material when the current deal expires, lack of confidence in future U.S. willingness to abide by commitments to reasonable commercial terms (given past U.S. shifts in its approach to the existing HEU Purchase Agreement), concerns over the political implications of agreeing to sell off another large piece of Russia’s nuclear stockpile, lack of interest in an arrangement that provides more jobs and revenue for facilities that already have plenty of jobs and revenue under the existing HEU deal, and the like.⁸

At the same time, destroying nuclear material that might otherwise be vulnerable to terrorist theft is as much in Russia’s interests as it is in the U.S. interest, and reducing the quantity of HEU that had to be guarded to stringent standards would reduce Russia’s security costs. Some senior Russian experts have endorsed such an initiative as an important next step in U.S.-Russian nuclear security cooperation.⁹

To be successful, a deal will have to be structured that clearly serves Russia’s interests as well as international interests in destroying HEU. Such an arrangement is clearly possible; the key question is what combination of price and other arrangements would ensure that the answer was not “nyet” but “da.”

To move this effort forward, the United States should begin a serious exploration with Russia of the circumstances under which it might be willing to agree to a large-scale accelerated blend-down of

⁵ If, on average, maintenance of each warhead requires 30 kilograms of HEU (including material in the warhead and material in various stages of the warhead support “pipeline”), then a stockpile of 5,000 nuclear warheads – substantially more than either the United States or Russia realistically needs – would require 150 tons of HEU. Another 50 tons of HEU would provide naval fuel for decades.

⁶ Secretary of Energy Spencer Abraham and Minister of Atomic Energy Alexander Rumiantsev, “Joint Statement” (press release, Washington, D.C., September 16, 2002).

⁷ Discussions with Nuclear Threat Initiative personnel. (Bunn is a paid consultant to the Nuclear Threat Initiative, working on this project among others.)

⁸ For a comprehensive discussion, see Thomas L. Neff, “Accelerating Russian Fissile Material Disposition” (paper presented at the 9th Annual International Nuclear Materials Policy Forum: The Disposition Stewardship, and Utilization of Weapons Grade Material and Spent Fuel, Washington, D.C., July 11, 2002).

⁹ See, for example, John P. Holdren and Nikolai P. Laverov, *Letter Report From the Co-Chairs of the Joint Committee on U.S.-Russian Cooperation on Nuclear Non-Proliferation* (Washington, D.C.: The National Academies, December 4, 2002; available at <http://www4.nationalacademies.org/news.nsf/isbn/s02052003?OpenDocument> as of February 25, 2003)

HEU. In particular, the United States and the other participants in the G-8 Global Partnership should consider approaches that might be able to leverage more than just the destruction of additional HEU: for example, if the payment for accelerated blend-down were in the form of a pre-payment against future deliveries (which would help convince Russia that the United States would have a strong incentive to help get the material onto the market in the future, allowing Russia ultimately to receive its full commercial value), the pre-payment might be designed to be larger than the actual cost of the blending, with an understanding that the additional funds would be spent on securing nuclear materials, shrinking Russia's nuclear complex, and providing jobs for excess nuclear personnel.¹⁰

As it did in 1998 to facilitate negotiation of a plutonium disposition agreement, Congress should provide an appropriation to pay for the blend-down and incentives that may be negotiated as part of the package (amounting to perhaps \$50 million for the first year), conditional on negotiation of an accelerated blend-down agreement. Having such conditionally appropriated funds makes U.S. commitments to pay for such initiatives much more credible, and greatly facilitates negotiation.

Recommendation: Reach agreement with Russia on an “accelerated blend-down” initiative, paying Russia a fee to blend additional HEU to non-weapons-usable levels and store it for later sale when the market is ready.

Expanded Disposition of Excess Plutonium

Ironically, disposition of excess plutonium is a long-term issue on which urgent action is needed. The program successfully made the case for a substantial and long-term budget increase in the Bush administration's threat reduction policy review in 2001, and won support for that increase from Congress. Then, in 2002, the program gained renewed international support as one of the priority items for expenditure of the \$20 billion pledged in the G-8 Global Partnership. If, following both of these victories, the program does not make substantial headway toward putting realistic financing

arrangements in place and moving toward actual construction of facilities during 2003 – after nearly a decade of attempts to move this effort forward – officials and legislators in Washington, Moscow, and other capitals are likely to begin to lose faith that this effort will ever move forward. The current momentum, if lost, would be very difficult to regain – with the result that enough excess weapon-grade plutonium for many thousands of nuclear weapons will simply remain in storage, in forms readily usable in new nuclear bombs.

To keep the momentum, to ensure that disposition goes forward on a scale large enough to matter, to guarantee security throughout the process, to and provide backups should the present strategy fail, the United States should:

■ **Press hard to complete during 2003 both an international agreement on financing and management and a clear, implementable work plan with Russia.** Currently, the plan is to burn U.S. and Russian excess weapons plutonium as fuel in existing nuclear power plants in the United States and Russia (possibly supplemented by plants in Europe), primarily in light-water reactors. Toward that end, the United States proposes to construct very similar plutonium fuel fabrication plants in the United States and Russia. The United States would pay 100% of the cost of disposition of its own weapons plutonium, while contributing to an international consortium that would cover the estimated \$2 billion cost of disposition of 34 tons of Russian weapons plutonium. The countries contributing to the international consortium would also participate in the management and implementation of the project. International discussions intended to pull together such a consortium have been underway for several years, and a number of countries have pledged at least modest contributions, but no final arrangement has yet been reached. Similarly, U.S.-Russian discussions are still underway concerning exactly how all the steps toward burning this plutonium as fuel would be completed – how much plutonium will be burned in which reactors, starting when; what process has to be followed for getting approvals and licenses to build a plutonium

¹⁰ The authors are grateful to Thomas L. Neff of MIT for discussions of the virtues of such an approach.

fuel fabrication plant; how the plutonium fuel's safety when used in existing reactors will be confirmed and licensed; and so on. A particularly important activity, for the current strategy, is planning for enough reactor capacity to meet the goal, specified in the U.S.-Russian agreement, of being able to burn 4 tons of plutonium a year. Given the modest number of modern and relatively safe reactors in Russia, meeting this goal will require either substantial modifications to these reactors to enable them to burn more plutonium, use of additional reactors outside of Russia, or use of newly constructed reactors as well.

In both these areas, therefore, a substantial effort is needed to reach agreement during 2003, so that real movement toward building the needed facilities and ultimately carrying out disposition of excess plutonium can begin. Russia's Ministry of Atomic Energy continues to feel no urgency to move forward quickly with disposition of excess plutonium. Therefore, if progress is to be made, careful attention will have to be paid to structuring approaches that provide Russia a substantial incentive to agree. The international consortium, for example, might potentially be structured in a way that Russia saw as allowing it to build up long-term commercial partnerships with Western firms in the world nuclear fuel market. However, if it is proving difficult to work out an effective multilateral financing and management arrangement for plutonium disposition even as the other participants in the G-8 Global Partnership are making contributions to other threat reduction efforts on the scale pledged, the United States should consider paying for Russian disposition itself, as part of its contribution to the Global Partnership, simplifying management substantially by making the project bilateral rather than multilateral.¹¹

■ **Begin now to discuss going beyond the 34 tons of plutonium on each side addressed in the initial U.S.-Russian plutonium disposition agreement.** Disposition of 34 tons of excess weapons plutonium in

Russia, and 34 more in the United States, will be a very important and useful first step toward disposition of substantially larger quantities of material – but only if it is a first step. The material slated to be used as fuel in the U.S.-Russian disposition agreement (34 tons of weapons plutonium plus 2 tons of reactor-grade plutonium) represents roughly one-fifth of the total Russian stockpile of separated plutonium. (The U.S. 34 tons represents about one-third of its plutonium stockpile.) The material not covered by this agreement is more than enough to pose huge risks of theft if not properly secured, or to allow a return to Cold War levels of armament should political circumstances change. If the United States, Russia, and the rest of the international community get a 34-ton program going and then walk away without addressing the larger picture of excess plutonium, the 34-ton program will have had little benefit – either for reducing the risk of plutonium theft, or for ensuring that nuclear arms reductions would be difficult and costly to reverse.

Hence, the United States and Russia should begin discussions now on declaring additional material excess to their military needs, and should structure plans for the disposition program to ensure that the program, once underway, could handle much larger quantities of plutonium than are covered under the initial agreement. If all effort continues to focus on the initial 34 tons of plutonium on each side, policymakers in the participating countries are likely to lose sight of the need to deal with much larger quantities of plutonium. As a result, the financing and technical plans for disposition will wind up sized in a way that is not readily expandable to cope with additional material. This discussion of declaring additional plutonium excess should be in the context of the broader discussion recommended above dealing with what nuclear complexes and stockpiles each side needs to maintain.

Expanded disposition of plutonium was among the subjects of the statement from the May 2002 Bush-Putin summit, but the working group that followed up that statement did not reach

¹¹ In the past, bilateral threat reduction projects have had a substantially better track record of success than have multilateral projects.

any agreements on including additional material in the two sides' plutonium disposition programs. Nevertheless, Russia already has a large amount of additional material which it has formally committed never to use in weapons, including a total of 50 tons of plutonium from dismantled weapons, 32 tons of separated civilian plutonium, and all the weapons plutonium produced since 1994. All this material sums to a total currently in the range of 90 tons, slightly more than half of its total separated plutonium stockpile.¹² The United States has also declared 52.5 tons of plutonium, slightly more than half of its government stockpile, excess to its military needs. Even these figures should be considered initial goals, however: much of the remaining plutonium not yet declared excess is not in fact needed for any plausible military purpose. Ultimately, the United States and Russia should agree to reduce their nuclear warhead stockpiles to the lowest possible levels consistent with their military security, and to reduce their plutonium and HEU stockpiles to the levels needed to support those low, agreed warhead stockpiles.

■ **Begin now to plan in detail for maintaining very high levels of security and accounting throughout the disposition process.**

Nuclear material is more difficult to secure and account for when it is being transported and processed in bulk than when it is being stored at a secure storage facility. Hence, to ensure that disposition of excess plutonium in fact reduces the threat of nuclear theft over the long term rather than increases it, it will be essential to ensure that very high levels of security and accounting are maintained throughout the process. The theft of nuclear material from a process that was only taking place because of U.S. and international support provided to promote arms reduction and nonproliferation – causing, rather than preventing proliferation – would not only be a security disaster, but also a political catastrophe for the entire threat reduction effort. Achieving the needed levels of security and accounting for nuclear material will be more difficult and more costly if such issues are dealt with as an add-on after the entire approach has

been designed. It would be much better to design them in from the outset, and the United States should initiate discussions with Russia and its other international partners to do so.

■ **Initiate discussions of a “plutonium swap” approach, using existing plutonium fuel fabrication facilities and reactors already burning plutonium fuel, as a complement or alternative to the current plan.**

Today, some 10 tons of reactor-grade civilian plutonium is already being burned as fuel for civilian power reactors each year. By far the fastest and cheapest approach to reducing stockpiles of excess weapons plutonium, if agreement could be reached on it, would be to substitute excess weapons plutonium for this civilian plutonium, thereby burning some 10 tons a year of excess weapons plutonium while using existing fuel fabrication facilities and contract arrangements.¹³ The excess weapons plutonium would be converted to oxides suitable for fuel fabrication in Russia and the United States, and shipped to existing European fuel fabrication facilities under heavy guard. Modest license modifications for those facilities and for the reactors that use fuel from them would likely be needed in order for them to use weapon-grade rather than reactor-grade plutonium. The civilian plutonium that would have been burned at a rate of 10 tons per year would be displaced and would build up in storage, adding to the large quantities of civilian separated plutonium that are already in storage. In effect, this would transform a problem of excess weapon-grade plutonium in Russia and the United States, under no international safeguards, to a problem of excess reactor-grade plutonium stored in secure facilities in Europe under international safeguards – a significant improvement, though not a complete solution to the problem by any means. These stockpiles of displaced civilian plutonium could be “swapped” for the excess weapons plutonium, so that the United States and Russia would retain title to the same amount of fissile plutonium they each sent to Europe (potentially important for Russia, which focuses more on the potential future value of plutonium than on

¹² See Bunn, *The Next Wave*, pp. 54–55.

its present liabilities). Indeed, given the costs and difficulties for utilities in managing plutonium, the European and Japanese utilities that own the huge stocks of separated civilian plutonium now in storage would likely be happy to have Russia take title to two tons of civilian plutonium for every one ton of weapons plutonium sent to Europe. The United States should initiate discussions of such a “plutonium swap” approach, but should pursue them carefully, making sure not to disrupt current plutonium disposition plans.

■ **Continue to pursue options for burning part of Russia’s excess plutonium in reactors outside of Russia, including through leasing arrangements.** As already noted, without substantial modifications, Russia’s existing modern reactors alone are not enough to burn four tons a year, the target specified in the U.S.-Russian plutonium disposition agreement. Europe’s reactors already licensed to burn plutonium fuel already have more civilian plutonium than they can handle, unless some kind of substitution arrangement like that just described can be worked out. Nonetheless, for some years there have been quiet international discussions of possibilities for burning some of Russia’s excess weapons plutonium in reactors in other countries, and there are at least a few reactors that could be possibilities – particularly if their incentive to use this fuel was increased by having the fresh fuel service packaged with the service of taking the spent fuel back to Russia, in a fuel “leasing” arrangement. In addition to Western Europe, there is Ukraine, where 11 VVER-1000s, the most modern Soviet reactor design, are already operating, and already receive their fuel from Russia. There is also Canada, whose CANDU reactors have also been explored as possibilities for

burning excess weapons plutonium. The United States and Russia should continue discussions with these other countries, in pursuit of ways to accelerate the disposition of Russia’s excess weapons plutonium.

■ **Restart development of plutonium immobilization technologies.** The plutonium disposition program currently has no backup option ready should its current focus on burning plutonium as fuel in existing reactors encounter serious obstacles. Yet there is a substantial risk that major obstacles will arise. The current approach faces intense political opposition from U.S. non-governmental organizations that question its safety and security, and are concerned that it will encourage the use of plutonium fuel elsewhere. And the structure of the U.S. legal and regulatory system offers opponents many opportunities to attempt to stop or delay new nuclear projects, all of which are they are likely to exploit. The approach faces similar opposition from environmentalists in Russia, and while the opportunities for opponents to block or delay projects are fewer there, the Ministry of Atomic Energy is only lukewarm about moving the project forward. What is more, it may prove to be impossible to work out an approach that convinces Russian regulators that Russia’s Soviet-designed reactors can in fact burn plutonium fuel safely – or at least impossible to do so without substantial delays. Any significant accident or security incident with plutonium fuel fabrication or use in a reactor could potentially stop the program in its tracks, either politically or technically.

In short, it would make sense to have a fallback approach in development. Until it was effectively canceled, such an alternative was provided by technology for immobilizing plutonium with high-level

¹³ This approach was outlined in Thomas L. Neff, “Perspectives on Actions Necessary to Move the Plutonium Disposition Program Forward” (paper presented at the International Policy Forum: Management and Disposition of Nuclear Weapons Materials, Bethesda, Maryland, March 23–26, 1998). Senator Pete Domenici (R-NM) championed the idea briefly, but dropped it after finding little European interest (see, for example, Dave Airozo, “Finding Europeans Disinterested, Domenici Shelves ‘Global Burn,’” *Nuclear Fuel*, July 27, 1998). If appropriately presented and packaged with reasonable incentives for all concerned, however, this approach could be designed so that it would not interfere with European fuel-cycle choices, but, indeed, would effectively lock in use of plutonium fuel for a decade or more as part of a nuclear arms reduction initiative. A similar approach was also discussed in U.S. National Academy of Sciences, *Management and Disposition of Excess Weapons Plutonium*, op. cit., pp. 176–181.

wastes – creating massive, intensely radioactive objects quite similar in their proliferation characteristics to spent fuel from nuclear power plants. Indeed, to avoid putting all the plutonium disposition eggs in one basket, a panel of the National Academy of Sciences recommended that the U.S. and Russian programs pursue both technologies at the same time, as did a group of senior U.S. and Russian experts asked to advise their two Presidents on plutonium disposition in the late 1990s. For the U.S. program, some means of dealing with the tons of highly contaminated plutonium unsuitable for making into fuel is likely to be needed, and immobilization appears to be the best approach.¹⁴ While the Russian government has traditionally opposed plutonium immobilization on the grounds that it would throw away a material that cost an enormous amount to produce and may be valuable in future, carrying out joint research and development on immobilization approaches could help build up the cadre of experts in Russia who understand immobilization and its potential value – a value which may become more apparent to Russian officials if the costs and difficulties of the plutonium fuel approach continue to escalate in the future. Moreover, if cost estimates for the plutonium fuel option continue to rise, it is conceivable that the option of buying Russia's excess plutonium and then paying to have it immobilized will ultimately prove to be competitive. In short, it is time for the United States to restart at least a modest research and development effort on plutonium immobilization, and restart joint development with Russia.¹⁵

■ **Advanced reactors and fuel cycles.** Since existing reactors and demonstrated fuel approaches are available, disposition of excess weapons plutonium should not wait for (or pay much of the costs of) the development, licensing, and construction of new types of reactors (such as high-temperature

gas-cooled reactors or new liquid-metal cooled reactors) or the development, licensing, and implementation of new fuel types (such as proposed thorium-plutonium-uranium fuels). But such new reactors and fuel types may well be promising subjects of research and development for the future of nuclear energy. A modest joint U.S.-Russian cooperative program to develop such advanced concepts – including, as much as possible, the participation of former nuclear weapons experts who are no longer needed – would make sense, as an item to be funded separately from disposition of excess weapons plutonium. Should such new reactors or fuels be developed and become available while there is still excess plutonium that needs to be eliminated, their use for disposition of that plutonium should certainly be considered.

■ **Consider options for purchasing excess Russian plutonium.** There are a variety of possible approaches worth considering for simply purchasing Russia's excess weapons plutonium – as the United States is now purchasing HEU from dismantled Russian weapons. If Russia were willing to sell (senior Russian officials have said different things on this point at different times) the cost would likely not be astronomical. If the buyer – the United States or other countries participating in the G-8 Global Partnership – were willing to pay the same amount per ton as the United States is now paying for HEU, then 50 tons plutonium (enough for over 10,000 nuclear weapons) would cost just over \$1 billion.¹⁶ This would be a generous offer, since in the current market the plutonium's actual commercial value is negative (the costs of securing it and making fuel from it are much higher than the value of the fuel). The buyer, however, would presumably then have the right to remove the material from Russia for immobilization or use as

¹⁴ These materials have been transferred out of the responsibility of the U.S. plutonium disposition program, to the Department of Energy's (DOE) Office of Environmental Management, but they still must be addressed, as part of a comprehensive approach to managing U.S. plutonium stockpiles.

¹⁵ There is a vast literature of articles from opponents of plutonium fuel use making the case for immobilization; for a representative one, see Allison Macfarlane and Adam Bernstein, "Russia's Nukes: Canning Plutonium – Faster and Cheaper," *Bulletin of the Atomic Scientists* 55, no. 3 (May/June 1999; available at <http://www.thebulletin.org/issues/1999/mj99/mj99mcfarlane.html> as of January 14, 2003).

¹⁶ The original estimated price for 500 tons of HEU was \$12 billion, but the price of enrichment work has declined since then, reducing the price-per-ton of HEU.

fuel elsewhere, or to pay for it to be immobilized or used as fuel within Russia. In the case of a U.S. purchase, for example, it might be possible to build only one plutonium fuel fabrication plant, rather than one in the United States and one in Russia. There are a wide range of difficult political and legal questions that would have to be addressed – along with some technical and economic questions – before such a purchase could become a reality, but it remains something that should be considered. The option may be particularly valuable if the current plan to use plutonium as fuel runs into serious obstacles or cost overruns, while Russia continues to resist throwing its plutonium away through immobilization. In that case, the option of purchasing Russia's plutonium (thereby allowing Russia to monetize it immediately), and then paying for it to be immobilized, might provide a plausible back-up approach. As with the "swap" concept, however, considerable care must be used to explore these concepts without undermining the main thrust of the plutonium disposition program, which remains focused on using the material as fuel while it remains under the control of its original owners, Russia and the United States.

A somewhat similar proposal is to offer a substantial financial incentive, perhaps \$10,000 per kilogram (\$500 million for 50 tons) for Russia to deposit its plutonium in a facility in Russia with international (rather than purely national) guards and monitors, and, for reciprocity, have the United States deposit its excess plutonium in a facility in the United States under similar arrangements.¹⁷ A more radical idea is to set up a single facility in some third country, where all the U.S. and Russian excess material – and perhaps excess warheads as well – would be stored.¹⁸ Obvious obstacles to that concept include obtaining the agreement of Russia, the United States, and the third country.

Recommendation: Move ahead with the currently planned approaches to disposition of excess weapons plutonium.

Recommendation: Seek to reach agreements by the end of 2003 on a financing and management arrangement, and a step-by-step work plan, for disposition of Russian excess weapons plutonium.

Recommendation: Begin now to discuss going beyond the 34 tons of plutonium on each side covered by the U.S.-Russian Plutonium Disposition and Management Agreement.

Recommendation: Begin now to plan in detail for maintaining very high levels of security and accounting throughout the disposition process.

Recommendation: Continue exploring complements or alternatives to the current approach to plutonium disposition, including:

- **Initiate discussions of a "plutonium swap" approach, using existing plutonium fuel fabrication facilities and reactors already burning civilian plutonium fuel, which could burn weapons plutonium fuel instead.**
- **Pursue options for burning part of Russia's excess plutonium in reactors outside of Russia, including through leasing arrangements.**
- **Restart development of plutonium immobilization technologies.**
- **If advanced reactors and fuel cycles are developed and built for other purposes, consider their use for disposition of whatever excess plutonium remains at that time.**
- **Consider options for purchasing Russian excess plutonium stockpiles.**

¹⁷ For a description of this "plutonium bank" idea, see Ashton B. Carter and Owen Coté, "Disposition of Fissile Materials," in Graham Allison, Ashton B. Carter, Steven E. Miller, and Philip Zelikow, eds., *Cooperative Denuclearization: From Pledges to Deeds*, CSIA Studies in International Security No. 2 (Cambridge, Mass.: MIT Press, 1993).

¹⁸ See Brian Chow, Richard H. Speier, and G.S. Jones, *A Concept for Strategic Material Accelerated Removal Talks*, DRU-1338-DOE (Washington, D.C.: RAND Corporation, 1996).

16. Conclusions

Our examination of the threat of nuclear weapons terrorism, the progress that has been made so far in addressing that threat, and the opportunities for further action leads us to four key findings.

Key Finding 1: *The threat that terrorists could acquire and use a nuclear weapon in a major U.S. city is real and urgent.*

As described in Chapter 2, al Qaeda is actively seeking nuclear weapons and the nuclear materials needed to make them; with the needed nuclear material in hand, construction of at least a crude nuclear explosive is potentially within the capabilities of such a well-organized terrorist group; hundreds of tons of nuclear material in hundreds of buildings in countries around the world is dangerously vulnerable to theft; multiple, documented cases of theft of weapons-usable nuclear materials have already occurred; very little capability now exists (or is likely to exist in the near term) to prevent a nuclear bomb or the nuclear material to make one from being smuggled into a target country and set off; and the impact of even a crude terrorist nuclear device would be destruction on a horrifying scale, changing America and its way of life forever. Given the challenges on the terrorist pathway to the bomb, the probability of such a terrorist attack with a nuclear weapon is not as high as the probability of other types of terrorist attack – but the consequences would be so overwhelming that we believe President Bush is correct in saying the U.S. government must do everything in its power to prevent such an attack from ever taking place.

Key Finding 2: *The most effective approach to reducing the risk is a multi-layered defense designed to block each step on the terrorist pathway to the bomb – but the most effective part of this defense, where actions that can be taken now can most reduce the risk, is to secure nuclear weapons and materials at their source.*

As described in Chapter 3, threat reduction programs designed to improve controls over nuclear

weapons, materials, and expertise; homeland security efforts; and the war on terrorism each have critical roles to play in blocking the terrorist pathway to the bomb. The war on terrorism, for example, can and should focus on identifying and destroying groups with the capabilities and intent to commit mass destruction terrorism; can eliminate terrorist safe havens (the overthrow of the Taliban may well have reduced the risk of an al Qaeda nuclear attack more than any other action taken since the September 11 attacks); and the war of ideas and efforts to address the root causes of terrorism can reduce terrorists' ability to recruit the expertise they need for a nuclear attack, and increase the ability of key states to clamp down on terrorist groups without facing domestic unrest. Homeland security programs can modestly increase the chances of preventing a nuclear bomb or the materials to make one from being smuggled into the United States, or contribute to finding it and disabling it if intelligence offers clues on where to look. Both foreign and domestic intelligence are critical to all the elements of blocking the terrorist pathway to the bomb.

The most critical choke-point on that pathway is in preventing nuclear weapons and materials from being stolen in the first place. Once a nuclear weapon or the material to make one has been stolen, and is beyond the gates of the facility where it was supposed to be, it could be anywhere – and finding and recovering it, or blocking it from being smuggled to a terrorist safe haven or into a target country, becomes an enormous challenge. As former Senator Sam Nunn has said, “the most effective, least expensive way to prevent nuclear terrorism is to secure nuclear weapons and materials at the source. Acquiring weapons and materials is the hardest step for the terrorists to take, and the easiest step for us to stop. By contrast, every subsequent step in the process is easier for the terrorists to take, and harder for us to stop.” Hence, threat reduction programs are central to any serious effort to reduce the risk of nuclear weapons terrorism.

Key Finding 3: *Current programs designed to reduce the threat are making progress, but have finished much less than half the job in virtually every category, and the pace at which the remaining work is being completed is unacceptably slow. There is a substantial gap between the urgency of the threat and the pace and scope of the current response.*

In Chapters 4 and 5, we examined both the inputs to current programs – ranging from the time and energy of senior political leaders to appropriated and requested budgets – and the outputs, measured by what fraction of various parts of the job of controlling nuclear warheads, materials, and expertise has been accomplished, and the pace at which the rest of job is being done.

In each of the critical inputs to the effort we have examined – political leadership, organization and planning, information, and resources – much more can and should be done to address the threat of terrorists getting nuclear explosives than is now being done. While President Bush has focused unprecedented attention on the dangers of mass destruction terrorism, and he and senior officials of his administration have launched several new initiatives designed to strengthen and accelerate efforts to address this threat, the fact remains that the level of sustained, day-to-day engagement from the highest levels in overcoming the many impediments to accelerating efforts to secure nuclear warheads and materials has been very modest (as, indeed, it was in the previous administration, and the one before that). At the same time, while there are dozens of separate programs addressing parts of this problem, there is no senior official anywhere in the government with the full-time job of leading and coordinating these efforts, and no integrated and prioritized plan for them. The level of funding available, while generally adequate to sustain the current slow rate of progress if other constraints are regarded as immutable, would *not* be adequate to finance the new initiatives we suggest, or to accelerate and strengthen existing programs in the ways we recommend, if changes in leadership attention and policy approaches made it possible to overcome the other roadblocks.

In terms of outputs, the progress of existing programs is impressive if compared to the complete lack of cooperation in these areas that existed when the Soviet Union collapsed. But eleven years after that collapse, and a year and a half after the September 11 attacks, more than half the needed work remains undone, across a broad range of efforts critical to blocking the terrorist pathway to the bomb. Moreover, the pace at which the remaining work is being accomplished is not fast enough to give the United States a strong chance of winning the race to keep nuclear weapons out of terrorist hands. To take just one example, as described in Chapter 5, during the year following the September 11 attacks, comprehensive security and accounting upgrades were completed on only an additional 2% of the potentially vulnerable nuclear material in Russia, and rapid upgrades were completed on only an additional 5% of the material.

In short, today, it is simply not the case that the U.S. government is doing everything in its power to prevent a terrorist nuclear attack on the United States from occurring. There continues to be an enormous gap between threat and response.

Key Finding 4: *Opportunities exist for new initiatives and steps to strengthen and accelerate existing efforts, which, if fully implemented, could rapidly and dramatically reduce the risk.*

The technology exists to secure all the world's stockpiles of nuclear weapons and materials – with the potentially important exception of the unknown quantity that may already have been stolen without detection. In the final chapters of this report, we have outlined a comprehensive set of recommendations, including both new initiatives and steps to accelerate and strengthen existing programs. We believe that if fully implemented, these steps could reduce the danger of nuclear weapons terrorism to a fraction of its current level.

Many of the most important steps could be taken quickly. With a focused program with the necessary authority, resources, and expertise in a single set of hands, weapons-usable nuclear material could be removed entirely from many of the world's most vulnerable sites within a few years.

With sustained high-level attention focused on overcoming the impediments to progress, rapid upgrades for all the nuclear warheads and materials in Russia could probably be completed within two years, and comprehensive upgrades within four – and we recommend that, as part of an accelerated and strengthened nuclear security partnership, Russia and the United States set themselves that goal.

To achieve such goals will require sustained political leadership from the highest levels,

putting the mission of keeping nuclear weapons out of terrorist hands at the very top of the national agenda. The other most critical elements of success will be the appointment of a single senior leader in the White House with full-time responsibility and accountability for leading the effort and overcoming the obstacles to accelerated progress; an integrated and prioritized plan to accomplish the goal; and an effectively functioning global coalition of nations working together to keep nuclear weapons out of terrorist hands.

Appendix A: Anecdotes of Nuclear Insecurity

Security of nuclear weapons, materials, and expertise in the former Soviet Union continues to be undermined by a broad range of factors including low pay and morale for nuclear workers, guards, and military forces; widespread theft and corruption, including in the military; and inadequate resources for building, maintaining, and operating effective nuclear security and accounting systems. The list below provides descriptions of specific incidents highlighting these concerns. It is intended only to be illustrative, not definitive. Only incidents that are reasonably well confirmed – through statements by senior government officials, arrests or convictions of named individuals, and the like – are included. The list covers the period from mid-1998 (just as the financial crisis that led to the devaluation of the ruble was unfolding) to the present. Both salaries and facility finances have improved substantially since 1998, so incidents from that period describing protests over insufficient or delayed salaries no longer reflect current conditions. Nevertheless, problems remain, as the more recent incidents below attest.

■ In January 2003, General Igor Valynkin, commander of the 12th Main Directorate of the Russian Ministry of Defense, the branch responsible for guarding Russia's nuclear weapons, told visiting U.S. Department of Defense officials at a reception at Sergiyev Posad, north of Moscow, that "Chechen terrorists plan to seize some crucial military facility or nuclear warhead so as to threaten not just Russia, but the whole world." At the same session, retired Brigadier General Thomas Kuenning, the head of the of

the U.S. Defense Threat Reduction Agency's Cooperative Threat Reduction program, noted that the possibility of war with Iraq had increased the risk of nuclear terrorism within the United States, prompting U.S. nuclear weapons facilities to step up security.¹

■ On November 14, 2002, Yuri Vishnevski, head of Russia's nuclear regulatory agency Gosatomnadzor (GAN), said in a press conference that in a recent inspection of Russia's civilian nuclear facilities, his agency's inspectors had found scores of violations of security regulations, and had reported to Russia's Security Council that 6 billion rubles (some \$200 million) would be needed to bring these facilities into compliance. While Vishnevski acknowledged that security at Russian nuclear facilities had been beefed up after the September 11 attacks in the United States, he argued that further investments were needed "to modernize technical defense equipment, as well as for preparing and arming the security services at nuclear sites." Vishnevsky acknowledged that there had been thefts of nuclear material from Russian nuclear facilities, but claimed that the confirmed cases at civilian facilities regulated by GAN involved only grams of highly enriched uranium (HEU), or kilograms of low-enriched uranium (LEU), citing the fuel fabrication plants at Elektrostal and Novosibirsk as the sites of "most" of the known cases.² Vishnevsky called the press conference to criticize a proposed law on technological regulation being debated in the

¹ Sergei Ostanin, "Chechen terrorists out to lay hands on nuclear arms – military," *ITAR-TASS World Service*, January 30, 2003.

² While GAN does not regulate the Navy facilities from which some past thefts of kilograms of HEU have occurred, there have been confirmed cases of kilogram-scale thefts of HEU from facilities GAN does regulate, contrary to Vishnevski's statement.

³ See, for example, James Heintz, "Russian Official Says Nuclear Material Disappeared From Country's Plants," *Associated Press*, November 15, 2002, and "Head of Russia's Nuclear Regulatory Agency Admits Leakage of Weapons-Grade and Reactor-Grade Nuclear Materials From Atomic Facilities," *Nuclear.ru*, November 15, 2002.

Duma, which he said called for “the minimal necessary demands for security at the same time that in the whole world and in our country the demands for security in using atomic energy should be the maximum.”³

■ In late October 2002, a force of some 40 Chechen terrorists armed with automatic weapons and explosives seized more than 700 hostages at a Moscow theater, and announced their willingness to kill the hostages, and to die themselves, if their demands were not met – demonstrating the ability to Chechen terrorists to mount large-scale operations within Moscow itself.⁴ The official Russian government newspaper reported that the terrorists had planned to seize a reactor at the Kurchatov Institute in Moscow, but decided to seize the less well defended theater.⁵ Hundreds of kilograms of weapons-usable HEU are located at Kurchatov. The paper also reported that Russian military counter-intelligence had “foiled four attempts” by terrorists to gain access to Russian nuclear stockpiles – two at nuclear warhead storage sites (see discussion below), and two previously unreported incidents involving nuclear warhead transport trains. During a meeting with the European Union, Russian Interior Minister Boris Gryzlov warned that terrorists were “eager to gain access to weapons of mass destruction,” and planned to attack hazardous facilities in Russia.⁶

■ In late October 2002, Akhmed Zakayev, an envoy for Chechen leader Aslan Maskhadov, warned of future Chechen attacks on Russian targets, possibly including Russian nuclear

power plants. “We cannot guarantee that there will not be another group on Russian territory,” Akhmed Zakayev told Reuters. “Terrorist acts are possible. We cannot exclude that the next such group takes over some nuclear facility. The results may be catastrophic, not only for Russian society and for Chechen society but for the whole of Europe.”⁷

■ In October 2002, the Russian nuclear regulatory agency reported that inspectors from its Siberian branch had uncovered 37 violations of material control and accounting regulations and standards, and 32 physical protection violations in the third quarter of 2002 alone. The Siberian branch covers the massive plutonium and HEU production site at Seversk, the plutonium production plant at Zheleznogorsk, and the fuel fabrication facility at Novosibirsk. These were violations of rules, but not actual thefts or losses of nuclear material.⁸

■ Police in the Sverdlovsk region arrested three Chechens in March 2002 who were charged with attempting to sell weapons and explosives. One of the men was found to have a valid pass to the high-security closed city of Lesnoy, site of one of Russia’s largest nuclear weapons assembly and disassembly facilities. Roman Tarsukhanov could have used his pass to enter the city, and have a wide range of contacts with workers at the weapons plant, but would not have been able to enter the plant itself. A subsequent search of the arrested individuals’ apartment revealed more weapons, a remote-control bomb, and a

⁴ See, for example, “118 Hostages are Dead in Moscow Theater Raid,” *The Russia Journal*, October 27, 2002.

⁵ Vladimir Bogdanov, “Propusk K Beogolovkam Nashli U Terrorista (A Pass To Warheads Found on a Terrorist),” *Rossiiskaya Gazeta*, November 1, 2002.

⁶ “Gryzlov: boeviki hotyat poluchit’ oruzhie massovogo porazheniya (Gryzlov: Terrorists Want to Get Weapons of Mass Destruction),” *Gazeta.Ru*, November 5, 2002.

⁷ “Threat Assessment: Chechen Militants Threaten Nuclear Plant Strike,” *NTI Global Security Newswire*, October 30, 2002 (available at http://www.nti.org/d_newswire/issues/2002/10/30/1s.html as of February 7, 2003).

⁸ “Svedeniya o sluchayah nevapolneniya uslovii deistviya licenzii, a takzhe nevypolnenia polozhenii zakonov I federal’nyh norm I pravil v oblasti ispol’zovaniya atomnoi energii, prinyatyh merah vozdeistviya k narushitelyam (Evidence of Noncompliance With License Requirements, Violations of Laws and Federal Norms and Rules in the Field Of Atomic Energy Use, and Imposed Penalties),” *Gosatomnadzor (Russian Federal Ministry of Nuclear and Radioactive Safety)*, October 11, 2002 (available at <http://www.gan.ru/> as of February 7, 2003).

⁹ Sergei Avdeyev, “Chechens Gain Access to Nuclear Warheads,” *Izvestia*, March 22, 2002.

copy of Chechen president Aslan Maskhadov's book, *Honor is More Valuable Than Life*.⁹

■ In January 2002, Russian troops found what they described as late Chechen president Dzhokhar Dudayev's personal archive, which contained a detailed plan to hijack a Russian nuclear submarine.¹⁰ The commander of Russia's troops in Chechnya, Vladimir Moltenskoï, told reporters on February 2, 2002, that the plan provided for seven Slav-looking fighters to seize a submarine from the Russian Navy's Pacific Fleet some time in 1995–96, and blackmail Moscow into withdrawing troops from Chechnya and recognizing the republic as an independent state.¹¹ Moltenskoï reported that former naval officer Islam Khasukhanov developed the plan back in 1995 and that then-chief of the Chechen General Staff Maskhadov had personally reviewed the plan and made notes on it. Khasukhanov had served on Russian submarines before leaving the Pacific Fleet in the rank of naval commander to become chief of the operational department of the Chechen separatists' general staff.¹²

■ In January 2002, four soldiers from the unit that guards the weapons plutonium production facility in Zheleznogorsk died, in two separate incidents. On January 1, a drunk driver lost control of his truck, killing two soldiers immediately and a third who died later. Unit officials tried to cover up the accident, but the Krasnoyarsk military prosecutor's office

opened an investigation. On January 20, another of the guards died from a gun shot to the head; the circumstances are under investigation.¹³

■ In December 2001, GAN chairman Yuri Vishnevsky, wrote to Deputy Prime Minister Ilya Klebanov about a case in March 2001 in which pieces of radioactive spent nuclear fuel from Russia's navy were damaged and others missing. The fuel was sent from the Northern Fleet to the Mayak reprocessing plant by train, but when the canisters were opened, as much as half of some of the fuel elements were found to be missing – and some of the remainder were badly enough damaged to pose a serious safety hazard to those unloading the fuel. The Russian navy uses both HEU and LEU fuel, and Vishnevsky did not specify whether it was HEU that was missing. Because the navy is not subject to GAN regulation, GAN inspectors had not been present when the fuel was first loaded into the shipping containers, and the hazardous conditions were not documented in the shipping documents, leaving those transporting and unloading the fuel unaware of them. Vishnevsky warned that this was not the first case of this kind, and that the practice of having the Ministry of Defense regulate the security and safety of its own facilities posed serious risks. The whereabouts of the missing pieces are unknown. According to Vishnevsky, this incident was not the first of its kind.¹⁴

¹⁰ "Nachalnik Operativnogo Shtaba Maskhadova Gotovil Plan Zakhvata Rosiiskoi Atomnoi Podlodki (Chief of Maskhadov's Operational Staff Was Preparing a Plan to Hijack Russian Atomic Submarine)," *RIA-Novosti*, April 25, 2002.

¹¹ Russian *RTR* Television reported on April 26, 2002, that the plan included removing a nuclear warhead from the submarine and bringing it back to Chechnya (transcription and translation from *BBC Monitoring*). No other media confirmed this report, however. The Pacific Fleet presently operates no nuclear-powered ballistic missile submarines (SSBNs), but it still has some 20 nuclear powered submarines, including those of the Oscar-II class that can carry nuclear torpedoes.

¹² "Nachalnik Operativnogo Shtaba Maskhadova Gotovil Plan Zakhvata Rosiiskoi Atomnoi Podlodki (Chief of Maskhadov's Operational Staff Was Preparing a Plan to Hijack Russian Atomic Submarine)," *RIA-Novosti*, April 25, 2002.

¹³ "Smert' Soldat (Death of Soldiers)," *Segodnyashnyaya Gazeta*, quoted in *Nuclear No*, February 12, 2002. Translated and summarized by Galya Balatsky, Los Alamos National Laboratory.

¹⁴ Yu. G. Vishnevsky, "Gosatomnadzor (State Committee for Supervision over the Safety of Work in Nuclear Power Engineering) of Russia Sounds Alarm about Extremely Unsatisfactory Safety of Removing Spent Nuclear Fuel at 'Mayak' Production Association," *Nuclear No* (December 26, 2001).

¹⁵ *RFE/RL Crime, Corruption, and Terrorism Watch*, December 6, 2001.

- Yevgenii Tarasenko, the officer in charge of a military warehouse in the Nizhny Novgorod region, was arrested for selling dozens of automatic weapons and pistols, thousands of rounds of ammunition, bayonets, field binoculars, night-vision instruments, gun sights, and mobile electric generators, Russian NTV reported on November 23, 2001. The warehouse belonged to one of the artillery units of the Mulino garrison. Roughly 27,000 firearms are known to have been stolen from military units in Russia. Reportedly, 53,900 crimes involving illegal trading in weapons were recorded in Russia in 2001.¹⁵
- On November 10, 2001, Russian President Vladimir Putin met with Minister of Atomic Energy Alexander Rumiantsev on a Saturday to discuss security at Russia's nuclear facilities. Two Russian press accounts of the meeting indicate that Putin ordered that security be beefed up, with expanded guard forces to protect against terrorists.¹⁶ One of these articles reports that the meeting was occasioned by an FSB test of security at one nuclear facility, in which the mock "terrorists" were easily able to break through the security system.¹⁷
- Speaking at the International Atomic Energy on October 31, 2001, Yuri G. Volodin, chief of safeguards for the Russian nuclear regulatory agency, revealed that in the last year, his agency had uncovered dozens of violations of Russia's regulations for securing and accounting for nuclear material – including one loss of nuclear material, an event he described as of the "highest consequence." When asked for details, Volodin indicated that he was not at liberty to describe the loss in more detail.¹⁸ In a later interview with Russian TV, Volodin indicated that the case involved a nuclear facility receiving a shipment of nuclear material that had much less material in it than the documents prepared by the shipper indicated it should – which could have been caused by a theft in transit, a theft and forgery of the documents at the shipping facility, or a paperwork mistake. Volodin indicated that the investigation was continuing. Volodin argued that nuclear material in Russia was more vulnerable to theft during such transports than when it was in storage.¹⁹
- In an interview on Russian ORT Television on October 25, 2001, General Igor Valynkin, commander of the 12th Main Directorate of the Russian Ministry of Defense, the force that guards Russia's nuclear weapons, reported two incidents during 2001 of terrorist groups carrying out reconnaissance at Russian nuclear weapon storage facilities – one, eight months before his remarks, and the second, three months later. In both cases, Valynkin said the terrorist efforts were "nipped in the bud," and that no one had entered the grounds of the weapon storage facilities. Valynkin did not explain, however, how the terrorists had found the facilities, whose location is considered a state secret. Valynkin indicated that he took the possibility of terrorist attack on a warhead stor-

¹⁶ "The Ministry of Atomic Energy in the Middle of a Scandal," *Nezavisimaya Gazeta*, December 14, 2001 (translated by *BBC Monitoring Service*), and Yuri Golotyuk, "Peaceful Atom Preparing For a War," *Vremya Novostei*, November 12, 2001. For another account of the meeting, see "Russia's Putin Assured of Safety of Postal System and Nuclear Power Plants," *BBC Worldwide Monitoring* (excerpt from *Kommersant*), November 12, 2001.

¹⁷ "The Ministry of Atomic Energy in the Middle of a Scandal," op. cit.

¹⁸ Yuri G. Volodin, remarks to the International Atomic Energy Agency Safeguards Symposium, Vienna, Austria, October 31, 2001. The formal paper is Alexander Dmitriev, Yuri Volodin, Boris Krupchatnikov, and Alexander Sanin, "Efforts in Strengthening Accounting for and Control of Nuclear Material in Russia," IAEA-SM-367/12/14, in *IAEA Symposium on International Safeguards: Verification and Security of Nuclear Material*, October 29–November 2, 2001.

¹⁹ "Russian Official Refuses to Rule Out Chance That Nuclear Materials Were Stolen," *TV6*, Moscow, November 13, 2001, translated by *BBC Monitoring Service*.

²⁰ Pavel Koryashkin, "Russian Nuclear Ammunition Depots Well Protected – Official," *ITAR-TASS*, October 25, 2001; "Russia: Terror Groups Scoped Nuke Site," *Associated Press*, October 26, 2001.

²¹ "Corruption in the MVD," *RFE/RL Crime, Corruption, and Terrorism Watch*, November 12, 2001.

age facility seriously enough to have added additional guards, with better equipment and training, at all facilities.²⁰

■ In a rare unanimous vote on October 21, 2001, the Russian Duma called on the Russian Prosecutor's Office to investigate allegations of corruption by the chief of the corruption-fighting department of the national police, the Interior Ministry (MVD), Lieutenant General Aleksandr Orlov. It is alleged that he was involved in business conflicts between debtors and creditors in which the directorate took a 50 percent cut of debts collected on creditors' orders. Orlov has reportedly fled the country.²¹ MVD forces play a key role in guarding many of Russia's nuclear facilities.

■ In October 2001, the FSB and military counter-intelligence agents arrested two guards who had been stealing copper wire from military facilities in the closed city of Krasnoyarsk-35 (Podgorniy), where rockets are assembled and disassembled. During the previous year, the thieves had stolen 230 coils of copper wire from potentiometers at the facility. The facility managers installed additional alarm systems in all the buildings of the facility, so they would not be solely dependent on the guards for security.²²

■ In late September 2001, Alexander Orlov, director-general of the "Avangard" nuclear weapons assembly-disassembly facility in the town of Sarov (formerly Arzamas-16, also home to one of Russia's two nuclear weapons design laboratories), reported that employees at the plant were stealing integrated circuits and printed cir-

cuit boards from the plant's computers, substantially delaying the plant's efforts to convert to civilian production. Orlov said that he had added guards to protect the equipment from the insider thieves, who had not yet been caught. Previously, other insider thieves had been stealing precious metals from the plant, and had been caught and brought to trial.²³

■ On July 8, 2001, a Russian border guard pointing an automatic weapon stole a car from a man driving near the border between Russia's Kaliningrad district and Poland. When police caught up with the deserter, Maksim Starostin, he opened fire, wounding one policeman. He was shot in the leg as he tried to escape on foot, and arrested. This followed soon after an incident when another soldier fled a Kaliningrad border post and shot five people at a farm. Sources attributed these problems to military recruiters, under pressure to meet conscription targets, allowing conscription of mentally ill people into the military.²⁴ Border guards play a key role in interdicting nuclear smuggling.

■ In June 2001, the garrison court at Severomorsk, one of Russia's largest naval bases, where large quantities of HEU naval fuel are stored, convicted three officers for stealing and selling FK-P air filter cartridges, which each contain about 130–140 grams of palladium. The group included the commander of the garrison, Captain Aleksandr Kupchenko, UFSB senior representative Captain Aleksandr Okladnikov, and seaman Vladimir Nani. Between spring 1999 and March 2000 the group stole 135 canisters worth about 10.8 million rubles (over \$370,000

²² Russian website www.gzt.ru, January 14, 2002. Translated and summarized by Galya Balatsky, Los Alamos National Laboratory.

²³ Elena Mazanova, "One Day of Plant's Director," *Gorodskoy Kuryer*, September 27, 2001.

²⁴ "Russia: Another Armed Soldier Deserts, Pressure On Army Boards to Meet Conscription Targets," *Mayak Radio* (Moscow), July 9, 2001, monitored and translated by *Federal Broadcast Information Service*.

²⁵ Andrey Riskin, "Ordena i Pogony Ne Spasli ot Tyurmy (Honours and Epaulets hasn't Saved from Jail)," *Nezavisimaya gazeta - regiony*, June 19, 2001, reproduced in *Integrum Techno*.

²⁶ N. Kocheshkova, "Samoubiystvo i Samostrel v Divizii (Suicide and Self-Shooting in Division)," *Gorodskoy Kuryer*, No. 20, May 17 2001. Summary translation provided by the Center for Nonproliferation Studies, Monterey Institute for International Studies.

²⁷ "International Agency Concerned by Russian Traffic in Nuclear Materials," *ITAR-TASS*, April 2, 2001.

at June 2001 exchange rates). The canisters were sold in Murmansk for \$400 each. The thieves received prison sentences of three-and-a-half to four-and-a-half years.²⁵

- In early May 2001, a soldier guarding the nuclear weapons laboratory in the closed city of Sarov shot and killed himself while on guard duty. Ten days later, another soldier from the same unit fired a warning shot and then injured himself in a suicide attempt. At around the same time, a drunken contractor attacked one of the guards at this facility, who opened fire and wounded the contractor. The contractor was later arrested.²⁶
- At an April 2001 conference, Chief of the Russian State Customs Committee Nikolay Kravchenko reported that more than 500 incidents of illegal transportation of nuclear and radioactive materials across the Russian state border were detected by his agency in 2000.²⁷
- In April 2001, two Russian naval officers were arrested in Petropavlovsk-Kamchatsky for attempting to sell components they had stolen from a nuclear submarine, containing radioactive substances.²⁸
- In February 2001, the U.S. General Accounting Office (GAO) reported visiting a nuclear facility where the door to the main area with nuclear material was left wide open, and another where guards did not respond when metal detectors went off, and where visible wires to alarm systems that could be cut easily by intruders. The director of the facility with the open door to the

nuclear material area said it was left open so employees did not have to use the combination lock to enter the premises.²⁹

- On October 6, 2000, at a conference on nuclear non-proliferation in Moscow, Russian Security Council official Raisa Vdovichenko reported that Taliban envoys had sought to recruit at least one Russian nuclear expert. While the recruiting target did not agree to work for the Taliban, three of his colleagues had left his institute for foreign countries and Russian officials did not know where they had gone.³⁰
- On September 22, 2000, Russian security service officials found 240 (non-nuclear) missile warheads in a private company's scrap metal storage area in Russia's Pacific port of Khabarovsk.³¹
- At the end of September 2000, Valentin Ivanov, First Deputy Minister of Atomic Energy, told ORT television that the government still lacked the modern accounting methods necessary to keep track of nuclear materials held in 61 different institutions, public and private, scattered around the country. He had just told a meeting of the Russian Cabinet that more than 2 billion rubles (\$70 million) would be required to create an adequate accounting system, but only 70 million rubles (\$2.3 million) had been allocated.³² Ivanov said that between 1991 and 1999 there had been 23 attempts to steal fissionable materials, including 21 attempts between 1991 and 1995 and two attempts between 1995 and 1999. In comparison, there were only two attempts between 1945 and 1991. His report to

²⁸ Alexander Arkhipov, "Two Naval Officers Nabbed For Selling Radioactive Goods," *ITAR-TASS*, April 23, 2001.

²⁹ U.S. General Accounting Office (GAO), *Nuclear Nonproliferation: Security of Russia's Nuclear Material Improving; Further Enhancements Needed* (Washington: GAO, February 2001; available at <http://www.gao.gov/new.items/d01312.pdf> as of February 7, 2003).

³⁰ *RFE/RL*, Oct. 9, 2000.

³¹ "Hundreds of Missile Warheads Found in Scrap Metal in Russian Far East," *Agence France Presse*, September 22, 2000.

³² "Ministry Notes Drop in Nuclear Material Theft," *Reuters*, September 30, 2000.

³³ "Russian Nuclear Material Monitoring System 'Far From Ideal,'" *Rossiyskaya Gazeta*, September 29, 2000; "Russia: Kasyanov says control over fissile material 'very important problem,'" *Moscow Interfax*, September 28, 2000.

³⁴ "Russian Troops Block Power Shutoff," *Associated Press*, September 12, 2000.

the Cabinet meeting attributed the dramatic increase in theft attempts to the emergence of private firms and insufficient systems for accounting and control of nuclear materials.³³

■ On September 12, 2000, a local branch of the national electricity utility cut off power to a strategic missile base 60 miles northeast of Moscow. The utility claimed that the cutoff, ordered because of continued failure to pay bills totaling approximately \$683,000, affected only non-combat units. Power was restored when armed troops seized the switching station. The military and the utility subsequently reached an agreement to settle debts and keep the power on.³⁴

■ In mid-September 2000, a short circuit in the regional electricity system resulted in a power failure at the Mayak nuclear reprocessing center and the Beloyarsk nuclear power plant. The Mayak plant and its reactors were reportedly without outside power supply for 45 minutes. The head of the Mayak plant, Vitaliy Sadovnikov, said that the back-up diesel generators needed to run the cooling systems came on-line only 30 minutes later. According to Sadovnikov, only the “near-military discipline” of the plant’s personnel prevented a disaster. Ministry of Atomic Energy officials, however, claimed that all backup power systems had come on-line immediately.³⁵

■ On September 3, 2000, a private from a local military unit in the closed city of Sarov (formerly

Arzamas-16), site of Russia’s premier nuclear weapons laboratory, was shot by guards after setting off an alarm when he tried to break into a restricted area. What the private had been attempting to do and why remain unknown.³⁶

■ In early September 2000, Minister of Atomic Energy Evgeniy Adamov told nuclear workers protesting months of unpaid wages that the government owed the ministry over \$170 million and had not provided a single ruble in two months.³⁷ Some 47,000 unpaid nuclear workers joined in protests at various locations around the country, over what the nuclear workers’ trade union said was over \$400 million in back wages to workers in the nuclear sector.³⁸

■ In August 2000, Russian President Vladimir Putin blamed the scientific “brain drain” on the low salaries for experts. He said that approximately 30,000 Russian scientists are now working abroad. He also confirmed that the average monthly salary for scientists was lower than the national average.³⁹

■ In late June 2000, the military court in Severomorsk, one of Russia’s largest naval bases, convicted seven men of stealing fuel oil from Northern Fleet ships, including the commander of an anti-submarine ship; a senior lieutenant from the fleet’s fuel base; the captain and first mate of the tanker Cheremshan; and Aleksandr Rumiantsev, a civilian electrician who was reportedly involved in a Murmansk criminal organization that deals in fuel. All seven men

³⁵ “Nuclear Disaster Averted—Russian Power Plant Workers Praised for ‘Heroic’ Operation,” *The Observer* (UK), September 17, 2000.

³⁶ N.Kocheshkova, “Proyti i pogoret (Pass, but Fail [meaning that somebody managed to pass the fence, but failed to achieve the final goal])” *Gorodskoy Kuryer*, No. 36, September 7, 2000. Summary translation provided by the Center for Nonproliferation Studies, Monterey Institute for International Studies.

³⁷ “Russia’s Nuclear Force Sinks With the Ruble: Economic Crisis Erodes Strategic Arsenal,” David Hoffman, *The Washington Post*, September 18, 1998.

³⁸ “Nuclear Center Staffers to Join Nation-Wide Protest,” *ITAR-TASS*, September 11, 1998, and “Fund Arrears Imperil Russia’s Nuclear Sites,” Kevin O’Flynn, *The Moscow Times*, September 8, 1998.

³⁹ “Scientists Pay Low,” *Associated Press*, August 17, 2000.

⁴⁰ Vyacheslav Gudkov, “Toplivnaya Amnistiya na Severnom Flote (Fuel Amnesty on the North Fleet),” *Kommersant*, June 27, 2000.

⁴¹ “Lights Out for Topol-M,” *RFE/RL*, June 22, 2000.

were amnestied. Five others were convicted in an earlier hearing. The theft of 74 metric tons of diesel fuel from the ship Marshal Vasilyevskiy was discovered in 1997.⁴⁰

■ In June 2000, after the Altaenergo electric company threatened to shut off power to local units of the Strategic Rocket Forces, which are equipped with Topol-M missile systems, the troops took over four power plants in Altai Krai. The unit owed about \$174,000 to the Altaenergo company.⁴¹

■ In May 2000, a military court sentenced 12 men (2 officers, 3 warrant officers, and 7 sailors) for the theft of batteries from submarine torpedoes. The leadership of the guard forces was involved in the theft: in November 1998, torpedo and missile unit Chief of Staff Captain Vladimir Pospelov discovered the thefts, and decided to join in rather than stopping them, inviting the deputy commander of the torpedo ammunition unit, Captain Oleg Yerostenko, and a warrant officer to join him. The warrant officer involved two contract sailors, who, when they went on watch, removed the batteries from specific torpedoes indicated by the officers. The thieves removed the batteries, each of which contains approximately 150 kilograms of silver, from the torpedoes, replaced them with bricks, and then

took the batteries apart in order to take them off the naval base in sections.⁴²

■ In April 2000, Georgian police arrested four Georgian nationals with 920 grams of highly enriched uranium. Reportedly, the uranium was enriched to 30 percent. The seizure took place in Batumi, the capital of the Adzhariya Autonomous Republic in Georgia.⁴³

■ In March 2000, five sailors from the Russian Pacific Fleet suffocated in a decommissioned Russian submarine while trying to steal parts from inside the submarine.⁴⁴

■ On January 28, 2000, the commander of a Strategic Rocket Forces unit in the village of Sibirsky beat one of his subordinates to death in a drunken brawl at the base. The commander is being charged with murder.⁴⁵

■ A police spokesman told *ITAR-TASS* on January 26, 2000, that a worker at the Mayak plant at Ozersk, where tens of tons of weapons-usable plutonium is stored, was detained with 10 doses of heroin—following the breakup of a ring selling drugs to the troops guarding the plant some months before (see below). The detained man admitted regular usage and sale of illegal drugs.⁴⁶

⁴² Vyacheslav Gudkov, "Moryaki Torgovali Torpednymi Akkumulyatorami (Sailors Traded in Torpedo Batteries)," *Kommersant*, May 31, 2000. See also NTV, May 26 2000, translated in "Northern Fleet Officers Sentenced for Theft at Gadzhiyevo," *Foreign Broadcast Information Service*, Document CEP20000526000073.

⁴³ "Georgian Police Detain Four Uranium Smugglers," *ITAR-TASS*, April 19, 2000, summarized and discussed by Monterey Institute for International Studies Center for Nonproliferation Studies NIS Nuclear Trafficking Database, *NTI Research Library: NIS Nuclear Trafficking Database*.

⁴⁴ "5 Sailors Suffocate," *Associated Press*, March 22, 2000; "Five Russian Sailors Die In Old Nuclear Submarine," *Reuters*, March 22, 2000.

⁴⁵ Vitaly Romanov, "A Brawl At a Unit of the Strategic Missile Forces Has Resulted in the Death of an Officer," *Segodnya*, February 16, 2000.

⁴⁶ Yevgeny Tkachenko, "Drugs Making Way Into Nuclear Sector Occupations," *ITAR-TASS*, January 26, 1999.

⁴⁷ "Russian Soldier Kills Three Comrades," *Reuters*, January 17, 2000.

⁴⁸ Thomas Nilsen, "GAN Threatens To Shut Down Leningrad NPP," *Bellona*, January 28, 2000.

⁴⁹ "Radioactive elements stolen from nuclear submarine," RIA, January 31, 2000, translated and reprinted by *BBC Worldwide Monitoring*. For more details on this case, see Mikhail Druzhin, "Sailors Break a Nuclear Reactor," *Kommersant-Daily*, January 29, 2000, and other accounts summarized and discussed by Monterey Institute for International Studies Center for Nonproliferation Studies NIS Nuclear Trafficking Database, *NTI Research Library: NIS Nuclear Trafficking Database*.

- On January 17, 2000, a soldier guarding a strategic rocket forces site in Russia's Far East gunned down three of his comrades as they came to relieve him. He also fired on the next watch, which arrived three hours later, but the soldiers returned fire, first injuring and then disarming him. The killer's motives were not immediately known.⁴⁷
- In January 2000, the Russian nuclear regulatory agency called for the Leningrad nuclear power plant to be shut down if workers appeared to be serious about their threat to reduce the power output from the reactors during a protest action. The workers wanted a 40 percent salary increase, while the management had offered only 10 percent. The plant supplies roughly 60 percent of northwest Russia's electrical power.⁴⁸
- In January 2000, four sailors stole precious metals and radioactive sources from an armored safe of their nuclear submarine in the military town of Vilyuchinsk-3, on the Kamchatka peninsula. The Federal Security Service arrested all four thieves and their agent. During a search of the thieves' homes, the investigators discovered the stolen radioactive sources and submarine equipment containing gold, platinum, silver and palladium.⁴⁹
- In December 1999, police detained a warrant officer of one of the military units in the city of Zheleznogorsk, one of Russia's major nuclear centers, and seized a whole arsenal of weapons he kept. The warrant officer was hiding the arsenal in an acquaintance's garage, which held 600 grams of TNT, six sticks of plastic explosives, 10 meters of quick-match fuse, six combat grenades with fuses, more than 500 rounds of ammunition of various calibers, and a large quantity of special ammunition and parts for firearms.⁵⁰
- On December 19, 1999, one of the guards at Mayak deserted his unit with his submachine gun and ammunition. He was arrested in two hours. After a long negotiation, he was persuaded to surrender and hand in the gun and all the ammunition. His motive has not been established.⁵¹
- On December 17, 1999, radioactive steel structures were found abandoned on the outskirts of the closed town of Ozersk. Several stainless steel structures with a total weight of one metric ton had been stolen from an industrial site at Mayak—where 30 tons of weapons-usable plutonium is also stored—with the aim to sell steel to a scrap yard.⁵²
- In November 1999, Colonel-General Vladimir Yakovlev, commander of the Strategic Rocket Forces, confirmed that the elite force gets no more preference in receiving pay than other units of the military, despite being the former command of then-Defense Minister Igor Sergeyev. "As far as the minister's love is concerned, we receive our salaries with delays, just like everyone else," Yakovlev said. Nevertheless, Yakovlev expressed confidence in his force's reliability, saying "the fact that we haven't ... had an emergency situation in the last 40 years speaks for the effectiveness of our selection procedures."⁵³
- On October 24, 1999, First Deputy Minister of Atomic Energy Valeriy Lebedev announced that security had been tightened at Russian nuclear facilities in response to fears of Chechen terror-

⁵⁰ "Review of Incidents in CIS," *ITAR-TASS*, December 30, 1999.

⁵¹ Yevgeny Tkachenko, "Armed deserter from Russian nuke facilities guard arrested," *ITAR-TASS*, December 23, 1998.

⁵² Yevgeny Tkachenko, "Radioactive Steel Stolen From Russian Nuclear Factory," *ITAR-TASS*, December 17, 1999.

⁵³ "Russia's Elite Missile-Men Get Paid Late Too," *Reuters*, November 25, 1999.

⁵⁴ "Russia Tightens Security at Nuclear Plants," *Agence France Press*, October 25, 1999.

⁵⁵ "Crime and Corruption Soar in Russian Army," *Reuters*, October 7, 1999.

⁵⁶ Alexsander Alf, "Soldiers Make Holes in the Nuclear Shield Morale," *Nezavisimaya Gazeta*, August 7, 1999, p. 2.

ism in the wake of the apartment bombings in Moscow. The day before Lebedev's statement, Russian Interior Minister Vladimir Rushaylo accused Chechen warlord Shamil Basayev and his ally Khattab of "openly threatening to commit acts of sabotage" at nuclear sites.⁵⁴ Chechen sources denied any such threat.

■ On October 7, 1999, the Russian army's top prosecutor said crime was rising in the ranks, costing the cash-strapped military millions of dollars and endangering national security. The offences involved officials of various ranks. The number of officers found to be lining their pockets through theft and graft jumped to 1,017 from 1993 to 1999 compared to 185 over an unspecified period up to 1993. The prosecutor warned that bribery is rife in the army, with unsolved cases up 82 percent over the six-year period to 1999. One of the cases under investigation involves several high-ranking anti-aircraft defense officers falsifying documents to steal more than \$2 million worth of missile system spare parts which were then sold to private companies.⁵⁵

■ On August 6, 1999, at the Gremikha base of the Northern Fleet, two soldiers brandishing an axe attacked a sentry and disarmed him. The attackers were surrounded and killed in the skirmish that followed. The post was guarding a radioactive waste storage facility, and the shooting took place in the immediate vicinity of the waste storage. There are also over a dozen retired nuclear submarines at the site.⁵⁶

■ In August 1999, a serviceman in one of the Strategic Rocket Forces units based near the town of Kolpashevo, Tomsk region, shot two soldiers and committed suicide. The unit belongs to the Main Test Center of Research and Control of the Defense Ministry.⁵⁷

■ Surveys taken in June and July 1999 indicated that the average wage at the nuclear weapons facilities in Russia's closed nuclear cities was \$43 per month. Three quarters of those surveyed reported delays in receiving even this meager level of pay. Sixty percent of those surveyed indicated that they had taken second jobs to get by. Those doing outside work had an average income of \$74 per month. On average, the nuclear experts in the closed cities estimated that \$160 per month would be needed for a "reasonable subsistence." 46 percent of the nuclear experts surveyed said they would be willing to work in the military programs of a foreign country.⁵⁸

■ In March 1999, a security guard at Mayak, in the closed city of Ozersk, stopped an attempt to take a large bag full of vodka bottles onto the grounds of the plant.⁵⁹ The following month, one of the MVD troops guarding Mayak died and two others were hospitalized after drinking antifreeze they believed was alcohol for human consumption.⁶⁰

■ In February 1999, a poverty-stricken naval conscript at one of the nuclear submarine bases

⁵⁷ Alexsander Alf, "Soldiers Make Holes in the Nuclear Shield Morale," op. cit.

⁵⁸ Valentin Tikhonov, *Russia's Nuclear and Missile Complex: The Human Factor in Nonproliferation* (Washington, D.C.: Carnegie Endowment for International Peace, April 2001).

⁵⁹ ITAR-TASS review of incidents in CIS on March 13 [in English], *RIA News Agency*, 19:01 GMT, March 13, 1999.

⁶⁰ "Servicemen on Sentry Duty are Poisoned with Antifreeze," *Novye Izvestia*, April 7, 1999, p. 8.

⁶¹ Carey Scott, "Poverty a Pox on Nuclear Safety," *The Sunday Times*, March 1, 1999, summarized and discussed by Monterey Institute for International Studies Center for Nonproliferation Studies NIS Nuclear Trafficking Database, *NTI Research Library: NIS Nuclear Trafficking Database*.

⁶² "Nuclear Center Worker Caught Selling Secrets," *Russian NTV*, Moscow, 16:00 Greenwich Mean Time, December 18, 1998, translated in *BBC Summary of World Broadcasts*, December 21, 1998.

⁶³ Yevgeniy Tkachenko, "FSB Agents Prevent Theft of Nuclear Materials," *ITAR-TASS*, December 18, 1998; and "Interview: Victor Yerastov: MINATOM Has All Conditions for Providing Safety and Security of Nuclear Material," *Yaderny Kontrol Digest* 5, No. 1 (Winter 2000).

⁶⁴ Interviews, June 2000.

on Kola-peninsula put an Akula-class nuclear attack submarine out of service after he snipped off 24 lengths of wire from the reactor room and sold them to an officer from another submarine. The coiled palladium-vanadium wire was of a vital control device and the theft in effect disabled the reactor.⁶¹

■ On December 18, 1998, an employee at Russia's premier nuclear weapons laboratory, in Sarov (formerly Arzamas-16) was arrested for espionage, for attempting to sell documents on new conventional weapons designs to agents of Iraq and Afghanistan for \$3 million. The regional head of the Federal Security Service (FSB) reported that there had been other similar cases at Sarov, and said that such spying was the result of the "very difficult financial position" of workers at such defense enterprises.⁶²

■ Also on December 18, 1998, Major General Valeriy Tretyakov, head of the Chelyabinsk Oblast Federal Security Service (FSB), revealed that FSB agents had thwarted a conspiracy by employees at a major nuclear facility of Russia's Ministry of Atomic Energy (MINATOM) in the Chelyabinsk region to steal 18.5 kilograms of weapons-usable nuclear material. The theft attempt, and the fact that if successful it could have caused "significant damage to the [Russian] state," was later confirmed by MINATOM's head of nuclear material accounting.⁶³ Subsequently,

MINATOM officials privately confirmed that the material was HEU.⁶⁴

■ On November 19, 1998, 3,000 workers staged a one-day strike over unpaid wages at Chelyabinsk-70, one of Russia's premier nuclear weapons design laboratories, complaining of "constant undernourishment, insufficient medical service, inability to buy clothing and footwear for children or to pay for their education."⁶⁵

■ In late October 1998, a Strategic Rocket Forces officer at a base for the Topol-M ICBMs—the most modern weapons in the Russian strategic force—was quoted on Russian television as saying that he had received his pay only through July, despite promises that back wages would be paid in October.⁶⁶

■ On October 12, 1998, Sergei Ushakov, a spokesman for Russia's Chief Military Prosecutor's Office, reported that some 20 servicemen were discharged during 1997–1998 after being diagnosed with psychiatric disorders, and that some of these were responsible for guarding nuclear arsenals. The office issued a report indicating the Strategic Rocket Forces, of all the services in Russia's military, had the most rapid increase in its crime rate, 25 percent higher in 1997 than in 1996.⁶⁷

■ On October 9, 1998, General Igor Valynkin, commander of the 12th Main Directorate of the

⁶⁵ Yevgeni Tkachenko, "Ural Nuclear Workers on Strike, Demanding Wage Arrears," *ITAR-TASS*, November 19, 1998.

⁶⁶ "Stretched Russian Army Faces Stark Choice," *Reuters*, October 28, 1998.

⁶⁷ Simon Saradzhyan, "Missile Guards Discharged For Mental Illnesses," *Moscow Times*, October 13, 1998.

⁶⁸ "Russia is capable to ensure its security, general," Mikhail Shevtsov, *ITAR-TASS*, October 9, 1998. According to Russian officials a statement in October that troops have only received pay for July means that they are receiving paychecks with some regularity, but that the paychecks they received recently only bring them up to what they were supposed to have been paid by July; it does *not* necessarily mean that they have received no pay at all since July.

⁶⁹ *Interfax*, October 7, 1998, cited in "Russian Army Sells Arms to Pay for Food: Global Intelligence Update Red Alert," *GlobalBeat*, October 9, 1998.

⁷⁰ William C. Potter, "Prospects for U.S.-Russian Cooperation for Nonproliferation in the Post-Cold War Era," presentation to the Defense and Security Committee of the North Atlantic Assembly, 44th Annual Session, Edinburgh, November 10–13, 1998.

⁷¹ Todd E. Perry, "Preventing the Proliferation of Russian Nuclear Materials: Limits of the Current Approach," paper prepared for the Annual Meeting of the International Security Studies Section (ISSS), International Studies Association (ISA), Monterey, California, November 8, 1998.

Ministry of Defense, in charge of security for nuclear weapons, told a press conference that Russia was fully capable of protecting its nuclear weapons, but acknowledged that the directorate's troops had not been given any higher priority in receiving pay than other troops, that they had received the paychecks due them only through July, and that the directorate was helping officers to get vegetables and potatoes for the winter in lieu of cash.⁶⁸

■ In early October 1998, Russian customs reportedly intercepted 5 “Hip C” assault transport helicopters with weapons pods, apparently stolen by military officers, bound for North Korea. The helicopters, valued at \$300,000 each, were reportedly being sold for \$20,000 apiece.⁶⁹

■ At some nuclear facilities, MVD guards have left their posts to forage for food. Others have been reluctant to patrol facility perimeters because they did not have winter uniforms to keep them warm on patrol. At some facilities, recently installed security equipment is not being used because there is no money to maintain it; at others, guards who had not been paid in months were expected to man unheated posts in sub-freezing conditions.⁷⁰ At some facilities, entire security systems – alarms, surveillance cameras, portal monitors, etc. – have been shut down because the facilities’ electricity was cut off for non-payment of bills.⁷¹ At other facilities, guards have intentionally turned off alarm systems, or even cut their cables, because they were annoyed by frequent false alarms.⁷²

■ In September 1998, at the closed Siberian nuclear city of Krasnoyarsk-26, home to enough plutonium for hundreds or thousands of nuclear

bombs, the heat was shut off for weeks, because lack of money delayed shipments of fuel to the reactor that heats the city, and workers staged a protest over unpaid wages at the plutonium processing facility. Shortly before this incident, the facility director wrote to Ministry of Atomic Energy headquarters in Moscow, warning that “wage payments are three months behind schedule...The social tension in the shops and factories has reached the critical level, and its consequences are unpredictable.”⁷³

■ On September 20, 1998, a Ministry of Internal Affairs (MVD) sergeant at the Mayak facility, where over 30 tons of separated weapons-usable civilian plutonium is stored, shot two of his MVD comrades and wounded another before escaping with an assault rifle and ammunition. The incident reportedly led President Yeltsin to order a review of nuclear security at the site.⁷⁴ That same month, counterintelligence officers closed down a ring that had been supplying illegal drugs to the MVD troops at Mayak.⁷⁵

■ On September 11, 1998, a 19-year-old sailor went on a rampage in Murmansk, killing seven people with a chisel and an AK-47 assault rifle aboard an Akula-class nuclear-attack submarine. He then barricaded himself for 20 hours in the torpedo bay and threatened to blow up the submarine, with its nuclear reactor. Finally, he reportedly committed suicide. Russian officials insisted there were no nuclear weapons on board at the time.⁷⁶

■ On September 5, 1998, five soldiers from the 12th Main Directorate at Novaya Zemlya—Russia’s only nuclear weapons test site—killed a guard at the

⁷² Barbara Slavin, “Nuclear Weapons Threat Lurks in Russia: Poorly Paid Guards Are a Security Concern,” *USA Today*, November 24, 1998; David Hoffman, “Russian Nuclear Security Called Lax: Easy Access to Fuel, Failure to Pay Wages Alarm U.S. Experts,” *The Washington Post*, November 27, 1998.

⁷³ Michael R. Gordon, “Special Report: The Hidden City: Hard Times at Russia’s Once-Pampered Nuclear Centers,” *The New York Times*, November 18, 1998.

⁷⁴ Gertz, “Yeltsin Orders Nuclear Security Probe,” *The Washington Times*, October 21, 1998.

⁷⁵ “Servicemen on Sentry Duty are Poisoned with Antifreeze,” op. cit., p. 8.

⁷⁶ Gertz, “Yeltsin Orders Nuclear Security Probe,” op. cit. See also “Nuclear Fears Resurface After Seizure of Russia Sub,” Richard Paddock, *Los Angeles Times*, October 5, 1998.

facility, took another guard hostage and tried to hijack an aircraft. After seizing more hostages, they were disarmed by other Ministry of Defense forces and Federal Security Service commandos.⁷⁷

■ On September 3, 1998, Russian radio reported that the mayor of Krasnoyarsk-45, one of Russia's closed "nuclear cities," where enough HEU for hundreds or thousands of bombs is located, had written to Krasnoyarsk Governor Alexander Lebed and Atomic Energy Minister Evgeniy Adamov warning that unless urgent action was taken, a social explosion in the city was unavoidable, as a cutoff in payments from the Atomic Ministry's bank meant that public sector workers had not been paid at all in

August, and even basic medical supplies could not be purchased.⁷⁸

■ In August 1998, Defense Minister Igor Sergeyev issued an order to all military officers to "look for additional sources [of sustenance for the winter] and assume personal control." The Defense Ministry announced that trips would be organized for all soldiers and officers to take to the fields to harvest mushrooms, berries, and other sources of food for the winter. In the Far East region of Khabarovsk, the territorial administration has reportedly stopped providing bread to Far East military units, due to non-payment of debts.⁷⁹

⁷⁷ Gertz, "Yeltsin Orders Nuclear Security Probe," op. cit.; see also Vladimir Georgiev, "Underlying Reason: Crime in the Russian Army Has Rolled up to Nuclear Munitions Units, But the Ministry of Defense Believes Russia Is Capable of Controlling Weapons of Mass Destruction Without Foreign Intervention," *Moscow Nezavisimoye Voennoye Obozreniye*, No.34, September 11–17, 1998, p. 1, translated in *Foreign Broadcast Information Service*, Central Eurasia, September 23, 1998.

⁷⁸ *Radio Russia* (Moscow), 0400 Greenwich Mean Time, September 3, 1998, translated in "Bank Default Threatens Social Explosion in Krasnoyarsk," *BBC Monitoring Service*, September 4, 1998.

⁷⁹ "Russian Army Sells Arms to Pay for Food: Global Intelligence Update Red Alert," op. cit.

Appendix B: The Demand for Black Market Fissile Material

None of the confirmed cases of seizures of stolen nuclear material includes clear evidence of a particular buyer – whether a state seeking nuclear weapons or a terrorist group.¹ Nevertheless, there is substantial and credible evidence that both terrorist groups and hostile states are actively seeking to acquire stolen fissile material for nuclear weapons, or stolen nuclear weapons themselves. Only a few states, and no terrorist groups, have both the capability and the desire to produce their own nuclear materials for nuclear weapons – but if stolen nuclear material were available on a nuclear black market, most states, and some particularly well-organized terrorist groups, could potentially make a nuclear bomb. Both al Qaeda and the Japanese terror cult Aum Shinrikyo have attempted to buy stolen nuclear material, and Iran, Iraq, Libya, and North Korea, among others, have all been reported to be seeking to acquire such material as well. Below, the cases of the two terrorist groups and Iraq and Iran are described, as examples of the broader phenomenon.

Al Qaeda

Most terrorist groups have no interest in threatening or committing large-scale nuclear destruction,

and would have little capability to produce a nuclear weapon. Unfortunately, however, there are a few dangerous exceptions who *do* seek to cause mass destruction, and well-organized and well-financed groups such as al Qaeda might well be able to make at least a crude nuclear explosive if they could get the needed material, and had time and resources to devote to the task.²

Osama bin Laden has called the acquisition of weapons of mass destruction (WMD) a “religious duty.”³ His al Qaeda terrorist network has made repeated attempts to buy stolen nuclear material from which to make a nuclear bomb, and has also tried to recruit scientists to help them with the task of weapon design and construction. Al Qaeda has attempted to get all types of weapons of mass destruction: chemical, biological, and nuclear.⁴ The 1998 U.S. Federal indictment of bin Laden for the bombings of two U.S. Embassies in Africa charges that “at various times from at least as early as 1992, Usama bin Laden and Mamdouh Mahmud Salim, and others known and unknown, made efforts to obtain the components of nuclear weapons.”⁵ The most well-documented of these incidents was an attempt to purchase highly enriched uranium

¹ See discussion in Rensselaer Lee, *Nuclear Smuggling and International Terrorism: Issues and Options for U.S. Policy*, CRS Report for Congress RL31539 (Washington, D.C.: Congressional Research Service, August 17, 2002).

² For a useful unclassified discussion of the possibility that terrorists could build nuclear explosives, see J. Carson Mark et al., “Can Terrorists Build Nuclear Weapons?” in Paul Leventhal, and Yonah Alexander, eds., *Preventing Nuclear Terrorism* (Lexington, Mass.: Lexington Books, 1987). That article, drafted by U.S. nuclear weapons designers, represented a negotiated statement agreed to by both advocates and skeptics of the thesis that terrorists could readily build nuclear explosives; unfortunately, it concludes that the answer to its title question is yes. For discussions of the incentives and disincentives for terrorists to acquire and use weapons of mass destruction, and specifically nuclear weapons, see, for example, Richard A. Falkenrath, Robert D. Newman, and Bradley A. Thayer, *America’s Achilles’ Heel: Nuclear, Biological, and Chemical Terrorism and Covert Attack* (Cambridge, Mass.: MIT Press for BCSIA Studies in International Security, 1998); and Jessica Stem, *The Ultimate Terrorists* (Cambridge, Mass.: Harvard University Press, 1999).

³ “Interview with Bin Laden: ‘World’s Most Wanted Terrorist,’” *ABCNews.com*, 1999 (available at http://more.abc-news.go.com/sections/world/DailyNews/transcript_binladen1_990110.html as of January 29, 2003).

⁴ For a useful discussion of the early days of al Qaeda’s efforts, see Gavin Cameron, “Multi-Track Micro-Proliferation: Lessons from Aum Shinrikyo and Al Qaida,” *Studies in Conflict and Terrorism* 22, no. 4, (1999), and sources cited therein. See also, Michael Dobbs and Peter Behr, “Analysts Debate Next Weapon in Al Qaeda Arsenal; Panel Finds Terrorists More Likely to Possess Radioactive ‘Dirty Bombs’ Than Nuclear Weapons,” *The Washington Post*, November 16, 2001.

(HEU) for a nuclear bomb in the Sudan, in 1993, which has been described in some detail in court testimony of Jamal Ahmad al-Fadl, the al Qaeda operative charged with several key steps in the transaction.⁶ While al-Fadl reports that al Qaeda believed the material to be HEU when it was seeking to purchase it, it appears that the group was being scammed by its suppliers, and the material was not in fact HEU. Senior bin Laden lieutenant Mamdouh Mahmud Salim, arrested in Germany in 1998 and still in prison, has been charged with being the mastermind of this attempted purchase, and possibly others: as with bin Laden, the indictment of Salim charges that he was involved in attempting to purchase uranium “for the purpose of developing nuclear weapons.”⁷ In addition to this 1993 attempt, there have been repeated reports, of varying levels of credibility, regarding al Qaeda attempts to purchase nuclear materials or nuclear weapons in the former Soviet Union, including in Kazakhstan (a situation that Israel was sufficiently concerned about to send a cabinet member to speak to the Kazakhstani government about it), from Chechen warlords in Russia, and in Ukraine.⁸ The Russian official state newspaper has reported that during 2001-2002 there were four cases of Chechen terrorist groups – who have very close ties to al Qaeda – carrying out reconnaissance on Russian nuclear warhead storage sites or nuclear warhead transport trains.⁹

In November 2001, Osama bin Laden boasted to a Pakistani journalist that “if America used chemical or nuclear weapons against us, then we may retort with chemical or nuclear weapons. We have the weapons as a deterrent.”¹⁰ While there is evidence (from videotapes acquired by CNN and other sources) that al Qaeda does have at least some crude capability with poisons or chemical weapons, there is no evidence as yet that bin Laden’s claim of a nuclear weapons capability is accurate. Nevertheless, detailed drawings, training manuals, and other documents and physical evidence recovered from caves and safe houses in post-Taliban Afghanistan verified that highly placed al Qaeda operatives, including alleged chemical and biological commander Abu Khabbab, had been very focused on obtaining a nuclear weapons capability. U.S. analysts who have reviewed a wide range of al Qaeda documents found in Afghanistan have concluded that the group’s pursuit of nuclear weapons was determined and substantial, and that, had they not been deprived of their Afghan sanctuary, the effort might well have succeeded. In particular, the al Qaeda author of a document on “Superbombs” appears to have been aware of a shortcut to initiating a nuclear explosion that was not available in the open literature.¹¹ The risk that it could still succeed elsewhere remains. Searches of more than 100 al Qaeda sites in Afghanistan, however, turned up no traces of nuclear materials.¹²

⁵ The text of the indictment is available at <http://cns.miis.edu/pubs/reports/pdfs/binladen/indict.pdf> as of January 29, 2003. Further testimony concerning al Qaeda and WMD terrorism can be found in Kimberly McCloud and Matthew Osborne, “WMD Terrorism and Usama bin Laden” (Monterey, Cal.: Center for Nonproliferation Studies, Monterey Institute for International Studies, November 20, 2001; available at <http://cns.miis.edu/pubs/reports/binladen.htm> as of January 29, 2003).

⁶ For a useful discussion of al-Fadl’s testimony, as well as a summary of other incidents related to bin Laden and nuclear weapons through mid-2001, see McCloud and Osborne, “WMD Terrorism and Usama bin Laden,” op. cit.

⁷ See discussion in Cameron, “Multi-Track Micro-Proliferation,” op. cit.

⁸ See discussion in Cameron, “Multi-Track Micro-Proliferation,” op. cit. and in McCloud and Osborne, “WMD Terrorism and Usama bin Laden,” op. cit.

⁹ Vladimir Bogdanov, “Propusk K Beogolovkam Nashli U Terrorista (A Pass To Warheads Found on a Terrorist),” *Rossiiskaya Gazeta*, November 1, 2002.

¹⁰ Hamid Mir, “Osama claims he has nukes: If US uses N-arms it will get same response.” *Dawn Internet Edition* (Karachi, Pakistan), November 10, 2001 (available at <http://www.dawn.com/2001/11/10/top1.htm> as of January 29, 2003). Al Qaeda members have also talked about unleashing a “Hiroshima” on the United States. See, David Albright, Kathryn Buehler, and Holly Higgins, “Bin Laden and the Bomb,” *Bulletin of the Atomic Scientists* 58, no. 1 (January/February 2002; available at <http://www.thebulletin.org/issues/2002/jf02/jf02albright.html> as of January 29, 2003), pp. 23–24.

In short, the results of the searches in Afghanistan demonstrate a long-standing interest in nuclear weapons, but do *not* demonstrate that al Qaeda yet has the nuclear material or the expertise needed to make a bomb – though of course one cannot know what may have been in other documents and materials that were not left behind. Even if they have not yet acquired such a capability, such a proliferation disaster could occur at any time. And al Qaeda is not the only terrorist group that might aspire to nuclear weapons. That is the terrifying reality the world now faces.

There is also evidence that al Qaeda and their Taliban allies were attempting to acquire the expertise to make nuclear weapons. Senior Pakistani scientist Sultan Bashiruddin Mahmood – an Islamic extremist who had been in charge of Pakistan’s production of weapons plutonium before his retirement – was arrested on suspicion of passing nuclear secrets to bin Laden. Mahmood had established an Islamic charity in Afghanistan, and had traveled there repeatedly. Mahmood acknowledged that he another senior Pakistani nuclear official, Chaudari Abdul Majeed, had met with bin Laden and his deputy Ayman al-Zawahiri, and that bin Laden had questioned them about nuclear weapons informa-

tion, but denied passing any nuclear-related knowledge to al Qaeda – though in doing so, he failed lie-detector tests.¹³ Similarly, Russian Security Council officials have reported that the Taliban attempted to recruit a Russian nuclear expert,¹⁴ and in 1998, an employee at the nuclear weapons design facility at Sarov (formerly Arzamas-16) was arrested for spying on behalf of the Taliban and Iraq – in this case on advanced conventional weapons, not nuclear weapons.¹⁵ Such experts could be extremely helpful to al Qaeda in attempting to build a nuclear bomb, should they acquire the nuclear material needed to do so.

The disruption of al Qaeda’s Afghanistan sanctuary will inevitably make it more difficult for them to make a nuclear bomb, should they get the nuclear material – or, if they should acquire an intact nuclear weapon, to figure out how to set it off. Nevertheless, the world cannot afford to rest its security on the notion that it would be impossible for al Qaeda to prepare its nuclear terror anywhere else.¹⁶

Aum Shinrikyo

Aum Shinrikyo carried out a comprehensive program of development for chemical, biological, and

¹¹ See particularly David Albright, “Al Qaeda’s Nuclear Program: Through the Window of Seized Documents,” *Special Forum* 47 (Berkeley, Cal.: Nautilus Institute, November 6, 2002; available at http://www.nautilus.org/fora/Special-Policy-Forum/47_Albright.html as of January 27, 2003). See also David Albright, Kathryn Buehler, and Holly Higgins, “Bin Laden and the Bomb,” *op. cit.*; Mike Boetcher and Ingrid Arnesen, “Al Qaeda Documents Outline Serious Weapons Program,” *CNN*, January 25, 2002 (available at <http://www.isis-online.org/publications/terrorism/cnnstory.html> as of January 29, 2003); David Albright, Corey Hinderstein, and Holly Higgins, “Does Al Qaeda Have Nuclear Materials? Doubtful, But...” (Washington, D.C.: Institute for Science and International Security, March 1, 2002; available at <http://www.isis-online.org/publications/terrorism/doubtful.html> as of January 29, 2003); “Al Qaeda Nuclear and Conventional Explosive Documents: CNN-ISIS Collaboration,” (Washington, D.C.: Institute for Science and International Security, 2002; available at <http://www.isis-online.org/publications/terrorism/intro.html> as of January 29, 2003); Thom Shanker, “U.S. Analysts Find No Sign bin Laden had Nuclear Arms,” *The New York Times*, February 26, 2002.

¹² See discussion in Albright, Hinderstein, and Higgins, “Does Al Qaeda Have Nuclear Materials? Doubtful, But...,” *op. cit.*

¹³ 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 Suspensions,” *Washington Post*, March 3, 2002.

¹⁴ *Radio Free Europe/Radio Liberty Daily Report*, Oct. 9, 2000.

¹⁵ “Nuclear Center Worker Caught Selling Secrets,” *Russian NTV*, Moscow, 16:00 Greenwich Mean Time, December 18, 1998, translated in *BBC Summary of World Broadcasts*, December 21, 1998. In announcing the arrest the chief of the local Federal Security Service said that there had been other, similar cases at Sarov.

¹⁶ See discussion in Albright, “Al Qaeda’s Nuclear Program,” *op. cit.*

nuclear weapons prior to its famous nerve gas attack in the Tokyo subway.¹⁷ These programs, however, were riddled with mistakes – which explains why Aum’s chemical attacks and attempted biological attacks caused so few fatalities. Much of Aum’s nuclear program seems to have been poorly focused, pursuing efforts such as purchasing a sheep farm with uranium deposits in Australia and stealing confidential documents on laser isotope enrichment, with the idea of producing HEU by mining uranium, purifying it, and using laser enrichment to separate the U-235 – perhaps the most technically demanding and difficult route to acquiring fissile material yet devised.

At the same time, however, Aum aggressively pursued the possibility of acquiring nuclear technology and material from the former Soviet Union, recruiting thousands of members in Russia, including staff from the Kurchatov Institute in Moscow (a leading nuclear research institute where hundreds of kilograms of weapons-usable HEU was poorly protected and accounted for at that time) and physicists from Moscow State University, and even seeking a meeting with Minister of Atomic Energy Victor Mikhailov to attempt to purchase a nuclear weapon. While Mikhailov refused to meet with Aum, then-Russian Vice President Alexander Rutskoi met with an Aum delegation headed by the cult’s leader, Shoko Asahara, in early 1992, and Aum reportedly paid between \$500,000 and \$1 million to Oleg Lobov, then Secretary of the Russian Security Council, between 1991 and 1995 – a charge Lobov denies. Kiyohide Hayakawa, a

leading official of the cult, made repeated trips to Russia on weapons-buying expeditions on the cult’s behalf, and included numerous entries in his diary relating to nuclear weapons, citing possible prices.¹⁸

Iraq

For most states, the first preference would be an indigenous ability to produce their own nuclear material for nuclear weapons, making possible a substantial arsenal. But acquiring stolen nuclear material from abroad could offer an extraordinarily valuable shortcut, cutting a proliferator’s bomb program from years to months, or even less, if other necessary preparations had already been made. Making a bomb from nuclear material already in hand might be done both quickly and in facilities that might remain covert, presenting the international community with a terrifying new threat with very little warning.

Iraq’s Saddam Hussein spent billions of dollars attempting to establish an indigenous Iraqi capability to produce fissile material.¹⁹ While such an indigenous production capability was the first choice, after the invasion of Kuwait, when Iraq launched a “crash” program to rapidly produce a single bomb, it planned on using HEU from its safeguarded research reactor.²⁰

Iraq has admitted that it received many offers of stolen nuclear materials for its nuclear weapons program: one senior Iraqi official told inspectors

¹⁷ This account is largely based on Cameron, “Multi-Track Micro-Proliferation,” op. cit.

¹⁸ See discussion in Cameron, “Multi-Track Micro-Proliferation,” op. cit.

¹⁹ For overviews, see Gary Samore, ed., *Iraq’s Weapons of Mass Destruction: A Net Assessment* (London: International Institute for Strategic Studies, September 2002); *Iraq’s Weapons of Mass Destruction: The Assessment of the British Government* (London: Office of the Prime Minister, September 2002; available at <http://www.official-documents.co.uk/document/reps/iraq/iraqdossier.pdf> as of January 29, 2003); U.S. Central Intelligence Agency, *Iraq’s Weapons of Mass Destruction* (Langley, Virginia: CIA, October 2002; available at http://www.cia.gov/cia/publications/iraq_wmd/Iraq_Oct_2002.pdf as of January 29, 2003); *Fourth Consolidated Report of the Director General of the International Atomic Energy Agency Under Paragraph 16 of Security Council Resolution 1051 (1996)*, S/1997/779 (New York: United Nations, 1997; available at http://www.iaea.org/worldatom/Programmes/ActionTeam/reports/s_1997_779.pdf as of January 29, 2003); David Albright, “Iraq’s Programs to Make Highly Enriched Uranium and Plutonium for Nuclear Weapons Prior to the Gulf War” (Washington, D.C.: Institute for Science and International Security, 1997, revised October 2002; available at http://www.isis-online.org/publications/iraq/iraqs_fm_history.html as of January 29, 2003); and Joseph Cirincione, Jon B. Wolfsthal, and Miriam Rajkumar, “Iraq,” in *Deadly Arsenals: Tracking Weapons of Mass Destruction* (Washington, D.C.: Carnegie Endowment for International Peace, June 2002; available at [http://www.ceip.org/files/projects/npp/resources/DeadlyArsenals/chapters%20\(pdf\)/16-Iraq.pdf](http://www.ceip.org/files/projects/npp/resources/DeadlyArsenals/chapters%20(pdf)/16-Iraq.pdf) as of January 29, 2003).

in 1996 that Iraq had received over 200 offers of everything from red mercury to fissile material for its nuclear weapons program over the preceding decade.²¹ Iraq insists that it turned down all of these offers of assistance – a claim that is very difficult to believe. Khidir Hamza, a senior figure in Iraq's nuclear weapons program before the Gulf War, tells a rather different story. Hamza reports that when arms dealers from the Soviet Union and Eastern Europe with whom Iraq had an ongoing relationship made offers of plutonium or highly enriched uranium, Iraqi authorities told them they were interested, and gave them cash to acquire samples – but in every case of which Hamza was aware, the samples turned out to be radioactive trash, not plutonium or HEU.²² As a result of these experiences, and of fear of being caught by a Western sting operation, the part of Iraq's nuclear weapons program with which Hamza was associated began rejecting such offers – though Hamza believes that Iraqi military intelligence continued to pursue them. Hamza acknowledges that had any of the samples proved to be genuine weapons-usable nuclear material, Iraq would have been eager to purchase as much as was available – though Iraq's principal focus was on indigenous production, because what it sought was not a single bomb, but an arsenal of nuclear weapons to use as a deterrent against the United States or other countries interfering with Iraq's regional ambitions.²³

It is of interest that Hamza left the Iraqi program in 1990; hence, even *before* the Soviet Union col-

lapsed, arms dealers associated with the Soviet Union were attempting to get into the business of marketing material for nuclear weapons. What may have happened in the intervening dozen years, given the dire state of the former Soviet nuclear complex for much of the 1990s, remains unknown.

Unfortunately, the possibility that Iraq will be (or has been) offered genuine fissile material is all too real. Indeed, Egyptian President Hosni Mubarak has publicly stated that individuals from the former Soviet Union offered to sell Egypt both design information and materials for a nuclear weapon, that Egypt turned down this offer, but that he believes the offer was then made to other states in the Middle East.²⁴

Even after the Gulf War, with the U.N. inspection regime in place, Iraq sought to continue its weapons of mass destruction programs, and built up its foreign procurement network, including an extensive network of procurement agents in the former Soviet Union. Iraq succeeded, for example, in buying gyroscopes taken directly from Russian strategic nuclear missiles, tested and certified by the Russian institutes that had made them. Desperate Russian institutes also agreed to sell a wide variety of other key missile technologies.²⁵ U.S. officials have reported intelligence that in 1992, Iraq offered \$16,000 per kilogram for HEU from Kazakhstan.²⁶ As noted earlier, the employee of Russia's premier nuclear weapons laboratory arrested in December 1998 was accused of spying both for the Taliban and for Iraq – in this case on advanced conventional weapons.

²⁰ See discussion, for example, in Samore, ed., *Iraq's Weapons of Mass Destruction*, op. cit.

²¹ See discussion in 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 29, 2003).

²² Khidir Hamza, personal communication, September 2002. See also the interview with Hamza on *60 Minutes II*, CBS News, January 27, 1999, in which Hamza describes Iraqi bribery in Russia to acquire advanced weapons technologies.

²³ Khidir Hamza, personal communication, September 2002.

²⁴ See Uzi Benziman, "Mubarak Turns Down a Nuclear Bomb Offer," *Ha'aretz*, June 19, 1998.

²⁵ For a detailed account, see Vladimir Orlov and William C. Potter, "The Mystery of the Sunken Gyros," *Bulletin of the Atomic Scientists* 54, no.6 (November/December 1998; available at <http://www.thebulletin.org/issues/1998/nd98/nd98orlovpotter.html> as of January 29, 2003).

²⁶ Defense Department official Jeffrey Starr, quoted in Chris Flores, "Project Sapphire: A Nuclear Odyssey: Defusing a Lethal Legacy," *News & Advance* (Lynchburg), December 29, 2002.

The U.S. Central Intelligence Agency has warned that Iraq “has not abandoned its nuclear weapons program... [and] would seize any opportunity to buy nuclear weapons materials or a complete weapon.”²⁷ More recently, a White House report charged that Iraq has “embarked on a worldwide hunt for materials to make an atomic bomb.”²⁸ The British government has charged that Iraq recently attempted to get “significant quantities” of uranium – apparently natural uranium – in Africa.²⁹ Saddam Hussein’s continuing interest in getting a nuclear bomb sooner rather than later was highlighted in September 2000, when the Iraqi leader held a publicized meeting with his nuclear scientists, in which he urged his “Nuclear Mujahedeen” to “defeat the enemy.”³⁰

Indeed, experts on Iraq’s nuclear weapons program generally agree that if it has to rely on indigenous production of nuclear material, it will be a substantial number of years before Iraq succeeds in getting a nuclear bomb – but that if it got stolen nuclear material, it could produce a nuclear bomb

in a year or less. The CIA has said that: “If Baghdad acquires sufficient weapon-grade fissile material from abroad, it could make a nuclear weapon within a year,” but that without stolen nuclear material, it would be “the last half of the decade” before Iraq could get a bomb.³¹ Hence, as Hamza has warned, “preventing Iraq from acquiring nuclear explosive material abroad, particularly in Russia and the former Soviet republics, remains a difficult but absolutely essential goal.”³² Both he and the International Atomic Energy Agency (IAEA) inspectors for Iraq have emphasized that if Iraq does acquire enough nuclear material for a bomb, the small-scale effort needed to turn it into a bomb might be difficult for inspectors to find.³³ In short, the only thing stopping Iraq from getting a nuclear bomb quickly is not having enough nuclear material. There seems little question that for Saddam Hussein’s Iraq, the demand for stolen nuclear weapons or materials is high – though the desire for an indigenous production capability is even higher.

²⁷ John Deutch, then Director of Central Intelligence, testimony to the Permanent Subcommittee on Investigations of the Senate Governmental Affairs Committee, quoted in Rodney W. Jones and Mark G. McDonough, *Tracking Nuclear Proliferation: A Guide in Maps and Charts, 1998* (Washington, D.C.: Carnegie Endowment for International Peace, 1998; available at <http://www.ceip.org/programs/npp/track98b.htm> as of January 29, 2003)

²⁸ The White House, *A Decade of Deception and Defiance: Saddam Hussein’s Defiance of the United Nations* (Washington, D.C.: The White House, September 12, 2002; available at <http://www.whitehouse.gov/news/releases/2002/09/iraqdecade.pdf> as of January 29, 2003).

²⁹ See *Iraq’s Weapons of Mass Destruction: The Assessment of the British Government*, op. cit. Given the tone of the British document, if this incident had involved enriched uranium the report would have indicated so.

³⁰ See, for example, U.S. Central Intelligence Agency, *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January Through 30 June 2001* (Langley, Virginia: CIA, 2002; available at http://www.fas.org/irp/threat/bian_jan_2002.htm as of January 29, 2003).

³¹ CIA, *Iraq’s Weapons of Mass Destruction*, op. cit. Similarly, the U.S. Department of Defense concludes that “Iraq would need five or more years and key foreign assistance to rebuild the infrastructure to enrich enough material for a nuclear weapon,” but warns that this would be “substantially shortened” if Iraq acquired enough material for a nuclear bomb. See U.S. Department of Defense, *Proliferation: Threat and Response* (Washington, D.C.: Department of Defense, 2001; available at <http://www.fas.org/irp/threat/prolif00.pdf> as of January 29, 2003). Albright and Hamza conclude that Iraq could produce an implosion bomb from HEU in as little as two months; to modify its implosion design to make a bomb from plutonium would take longer, but still less than a year. See Albright and Hamza, “Iraq’s Reconstitution of its Nuclear Weapons Program,” op. cit.

³² Albright and Hamza, “Iraq’s Reconstitution of its Nuclear Weapons Program,” op. cit.

³³ As the IAEA diplomatically put it, “it must be recognised that Iraq’s direct acquisition of weapon-usable material would present a serious technical challenge to OMV [ongoing monitoring and verification] measures, and great reliance must continue to be placed on international controls.” See *Sixth Consolidated Report of the Director General of the International Atomic Energy Agency Under Paragraph 16 of UNSC Resolution 1051 (1996)* (Vienna, Austria: IAEA, October 8, 1998).

Iran

Iran, too, has sent a substantial network of procurement agents to the former Soviet Union in search of technologies for weapons of mass destruction and the means to deliver them, has succeeded in acquiring key missile technologies from Russian institutes, and has specifically sought technologies for producing both HEU and plutonium.³⁴ Indeed, U.S. concerns over leakage of Russian weapons of mass destruction technologies to Iran have been central issues in U.S.-Russian relations for most of the period since the Soviet collapse.³⁵ Like Iraq, Iran has focused first and foremost on an indigenous capability to produce nuclear material, and in recent months, Iranian construction of a plant for enriching uranium (which Iran indicates will be placed under international safeguards) and another plant for producing heavy water – used in some designs of plutonium production reactors has been revealed.³⁶

In 1996, the CIA warned that Iran was pursuing an indigenous production capability for both plutonium and HEU, and that “to shorten the timeline to a weapon, Iran has launched a parallel effort to purchase fissile material, mainly from sources in the former Soviet Union.”³⁷ Four years later, the CIA was still warning that “Teheran continues to seek fissile

material”³⁸ and reportedly concluded that it could not rule out the possibility that Iran has already acquired a nuclear weapon capability, or if it has succeeded in secretly procuring fissile material abroad.³⁹

There have been innumerable press reports (of varying levels of credibility) of Iranian attempts to acquire nuclear materials or even nuclear weapons, and there have been a significant number of actual arrests of Iranian nationals apparently associated with the Iranian special services, for smuggling of various types of nuclear or radioactive materials (though they have not been caught with substantial quantities of directly weapons-usable materials in any of the confirmed cases).⁴⁰ At the Ulba facility in Kazakhstan, canisters were found labeled for shipping to Teheran, in a room next to the room where hundreds of kilograms of HEU was located. The Iranians had reportedly approached Kazakhstan to secretly purchase beryllium and LEU from this facility, perhaps as a trust-building prelude to an offer to purchase the HEU. (The HEU was subsequently removed from this facility under the U.S.-Kazakh cooperative effort known as Project Sapphire.)⁴¹

The Demand is There

There is no evidence that either a nuclear weapon or the nuclear material needed to make one has

³⁴ See, for example, Department of Defense, *Proliferation: Threat and Response*, op. cit., and Jones and McDonough, *Tracking Nuclear Proliferation*, op. cit.

³⁵ For an excellent analysis of the issue, focusing on the nuclear aspect, see Robert J. Einhorn and Gary Samore, “Ending Russian Assistance to Iran’s Nuclear Bomb,” *Survival* 44, no. 2 (Summer 2002).

³⁶ See, for example, David Albright, “Iran at the Nuclear Crossroads” (Washington, D.C.: Institute for Science and International Security, February 20, 2003; available at <http://www.isis-online.org/publications/iran/crossroads.html> as of February 24, 2003).

³⁷ Quoted in Jones and McDonough, *Tracking Nuclear Proliferation*, op. cit.

³⁸ See *Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions: 1 January Through June 30, 1999* (Langley, Virginia: CIA, February 2, 2000).

³⁹ See James Risen and Judith Miller, “CIA Tells Clinton an Iranian A-Bomb Can’t Be Ruled Out,” *New York Times*, January 17, 2000.

⁴⁰ See, for example, the “NIS Nuclear Trafficking” database maintained by the Center for Nonproliferation Studies at the Monterey Institute of International Studies on the webpage of the Nuclear Threat Initiative (available at <http://www.nti.org/db/nistraff/index.html> as of January 29, 2003), which contains countless incidents involving Iranian nationals. For one particularly extensive account focusing on cases in Turkey, see Ali M. Koknar, “The Trade in Materials for Weapons of Mass Destruction,” *International Police Review*, March-April 1999 (summarized in the CNS database).

⁴¹ See discussion in William C. Potter, “Project Sapphire: U.S.-Kazakhstani Cooperation for Nonproliferation,” in Shields and Potter, *Dismantling the Cold War*, op. cit

yet fallen into the hands of terrorist groups or hostile states. But it is clear that both terrorist groups and states are attempting to get these items – and that if they succeeded, their path to the bomb could be frighteningly short. The fact that the known cases of theft and smuggling of plutonium and HEU cannot be linked to specific buyers should not blind us to the reality of the demand. Indeed, there is no way to know what

has not been detected: it may be that it is precisely those thieves and smugglers who are well-connected to potential buyers who do not get caught. This sobering reality should lead governments around the world to redouble their effort to ensure that all nuclear weapons and weapons-usable material are secure and accounted for and that potential nuclear smuggling can be successfully blocked.

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Current research priorities include reducing the threats of nuclear and radiological terrorism; securing, monitoring, and reducing nuclear warhead and fissile material stockpiles, and reshaping nuclear complexes; strengthening the global nonproliferation regime; addressing the security risks posed by nuclear programs in Iraq, Iran, North Korea, and South Asia; limiting proliferation risks of the civilian fuel cycle, including management of spent nuclear fuel and radioactive wastes containing weapon-usable materials; the future of nuclear energy; and democratic approaches to nuclear decision-making.

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