

Funding for U.S. Efforts to Improve Controls Over Nuclear Weapons, Materials, and Expertise Overseas: A 2009 Update

Andrew Newman and Matthew Bunn

June 2009

Commissioned by the Nuclear Threat Initiative



BELFER CENTER
for Science and International Affairs
John F. Kennedy School of Government
Harvard University



NTI

Working for a Safer World

ABOUT THE AUTHORS

Andrew Newman is a Research Associate with the Project on Managing the Atom. Before coming to the Kennedy School in August 2008, he worked at the Australian Embassy's Nuclear Science and Technology office in Washington, D.C.. His research interests include nuclear proliferation, nuclear terrorism, and the future of the nuclear fuel cycle. Andrew holds a Ph.D. from Monash University in Australia and is an Adjunct Research Associate with Monash's Global Terrorism Research Centre.

Matthew Bunn is an Associate Professor at Harvard University's John F. Kennedy School of Government. His current research interests include nuclear theft and terrorism; nuclear proliferation and measures to control it; and the future of nuclear energy and its fuel cycle. He is the winner of the American Physical Society's Joseph A. Burton Forum Award for "outstanding contributions in helping to formulate policies to decrease the risks of theft of nuclear weapons and nuclear materials" and the Federation of American Scientists' Hans Bethe Award for "science in service to a more secure world," and is an elected Fellow of the American Association for the Advancement of Science.

Before coming to Harvard, Bunn served as an adviser to the White House Office of Science and Technology Policy, as a study director at the National Academy of Sciences, and as editor of *Arms Control Today*. He is the author or co-author of some 18 books or major technical reports, and over a hundred articles in publications ranging from *Science* to *The Washington Post*.

ACKNOWLEDGMENTS

We would like to thank the Nuclear Threat Initiative, which commissioned the 'Securing the Bomb' series, and the John D. and Catherine T. MacArthur Foundation and the Ploughshares Fund for their generous support. Raphael Della Ratta and Michelle Marchesano of the Partnership for Global Security, Charles Curtis, Laura Holgate, Cathy Gwin, and Bryan Wilkes of the Nuclear Threat Initiative, and Martin Malin and Neal Doyle of the Managing the Atom Project provided helpful comments on an earlier draft. Neal Doyle designed and laid out the final publication. Several officials at the Departments of Energy, State, and Defense were generous with their time in answering questions and providing data. All responsibility for any remaining errors or misjudgments rests solely with the authors.

CITATION INFORMATION

© 2009 President and Fellows of Harvard College; Printed in the United States of America

The co-sponsors of this report invite liberal use of the information provided in it for educational purposes, requiring only that the reproduced material clearly state: Reproduced from Andrew Newman and Matthew Bunn, *Funding for U.S. Efforts to Improve Controls Over Nuclear Weapons, Materials, and Expertise Overseas: A 2009 Update*, (Cambridge, Mass., and Washington, D.C.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, June 2009).

Cover Image: Pellets of plutonium-uranium mixed oxide (MOX) fuel fabricated from weapons plutonium at the Los Alamos National Laboratory as part of the U.S. plutonium disposition program.
Source: Los Alamos National Laboratory

FUNDING FOR U.S. EFFORTS TO IMPROVE CONTROLS OVER NUCLEAR WEAPONS, MATERIALS, AND EXPERTISE OVERSEAS: A 2009 Update

The Obama administration is still developing a plan to ensure effective security for all nuclear weapons and weapons-usable nuclear material worldwide within four years, as President Obama outlined in his Prague speech.¹ Because the plan is still in development, the additional funding to implement such an effort was not included in the “steady as you go” fiscal year (FY) 2010 budget request sent to Congress in early May 2009. The \$1.3 billion request for programs to improve controls over nuclear weapons, materials, and expertise overseas is essentially the same as the FY 2009 appropriation and \$30 million less than the FY 2008 appropriation.² The request for all threat reduction programs (including chemical, biological, and missile-related programs as well as nuclear programs) is approximately \$1.6 billion, a slight decline from the FY 2009 appropriation. As Kenneth Luongo, president of the Partnership for Global Security, put it in an April 2 press release: “The budget request for FY 2010 needs to be significantly increased across the board if there is any hope of meeting the President’s high pri-

¹ See The White House, Office of the Press Secretary, Remarks by President Barack Obama, Hradcany Square, Prague, Czech Republic, April 5, 2009 available at http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/ as of 15 June 2009.

² For precise figures and references, see Table 1. This table includes U.S.-funded programs to improve controls over nuclear weapons, nuclear materials, and expertise in foreign countries; it does not include other threat reduction programs, or programs for security or disposition of U.S. nuclear stockpiles, or interdicting nuclear smuggling at the U.S. borders or within the United States (the latter activities being within the budget of the Department of Homeland Security). For a broader discussion of funding and policy for NNSA’s nonproliferation programs, covering programs in addition to those focused on improving controls on nuclear weapons, materials, and expertise overseas, see Matthew Bunn, “Next Steps to Strengthen the National Nuclear Security Administration’s Efforts to Prevent Nuclear Proliferation,” testimony to the Subcommittee on Energy and Water, Committee on Appropriations, U.S. Senate, 30 April 2008. For a detailed analysis of the history of these budgets, see Anthony Wier and Matthew Bunn, *Funding for U.S. Efforts to Improve Controls over Nuclear Weapons, Materials, and Expertise Overseas: Recent Development and Trends* (Cambridge, Mass.: Project on Managing the Atom, Harvard University, 2007; available at http://www.nti.org/e_research/cnwm/wier_bunn_fy08budget.pdf as of 9 June 2008). The FY 2009 appropriations can be found at Government Printing Office, *Duncan Hunter National Defense Authorization Act for Fiscal Year 2009*, Public Law 110-417, 14 October 2008; available at http://www.dod.mil/dodgc/olc/docs/2009NDAA_PL110-417.pdf and *Omnibus Appropriations Act, 2009*, Public Law 111-8, March 11, 2009 available at http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_public_laws&docid=f:publ008.111.pdf as of 20 March 2009. For a complementary analysis of the appropriations for FY 2009, see Michelle Marchesano with Kenneth Luongo and Raphael Della Ratta, *Funding Analysis of FY09 International WMD Security Programs*, Partnership for Global Security Policy Update, April 2009 available at http://www.partnershipforglobalsecurity.org/Documents/fy09_wmd_security_programs_final_funding.pdf as of 10 May 2009.

SECURING THE BOMB

This publication is part of the “Securing the Bomb” project commissioned by the Nuclear Threat Initiative, with additional support from the John D. and Catherine T. MacArthur Foundation and the Ploughshares Fund. Full text of all the reports in the Securing the Bomb series and hundreds of pages of additional information are available at <http://www.nti.org/securingthebomb>.

ority WMD proliferation prevention goals. A stagnant or modestly increased funding profile will be inadequate and amount to business as usual."³ If the four-year target is to be achieved, the administration and Congress will need to work together to ensure that these efforts are not slowed by lack of funds.

In Washington, it is often said that budgets are policy. The fact that the entire budget for all programs to prevent nuclear terrorism comes to less than one quarter of one percent of the defense budget makes a clear statement about whether this effort is really a top priority of the U.S. government—and makes clear that the U.S. government could easily afford to do more, if more effort is needed.

But in the case of preventing nuclear terrorism, policy is much more than budgets. Money is necessary but by no means sufficient. Most programs intended to reduce the risk of nuclear terrorism are constrained more by limited cooperation (resulting from secrecy, complacency about the threat, concerns over national sovereignty, and bureaucratic impediments) than they are by limited budgets. Sustained high-level leadership focused on overcoming the obstacles to cooperation would do more to increase the chances of success than larger budgets would.⁴

Nevertheless, some programs could move more quickly to seize risk reduction opportunities that already exist if their budgets were increased—and substantially increased funds will inevitably be needed to implement a faster and broader effort if the other obstacles can be overcome.

In his Prague speech, President Obama made clear that the effort to achieve effective and lasting security for all nuclear weapons and all stocks of plutonium and highly enriched uranium (HEU) worldwide within four years would be an *international* effort, not just a U.S.-funded effort. In many cases, the goal must be to convince other countries to upgrade security for their nuclear stockpiles themselves, or to convince other donor states to step in, rather than the United States paying for upgrades everywhere. Nevertheless, achieving the objective of effective security for all stockpiles of nuclear weapons and weapons-usable materials will inevitably require substantial expansions of current programs, to cover:

- Security upgrades at more sites in more countries
- Expanded efforts to strengthen security regulation and security culture
- Removing a wider range of materials from a wider range of facilities
- Incentives to convince states and operators to give up their material
- Expansion to shut-down of underutilized research reactors as a complement to the current focus on conversion.

³ Partnership for Global Security Press Release, "WMD Security Funding Is Inadequate to Meet Obama Administration Goals", 2 April 2009; available at http://www.partnershipforglobalsecurity.org/Documents/fy09_wmd_security_programs_press_release.pdf as of 22 April 2009. For a detailed description of the Partnership for Global Security's recommendations for expanding the nuclear and biological threat reduction agenda, see Kenneth N. Luongo, "Loose Nukes in New Neighborhoods: The Next Generation of Proliferation Prevention," *Arms Control Today*, May 2009; available at http://www.armscontrol.org/act/2009_5/Luongo as of 20 May 2009.

⁴ For recent summaries of what needs to be done to secure nuclear stockpiles worldwide, see Matthew Bunn, *Securing the Bomb 2008* (Cambridge, Mass.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, November 2008) and Matthew Bunn and Andrew Newman, *Preventing Nuclear Terrorism: An Agenda for the Next President* (Cambridge, Mass.: Project on Managing the Atom, Harvard University and Nuclear Threat Initiative, November 2008); both available at <http://www.nti.org/securingthebomb> as of 1 May 2009.

Table 1. U.S. Appropriations to Improve Controls on Nuclear Weapons, Materials and Expertise

(Current Dollars, in Millions)

Goal/Program		FY08 Estimated	FY09 Request	FY09 Approp.	FY10 Request	Change from FY09 Approp.	
Total, Improving Controls on Nuclear Weapons, Material, and Expertise		1,317	1,083	1,288	1,287	-1*	0%
Securing Nuclear Warheads and Materials		640	505	745	700	-45	-6%
Material Protection, Control, & Accounting (excl. SLD) ¹	Energy	367	217	280	280	0	0%
Nuclear Weapons Storage Security - Russia	Defense	34	23	23	15	-8	-34%
Global Threat Reduction Initiative	Energy	193	220	395	354	-41	-11%
Nuclear Weapons Transportation Security - Russia	Defense	41	41	41	46	5	+13%
International Nuclear Security	Energy	5	5	5	5	0	0%
Interdicting Nuclear Smuggling		377	315	288	433	+145	+50%
Second Line of Defense (part of MPC&A budget line)	Energy	258	213	175	273	+98	+56%
Export Control and Related Border Security Assistance	State	46	41	44	55	+11	+25%
WMD Proliferation Prevention	Defense	59	50	59	91	+32	+54%
International Counterproliferation ²	Defense	14	10	10	14	+4	+40%
Stabilizing Employment for Nuclear Personnel		92	91	80	93	+12	+15%
Global Threat Reduction Program ³	State	57	64	61	69	+8	+12%
Global Initiatives for Proliferation Prevention	Energy	31	24	15	20	+5	+30%
Civilian Research and Development Foundation ⁴	State	5	4	4	4	0	+0%
Monitoring Stockpiles and Reductions		28	29	33	36	+3	+10%
HEU Transparency Implementation	Energy	14	15	17	18	+1	+7%
Warhead and Fissile Material Transparency	Energy	14	14	16	18	+2	+14%
Ending Further Production		180	141	141	25	-116	-83%
Elimination of Weapons Grade Plutonium Production	Energy	180	141	141	25	-116	-83%
Reducing Excess Stockpiles		0	1	1	1	0	0%
Russian Plutonium Disposition	Energy	0	1	1	1	0	0%

Notes

Source: "Interactive Budget Database," in Nuclear Threat Initiative Research Library: Securing the Bomb (Cambridge, Mass., and Washington, D.C.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, 2009; available at http://www.nti.org/e_research/cnwm/overview/funding.asp as of 5 June 2009), updated by Andrew Newman, June 2009.

Except where noted, figures are taken from the following budget documents: U.S. Department of Defense *FY 2010 Budget Request*, "CTR Funding Breakout", slide provided by DOD official, 26 May 2009; U.S. Department of Energy, *FY 2010 Congressional Budget Request: National Nuclear Security Administration*, vol. 1, DOE/CF-035 (Washington, D.C.: DOE, 2009); Department of State, *Fiscal Year 2010 Congressional Budget Justification: Foreign Operations*, book 1, (Washington, D.C.: DOS, 2009). The reference for the MPC&A supplemental is: Senate Report 111-020 – Making Supplemental Appropriations for the Fiscal Year Ending September 30, 2009, and for Other Purposes, 14 May 2009; House Report 111-105 – Making Supplemental Appropriations for the Fiscal Year Ending September 30, 2009, and for Other Purposes, 12 May 2009.

Values may not add due to rounding.

* All figures in this column represent the difference between the FY2009 Appropriation and the FY2010 request, in current dollars, in millions.

1. The fiscal year 2009 total includes a \$55 million supplemental appropriation requested by the President in April and passed by the House and Senate in May 2009.
2. U.S. Department of Defense, *Fiscal Year 2010 Budget Estimates: Defense Threat Reduction Agency* (Washington, D.C.: U.S. Department of Defense, 2009), p.471.
3. A small portion of these funds are spent on programs to interdict nuclear smuggling, particularly the Nuclear Smuggling Outreach Initiative.
4. Estimated based on Michelle Marchesano and J. Raphael Della Ratta with contributions from Kenneth N. Luongo, *Funding Analysis of the Fiscal Year 2010 Budget Request for International WMD Security Programs*, Partnership for Global Security Policy Update, May 2009 and interview with CRDF official, May 2008. The figures here include only funds provided to CRDF for its own programs, not funds from other programs listed here which use CRDF as a facility for spending money on their programs.

Currently, these efforts are primarily led by the International Nuclear Materials Protection and Cooperation program, often known as Materials Protection, Control, and Accounting (MPC&A), and the Global Threat Reduction Initiative (GTRI), both in the National Nuclear Security Administration (NNSA) at the U.S. Department of Energy (DOE), though programs at the Department of Defense (DOD) and the State Department also contribute, and could be expanded. The needed budget increases to implement a four-year nuclear security plan would primarily focus on the MPC&A and GTRI programs, unless the administration changed the current organizational approach.

Nuclear security is affordable: a level of security that could greatly reduce the risk of nuclear theft could be achieved for all nuclear stockpiles worldwide for an initial investment of 1-2 percent of annual U.S. defense spending for a single year. President Obama and the U.S. Congress should act to ensure that lack of money does not slow or constrain any major effort to keep nuclear weapons and the materials needed to make them out of terrorist hands. In particular, since new opportunities to improve nuclear security sometimes arise unexpectedly, and difficult-to-plan incentives are sometimes required to convince facilities to give up their HEU or convert a research reactor, President Obama should seek, and Congress should provide, an appropriation in the range of \$500 million, to be available until expended, that can be spent flexibly on high-priority actions to reduce the risk of nuclear theft as they arise. Such a flexible pool of funds would give the new administration the ability to hit the ground running with an expanded and accelerated effort. There should, of course, be notification and full accountability to Congress concerning how this money is spent.

The remainder of this paper outlines the funding picture for programs in the key categories outlined in Table 1: securing nuclear warheads and materials; interdicting nuclear smuggling; stabilizing employment for nuclear personnel; monitoring stockpiles and reductions; ending further production; and reducing excess stockpiles. At the end of the paper, we provide detail on what programs are included in these categories and why.

SECURING NUCLEAR WARHEADS AND MATERIALS

As noted earlier, if President Obama's objective of securing all nuclear weapons and weapons-usable materials worldwide within four years is to be achieved, NNSA's MPC&A and GTRI programs will play a central role, along with the smaller warhead site security and warhead transportation security programs in DOD's Cooperative Threat Reduction (CTR) effort.

In May, the administration requested \$700 million in FY 2010 funding for these and other programs to improve security and accounting for nuclear weapons and materials, \$45 million below the FY 2009 appropriation.⁵

Some highlights:

MPC&A: Remarkably, the FY 2009 omnibus appropriation, the first in many years with a Democrat in the White House and Democrats in control of both houses of Congress, was also the first in many years in which the Congress cut the request for the International Nuclear

⁵ Authors' estimates drawn from "Interactive Budget Database," in Nuclear Threat Initiative Research Library: Securing the Bomb (Cambridge, Mass., and Washington, D.C.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, 2009; available at http://www.nti.org/e_research/cnwm/charts/cnm_funding_interactive.asp as of 29 May 2009), updated by Matthew Bunn and Andrew Newman.

Material Protection and Cooperation. (The administration, however, chose to take these cuts in the Second Line of Defense component of the effort, discussed below under interdicting nuclear smuggling, rather than in the MPC&A program itself.) The Obama administration's FY 2010 request of \$280 million for the MPC&A program is \$55 million more than the FY 2009 appropriation, but \$87 million less than the FY 2008 appropriation and a substantial decline from the FY 2007 peak of \$406 million.⁶ (The Obama administration's FY 2009 supplemental request, approved by the House on May 12 and the Senate on May 14, adds \$55 million to the MPC&A and brings total FY 2009 funding to \$280 million, the same as the FY 2010 request.⁷) For the out-years, the budget documents envision steadily declining funding, as currently planned work in Russia and elsewhere is completed; even in the out-year projections, no funds have been included for expanded efforts to implement the President's four-year goal. In essence, to avoid being criticized for carrying large unspent balances from one year to the next, the budget includes funding only for those areas where NNSA already has foreign countries' agreement to do work, or was confident (when the budget was being prepared) that such agreement would be forthcoming, rather than including not-yet-agreed activities likely to be needed to implement a four-year plan to achieve effective nuclear security worldwide.

GTRI: While the FY 2010 request of \$354 million is \$41 million less than the FY 2009 appropriation, Congress had boosted the FY 2009 appropriation to an unusually high level, far beyond either the FY 2008 appropriation or the request for FY 2009. (The Congressional appropriation was \$53 million above the \$140 million request for FY 2008 and \$55 million above the \$340 million request for FY 2009.⁸) It appears that the GTRI budget includes some accelerated activities meant to meet the four-year target for parts of GTRI's agenda. But as with the MPC&A program, the funds that would be needed to expand GTRI's coverage to ensure that the full range of facilities and materials were addressed, or to provide incentives to countries and facili-

⁶ DOE, National Nuclear Security Administration, *FY 2010 Congressional Budget Request*, Office of Chief Financial Officer, Vol. 1, May 2009, p.386; available at <http://www.cfo.doe.gov/budget/10budget/Content/Volumes/Volume1.pdf> and DOE, FY 2009 Congressional Budget Request, National Nuclear Security Administration, Office of Chief Financial Officer, Vol. 1, February 2008, p. 493; available at <http://www.cfo.doe.gov/budget/09budget/Content/Volumes/Volume1a.pdf> as of 21 May 2009.

⁷ "Supplemental Appropriation Request," Office of Management and Budget, Washington, D.C., 9 April 2009, pp. 68; available at http://www.whitehouse.gov/omb/assets/budget_amendments/supplemental_04_09_09.pdf as of 10 April 2009; Senate Report 111-020 – Making Supplemental Appropriations for the Fiscal Year Ending September 30, 2009, and for Other Purposes, 14 May 2009 available at http://thomas.loc.gov/cgi-bin/cpquery/?&dbname=cp111&sid=cp111UljC9&refer=&r_n=sr020.111&item=&sel=TOC_361041& as of 27 May 2009 and House Report 111-105 – Making Supplemental Appropriations for the Fiscal Year Ending September 30, 2009, and for Other Purposes, 12 May 2009 available at <http://appropriations.house.gov/pdf/HOUSERE-PORT111-105.pdf> as of 27 May 2009. In addition to the \$55 million for the MPC&A program, the supplemental included \$34.5 million to support disablement, dismantlement, and spent fuel management activities in North Korea—\$25 million of which was for GTRI's efforts in this area, and the remainder for the Nonproliferation and International Security account. Congress did not appropriate money for this due to the recent breakdown of cooperation in spent fuel disposition. At the State Department, the supplemental included \$122 million for the Nonproliferation, Anti-Terrorism, Demining and Related Programs (NADR) account, broken down as follows: \$97 million for the Nonproliferation and Disarmament Fund (NDF), of which \$47 million is to support dismantlement of nuclear facilities in North Korea and \$50 million is to provide border security equipment, training, and program management for Egypt to prevent smuggling of illicit goods into Gaza; \$11 million is for anti-terrorism training of Iraqi protective services forces, radioactive waste disposal, weapons reduction and improved border security in Iraq; \$12 million is to build the institutional capacity of the Afghan Presidential Protection Service; and \$2 million is for Crisis Response Team training for Pakistan. As of the time of writing, the House had recommended a total of \$98.5 million and the Senate a total of \$102 million for NADR. See "Supplemental Appropriation Request", p.88, House Report 111-105, p.62, and Senate Report 111-020, p.91.

⁸ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, p.443.

ties to allow their weapons-usable material to be shipped away, are not included in the FY 2010 GTRI request. Indeed, under current plans, GTRI would be spending dramatically more after the four-year plan is over (\$1.1 billion in 2014) than it would be in FY 2010 or FY 2011. (This is in part because high-density fuels required to convert some 27 of the reactors GTRI hopes to convert will not be available until the latter part of this period, requiring substantial spending on converting reactors and shipping away irradiated HEU once this high-density fuel becomes available.) It seems certain that if the four-year goal is to be achieved, GTRI's budgets for FY 2010 and FY 2011 will have to be substantially higher than those in the current request.

In particular, more money would be needed to accelerate conversion of the 38 HEU-fueled research reactors that could convert to proliferation-resistant low-enriched uranium (LEU) with LEU fuels already available. GTRI is planning to provide funds to accelerate private sector efforts to establish fabrication capability for the new high-density LEU fuels, and that is likely to be costly. Additional funds could also accelerate the pace of removing nuclear material from vulnerable sites around the world (in part because here, too, prices are escalating). More money is also needed to secure radiological sources and research reactors around the world—including in the United States, where upgrades are needed for some 1,800 locations with sources of 1,000 curies or more, and for the nation's 32 domestic research reactors, both of which have now been included in GTRI's scope.⁹ Moreover, GTRI is so far planning to return only a small fraction of the U.S.-origin HEU abroad; while most of the remainder is in developed countries, in many cases there is good reason to bring this material back as well, and more funds would be required to give these facilities incentives to give up their HEU. Finally, NNSA does not yet have a program focused on giving underutilized HEU-fueled reactors incentives to shut down—in many cases likely to be a quicker and easier approach than conversion. All told, an increase of \$200 million or more would be needed for GTRI to move forward as rapidly as possible in reducing these risks—though managing such a large single-year increase would pose a challenge.¹⁰

Warhead security and warhead transport at DOD: The \$15 million request for DOD's Nuclear Weapons Storage Security program is \$8 million less than the FY 2009 appropriation of \$23 million because it is largely finishing up its upgrade work. The FY 2010 funds are intended primarily for sustainability and training activities. By contrast, the \$46 million Nuclear Weapons Transportation Security program request is \$5 million more than the FY 2009 appropriation.¹¹ The Transportation Security program finances roughly four shipments of Russian nuclear warheads to dismantlement or secure central storage locations per month, and is also providing a variety of transportation security equipment, including secure warhead transport railcars to replace older cars that are wearing out. It is scheduled to continue through 2012.

INTERDICTING NUCLEAR SMUGGLING

The administration request of \$433 million in FY 2010 funding for programs to interdict nuclear smuggling is \$145 million more than the FY 2009 appropriation.¹²

⁹ Interviews with NNSA officials, May 2008, December 2008, and May 2009.

¹⁰ This does not include the potential cost of packaging and removing plutonium and plutonium-bearing spent fuel from North Korea, if an agreement to take those steps is reached. That substantial cost would likely have to be funded through a supplemental request.

¹¹ Data provided by DOD, 26 May 2009.

¹² Authors' estimates drawn from "Interactive Budget Database," in Nuclear Threat Initiative Research Library: Securing the Bomb. This figure does not include significant, but classified, resources from the intelli-

Some highlights:

Second Line of Defense: At \$273 million, the Second Line of Defense request is \$98 million more than the reduced FY 2009 appropriation and \$15 million more than the FY 2008 appropriation.¹³ The program has been successful in getting additional countries to agree to cooperate, and to take advantage of all the opportunities for cooperation with key countries that it now has before it would likely require additional funds beyond the request. At the same time, policymakers should recognize that large, observable radiation detectors that intelligent adversaries will not be likely to send their nuclear materials through – especially detectors incapable of detecting HEU metal with even modest shielding, as is the case with the detectors now being installed – are likely to have only a modest effect on reducing nuclear terrorism risks. Congress should direct the administration to develop an approach that offers a greater chance of stopping nuclear smugglers at lower cost than the current mandate for 100 percent scanning of all cargo containers coming to the United States, focusing on an integrated system that places as many barriers in the path of intelligent adversaries attempting to get nuclear material into the United States by any pathway as can be accomplished at reasonable cost.¹⁴

WMD Proliferation Prevention: The WMD Proliferation Program, launched in FY 2003 under DOD, improves the capabilities of former Soviet states other than Russia to “prevent, deter, detect and interdict illicit trafficking in WMD and related materials, and to respond effectively to trafficking incidents at the border.”¹⁵ Funding has fluctuated between a low of \$29 million in FY 2004 and a high of \$59 million in FY 2009. The program received a \$32 million boost in the FY 2010 request, to \$91 million. As reported by the Partnership for Global Security, the bulk of this increase – \$62.4 million compared to \$27.4 million in FY 2009 – is to fund fissile and radioactive material proliferation prevention in Kazakhstan.¹⁶

Enhancing national laws and enforcement: A key part of such a comprehensive effort will work to ensure that each key source or transit country has laws in place providing severe penalties for nuclear theft and smuggling, and effective enforcement of these laws—including units of their national police or intelligence agencies trained and equipped to cope with nuclear smuggling. Programs such as the Department of State’s Nuclear Smuggling Outreach Initiative (funded within the Global Threat Reduction Program, though most of that line is targeted on scientist redirection efforts) and the Department of Defense’s International Counterproliferation Program (which provides training for law enforcement and customs officials) are pursuing goals of this kind. Congress might consider providing additional funds for these efforts, while

gence community devoted to tracking and interdicting nuclear smuggling. In addition, it does not include the small portion of the State Department’s Global Threat Reduction Program that is devoted to efforts to interdict nuclear smuggling, such as the Nuclear Smuggling Outreach Initiative; because State does not routinely break out how much is spent for which purpose in this program in public documents, the entire program is listed here under its principal scientist-redirection mission.

¹³ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, p.389.

¹⁴ Bunn, *Securing the Bomb 2008*, pp. 163-165.

¹⁵ “Interdicting Nuclear Smuggling: WMD Proliferation Prevention Program,” in Nuclear Threat Initiative Research Library: *Securing the Bomb* (Cambridge, Mass., and Washington, D.C.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, 2008; available at http://www.nti.org/e_research/cnwm/interdicting/wmd.asp as of 22 May 2009), written by Matthew Bunn, last updated by Anthony Wier, 27 August 2002.

¹⁶ Data provided by DOD, 26 May 2009, and Michelle Marchesano and J. Raphael Della Ratta with contributions from Kenneth N. Luongo, *Funding Analysis of the Fiscal Year 2010 Budget Request for International WMD Security Programs*, Partnership for Global Security Policy Update, May 2009, p.10; available at http://www.partnershipforglobalsecurity.org/Documents/analysis_of_fy10_budget_request_final1.pdf as of 25 May 2009.

requiring the development of a comprehensive, integrated approach to interdicting nuclear smuggling.

STABILIZING EMPLOYMENT FOR NUCLEAR PERSONNEL

Programs focused on redirecting weapons scientists to civilian work have taken on new missions in recent years, going beyond the former Soviet Union to new areas where former weapons scientists may pose proliferation risks, such as Iraq and Libya. At the same time, these efforts clearly need to be reformed to match today's threats. The dramatically changed Russian economy creates a very different threat environment; for many former weapons scientists, the risk of desperation-driven proliferation that motivated the U.S. government to establish these programs is much less than it was before. Moreover, the experience of the A.Q. Khan network suggests that dramatic leakage of proliferation-sensitive expertise may come from well-to-do experts motivated by ideology and greed, and not only from desperate, underemployed experts. In addition, after 9/11, U.S. concerns have changed, with a much greater focus on nuclear or biological terrorism, as opposed to only proliferation by states.¹⁷

For a terrorist group, a physicist skilled in modeling the most advanced weapons designs—the kind of person who has often been the focus of these programs in the past—may be much less interesting than a machinist experienced in making bomb parts from HEU metal, or a guard in a position to let thieves into a building undetected. Experts who are no longer employed by weapons institutes, but whose pensions may be inadequate or whose private ventures may have failed, could pose particularly high risks, but they are not addressed by current programs focused on redirecting weapons expertise. The U.S. government needs to find ways to address all of the highest-priority risks—but is not likely to have either the access or the resources to do everything itself. The solution is likely to require working in partnership with Russia and other countries, to get them to do most of what needs to be done.

The administration request of \$93 million in FY 2010 funding for programs to stabilize employment for weapons personnel is \$13 million more than the FY 2009 appropriation.¹⁸ Actual funding for nuclear experts is certainly less than half of this total, and may be less than one-third.

Some highlights:

¹⁷ For a useful discussion of this changed threat environment and its implications, see Laura Holgate, testimony to the Subcommittee on Prevention of Nuclear and Biological Attack, Committee on Homeland Security, U.S. House of Representatives, 26 May 2005; available at http://www.nti.org/c_press/c4_testimony.html as of 11 November 2008. See also John V. Parachini and David E. Mosher, *Diversion of NBC Weapons Expertise from the FSU: Understanding an Evolving Problem* (Santa Monica, Cal.: RAND, 2005). For additional suggestions for new approaches, see Matthew Bunn, Anthony Wier, and John Holdren, *Controlling Nuclear Warheads and Materials: A Report Card and Action Plan* (Cambridge, Mass., and Washington, D.C.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative, 2003; available at http://www.nti.org/e_research/cnwm/cnwm.pdf as of 28 March 2008), pp.141-146.

¹⁸ Authors' estimates drawn from "Interactive Budget Database" in Nuclear Threat Initiative Research Library: Securing the Bomb. This is a substantial overstatement of the amount actually devoted to *nuclear* scientists, as opposed to chemical, biological, or missile experts because of the difficulty of determining how much is being spent for each category of expert in a timely way each year, in these budget estimates, we simply include the entire budgets for the scientist-redirection programs, unless they are specifically identified as non-nuclear efforts, as is the case with the Biological Threat Reduction program sponsored by the Department of Defense.

Global Threat Reduction Program: The administration request of \$69 million for State's Global Threat Reduction Program is \$8 million more than the FY 2009 appropriation.¹⁹ Because of the changing picture in Russia, however, the fraction of this program devoted to the former Soviet Union has greatly decreased. Today, only a minority of these funds are spent in the former Soviet Union, and only a fraction of the total is spent on nuclear scientists, as opposed to biological, chemical, or missile experts.²⁰ (State's contribution to the Civilian Research and Development Foundation (CRDF) has also been declining.)

Global Initiative for Proliferation Prevention: The administration request of \$20 million in FY 2010 funding for NNSA's redirection program, now known as Global Initiatives for Proliferation Prevention (GIPP) is \$5 million more than the FY 2009 appropriation. GIPP has come under intense criticism in recent years, from analysts who argued it was no longer needed, given improving economic conditions in Russia; from Congressional investigators who pointed out that a significant portion of the long-term jobs the program claims to have created have gone to people who never were weapons experts;²¹ and from members of Congress who have complained about the program funding projects at institutes which also have personnel working on Iran's safeguarded nuclear power reactor.²² Despite the recent improvements in the Russian economy, however, a strong case can be made that reformed NNSA scientist-redirection programs, which help integrate former Soviet weapon scientists into the world technical community with its nonproliferation norms, maintain an ongoing dialogue with institutes that will be central to the future of Russia's weapons programs, and provide access to technologies that benefit U.S. industry, continue to offer benefits to U.S. national interests that are worth the modest investments the U.S. government makes in them. The fact that some institutes that have received NNSA funds also have some experts who have worked on a safeguarded power reactor in Iran does not in any way mean that NNSA programs have somehow contributed to Iran's nuclear program. Moreover, while a substantial fraction of the long-term jobs these programs have created have gone to people who are not weapons scientists, that is hardly a surprise. It is hard to think of a new business in the United States or elsewhere that has former weapons scientists for 100 percent, or even 80 percent, of its employees. To maintain the momentum of this effort, a budget of roughly \$30 million (comparable to the FY 2008 appropriation) would be appropriate, combined with direction to carry out an in-depth analysis of what the most urgent risks of proliferation of weapons expertise are, and how they might best be addressed.

MONITORING NUCLEAR STOCKPILES AND REDUCTIONS

The administration requested \$36 million in FY 2010 funding for programs focused on monitoring nuclear stockpiles and reductions—\$18 million for ongoing implementation of transparency measures for the U.S.-Russian HEU Purchase Agreement, and \$18 million for Dismantlement and Transparency program (formerly known as Warhead and Fissile Materials Transparency), which focuses on developing key transparency and counter-terrorism technologies jointly with Russian experts and supporting a range of negotiations involving transpar-

¹⁹ Department of State, *Fiscal Year 2010 Congressional Budget Justification: Foreign Operations*, Book 1, 28 May 2009, p.60 available at <http://www.state.gov/documents/organization/123415.pdf> as of 29 May 2009.

²⁰ Interview with State Department official, May 2006.

²¹ See U.S. Government Accountability Office, *Nuclear Nonproliferation: DOE's Program to Assist Weapons Scientists in Russia and Other Countries Needs to be Reassessed* (Washington, D.C.: December 2007); available at <http://www.gao.gov/new.items/d08189.pdf> as of 29 May 2009.

²² Matthew Wald, "U.S.-Backed Russian Institutes Help Iran Build Reactor," *New York Times*, 7 February 2008; available at <http://www.nytimes.com/2008/02/07/washington/07nuke.html> as of 11 November 2008.

ency or verification for nuclear warheads and materials.²³ This is \$3 million more than the FY 2009 appropriation. If a transparency agreement is reached for the Mayak Fissile Material Storage Facility, the Department of Defense intends to reprogram funds to support transparency implementation.²⁴

ENDING FURTHER PRODUCTION

The administration requested \$25 million in FY 2010 funding for Eliminating Weapons-Grade Plutonium Production, the one program substantially focused on ending additional production of fissile material.²⁵ (Negotiation of a fissile cutoff treaty is also focused on that objective, but does not have a separate budget line-item.) This is roughly \$116 million below the FY 2009 appropriation, largely because the program is finishing its work.²⁶ The program has already succeeded in helping Russia shut down two of the three remaining plutonium production reactors, each of which were producing of the order of 400 kilograms of plutonium per year. The last reactor, at Zheleznogorsk, may shut down as soon as the summer of 2009.

REDUCING EXCESS STOCKPILES

Much to the surprise of many, the United States has never paid for the actual dismantlement of nuclear weapons in Russia. (The ongoing HEU Purchase Agreement, under which Russia blends HEU from weapons to LEU and sells the LEU to the United States, gives Russia a financial incentive to dismantle weapons and destroy HEU, and DOD's Nuclear Weapons Transportation Security program helps transport warheads to dismantlement sites, but neither of these involve direct support for the actual dismantlement of nuclear weapons.) Similarly, the HEU Purchase Agreement is implemented commercially, and does not require U.S. government financing (except for the associated transparency measures, noted above).

The main area in which the United States has provided or pledged direct financing for reducing excess stockpiles of warheads or materials in the former Soviet Union is in disposition of excess plutonium. For years, the United States and Russia have been discussing modifications to the 2000 Plutonium Management and Disposition Agreement (PMDA), which never entered into force; by some accounts, modifications to the pact may be ready to be signed in the summer of 2009. In FY 2008, Congress rescinded all unspent prior-year funds for Russian plutonium disposition, throwing into doubt an earlier U.S. pledge to provide up to \$400 million to support Russian plutonium disposition efforts. Since then, U.S. funding for plutonium disposition has been only about \$1 million per year, and the administration's FY 2010 request is in line with this approach.²⁷ For the out-years, however, the U.S. government still plans to provide up to \$400 million to support irradiation of excess plutonium in fast-neutron reactors in Russia, principally the BN-800, which is still under construction.²⁸

²³ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, p.377-78.

²⁴ U.S. Department of Defense, *Cooperative Threat Reduction Annual Report to Congress: Fiscal Year 2009* (Washington, D.C.: DOD, 2008; available at <http://www.dtra.mil/documents/oe/ctr/FY09%20CTR%20Annual%20Report%20to%20Congress.pdf> as of 9 June 2008), p. 15.

²⁵ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, p.351.

²⁶ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, p.351.

²⁷ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, p.413. Congress rescinded all unspent prior-year funds in FY 2008.

²⁸ For a discussion, see Matthew Bunn and Anatoli Diakov, "Disposition of Excess Plutonium," in International Panel on Fissile Materials, *Global Fissile Materials Report 2007* (Princeton: IPFM, 2007), pp. 33-42.

U.S. Plutonium Disposition: Our analyses of funding for improving controls over nuclear weapons, materials, and expertise focus primarily on programs to improve controls overseas. Nevertheless, a brief discussion of disposition of excess plutonium is appropriate, as it represents a very large element of NNSA's nonproliferation budget, and has some linkages to disposition of Russia's excess plutonium. NNSA proposes to build three major facilities for disposition of U.S. excess weapons plutonium – a plutonium-uranium mixed oxide (MOX) fuel fabrication plant (known as the MOX Fuel Fabrication Facility, or MFFF), a Pit Disassembly and Conversion Facility (PDCF) to transform U.S. plutonium weapons components or “pits” into oxide suitable for fuel fabrication, and a Waste Solidification Building (WSB) to handle the wastes from the other two. All of these facilities are to be built at the Savannah River Site in South Carolina. In addition, DOE's Office of Environmental Management controls tons of plutonium in forms not suitable for use as MOX; some of this is slated for direct disposal at the Waste Isolation Pilot Plant (WIPP), and much of the rest DOE currently expects to purify some of this for use as MOX and to dissolve the rest in the H-Canyon reprocessing facility at Savannah River, and then vitrify the resulting plutonium-bearing liquid wastes. (A DOE review of this plan is underway, however.) All told, disposition of U.S. excess plutonium will cost many billions of dollars.

In FY 2008, Congress slashed the requested budget for U.S. plutonium disposition and rescinded half of the prior-year balances remaining for construction of the MOX plant. In FY 2009, Congress fully funded the administration's \$487 million request to build a MOX fuel fabrication plant for disposition of excess plutonium, in the “Other Defense Activities” account, a 103 percent increase over the \$240 million FY 2008 appropriation.²⁹ In addition, the PDCF received over \$90 million, and the WSB received \$40 million.³⁰ For FY 2010, the administration requested \$588 million for the MOX plant, \$77 million for the WSB and over \$100 million for the PDCF (including both construction and operations costs in each case).³¹

The cost of the U.S. MOX program has skyrocketed over the years. DOE's latest published estimates indicate a life-cycle cost for the MOX facility of some \$7.2 billion (not counting the substantial costs of the PDCF and the WSB).³² DOE has never adequately explained why this facility is costing many times what comparable facilities in Europe with more capability cost to build. Even once the expected \$2 billion in expected revenue from MOX sales is subtracted, this still comes to over \$120 million per ton of excess plutonium.

Something has to be done with this plutonium, but it would be surprising if no effective approach could be found that would manage this material securely for less than \$120 million per ton.

Unfortunately, lower-cost alternatives are not yet sufficiently mature that the MOX effort could be canceled with high confidence that something better would be available. Given that reality, Congress should consider approving funding to proceed with the MOX plant for this

²⁹ H.R. 1105, FY 2009 Omnibus Appropriations Act, Division C – Energy and Water Development And Related Agencies; available at http://appropriations.house.gov/pdf/2009_Con_Bill_DivC.pdf as of 9 April 2009), p. 53. See also DOE, *FY 2010 Congressional Budget Request*, Vol. 1, May 2009, pp. 419-421.

³⁰ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, May 2009, pp. 78, 229, 419-21. See Department of Energy, “Project Functions and Activities Definitions for Total Project Cost”, *Directives, Regulations and Standards*, DOE G 430.1-1, 28 March 1997, p.6-1 – 6-2; available at <http://www.directives.doe.gov/pdfs/doe/doetext/neword/430/g4301-1chp6.pdf> as of 27 May 2009.

³¹ DOE, *FY 2010 Congressional Budget Request*, Vol. 1, p. 419-21, 229.

³² DOE, *FY 2010 Congressional Budget Request*, Vol. 1, May 2009, pp. 432-434.

year, while simultaneously directing DOE to carry out an in-depth study of potentially lower-cost alternatives—including some alternatives that were not fully explored in recent options studies. In particular, Congress should provide funding for DOE to restart development of plutonium immobilization technology, and direct DOE to outline the lowest-cost practicable immobilization option for the entire excess plutonium stockpile; Congress should also direct DOE to include, in its options assessment, the option of transporting the excess plutonium to Europe for fabrication and irradiation in existing facilities there. If, for example, the French were willing to take the U.S. excess plutonium and use it in their existing MOX programs for a one-time payment of \$1 billion, the U.S. government would have saved billions compared to other approaches; if not, that would certainly make clear that even with high uranium prices, plutonium is a costly liability, not an asset.³³

On the Russian side, critics have raised legitimate concerns about using excess plutonium in the BN-800 fast-neutron reactor, since it creates roughly as much plutonium as it burns. While NNSA is working with Russia to modify the reactor from a plutonium “breeder” to a plutonium “burner,” consuming more plutonium than it produces, this is largely a distinction without a difference, as the baseline design for the BN-800 produces only slightly more plutonium than it consumes, and the revised design produces only slightly less. More important is the fact that under the 2000 Plutonium Management and Disposition Agreement, spent fuel from plutonium disposition will not be reprocessed until decades from now, when disposition of all the plutonium covered by the agreement has been completed. Thus, a large stockpile of weapons-grade separated plutonium will be transformed into a stockpile of plutonium embedded in radioactive spent fuel—at least for some time to come.

The United States and Russia should agree that (a) the highest practicable standards of security and accounting will be maintained throughout the disposition process; and (b) all separated plutonium beyond the amount needed to support low, agreed numbers of warheads will be subject to disposition.³⁴ If the United States and Russia agreed on those points, and also agreed that spent fuel from plutonium disposition (a) would not be reprocessed except when the plutonium was immediately going to be reused as fuel, and then under heavy guard, with stringent accounting measures, and (b) would only be reprocessed in ways that did not separate weapons-grade plutonium from fission products, and in which plutonium would never be separated into a form that could be used in a bomb without extensive chemical processing behind heavy shielding, then this disposition approach would deserve U.S. financial support. This is particularly the case as the BN-800 approach fits in to Russia’s own plans for the nuclear energy future, unlike previous plans that focused on MOX in VVER-1000 reactors. If the United States does not provide promised financial support for disposition in Russia, Russia may conclude that it is free to use the BN-800 to breed more plutonium from this weapons plutonium, and to reprocess the spent fuel immediately, adding to Russia’s huge stockpiles of separated plutonium. Congress should provide sufficient funding for NNSA to explore such approaches, and support them if agreement can be reached.

³³ Areva officials indicate that there are now trades among utilities in which some utilities agree to burn MOX fabricated from other utilities’ plutonium, suggesting that if the price were right, it might be possible to convince utilities to burn this MOX in Europe.

³⁴ For more detailed discussions, see Matthew Bunn and Anatoli Diakov, “Disposition of Excess Highly Enriched Uranium,” and “Disposition of Excess Plutonium,” in *Global Fissile Materials Report 2007* (Princeton, NJ: International Panel on Fissile Materials, October 2007; available at <http://www.fissilematerials.org>), pp. 24-32 and 33-42 as of 9 June 2008.

All of these approaches will take many years to implement. In the near term the United States and Russia should move to legally commit their excess material to peaceful use or disposal and place it under international monitoring to confirm that commitment—sending an important signal to the world that the United States and Russia are serious about their arms reduction obligations, at relatively minor cost.

Disposition of Excess HEU: The current 500-ton HEU Purchase Agreement expires in 2013. Russia is likely to have hundreds of tons of additional HEU at that time that are not needed either to support its nuclear weapons stockpile or for naval and icebreaker fuel. Russia has made clear that it has no interest in extending the current implementing arrangements for the HEU Purchase Agreement, under which Russia faces higher costs and lower prices than it would marketing new-production commercial LEU. But a variety of other arrangements are possible that could create substantial incentives for Russia to blend down additional HEU.³⁵ Congress should direct DOE to enter into discussions with Russia concerning a broad range of possible incentives the United States might be willing to provide to help convince Russia to blend down additional HEU—and should consider setting aside a conditional appropriation in the range of \$200 million to finance such incentives if an agreement is reached that requires such funding.

Similarly, the United States can and should expand and accelerate the blend-down of its own excess HEU, beyond the roughly three tons per year now planned. The administration request of \$35 million for the disposition of U.S. HEU is \$4 million less than the FY 2009 appropriation.³⁶ Congress should provide additional funding targeted to accelerating the effort to get the HEU out of warheads and their components and blended down to LEU as rapidly as practicable.

NEXT STEPS

The FY 2010 funding request is clearly insufficient to support a fast-paced global program to ensure effective security for all nuclear weapons and weapons-usable nuclear materials worldwide within four years. Once the administration has developed a plan matching resources to this goal, it will need the scope to ramp up efforts as required. As suggested above, the administration and Congress should work together to establish a flexible fund in the range of \$500 million, to be available until expended, that can be spent on high-priority actions to reduce the risks of nuclear theft as they arise. Such a flexible pool of funds would give the new administration the flexibility to expand and accelerate this effort.

In some cases, new resources will also be needed beyond traditional national security agencies. The Nuclear Regulatory Commission (NRC), for example, currently has a very limited budget for international cooperation, yet improving national regulations for nuclear security is likely to be a key element of an effective global strategy. Similarly, there may well be cases where getting an agreement to shut down a research reactor will require assistance from the U.S. Agency for International Development (USAID) to help redirect institute personnel.

³⁵ See Matthew Bunn, "Expanded and Accelerated HEU Downblending: Designing Options to Serve the Interests of All Parties," in *Proceedings of the Institute for Nuclear Materials Management 49th Annual Meeting*, Nashville, Tenn., 14-17 July 2008 (Deerfield, IL: INMM, 2008).

³⁶ DOE, *FY 2010 Congressional Budget Request*, Vol. 2, p. 420; Communication with DOE official, 13 April 2009; U.S. Department of Energy, *FY 2009 Congressional Budget Request: National Nuclear Security Administration*, vol. 1, DOE/CF-024 (Washington, D.C.: DOE, 2008; available at <http://www.cfo.doe.gov/budget/09budget/Content/Volumes/Volume1a.pdf> as of 9 June 2008), p. 517.

Similarly, the Partnership for Global Security recommends creating a next-generation “Global Proliferation Prevention Initiative” that would build on current structures but also include new policy ideas and tools, players and coalitions, and funding to reconceptualize the existing agenda as an integrated global proliferation prevention tool focused on security, removal, and elimination of WMD and targeting of the financing for illicit programs and activities.³⁷ The Global Proliferation Prevention Initiative concept fits well with the recommendations in this update.

No one knows for sure how much it would cost to provide high levels of security for all nuclear weapons and weapons-usable nuclear material worldwide. The number of buildings and bunkers worldwide where these materials exist is not known precisely, and how many of these require upgrades, and how extensive the needed upgrades might be, depends on the level of security that is set as the goal. (No matter how many security measures have already been taken, additional steps can always be put in place.) In Russia, which has the world’s largest and most dispersed nuclear stockpiles, DOE spent nearly \$1.2 billion on MPC&A improvements through the end of fiscal year (FY) 2006, and at that time the remaining upgrades planned were expected to cost just under an additional \$100 million.³⁸ In addition, DOE and the Department of Defense together have spent just under \$1.1 billion on upgrading nuclear warhead security in Russia through the end of FY 2009.³⁹ Russia, of course, is paying the costs of providing guard forces, security personnel, and the like, as well as its own investments in security and accounting equipment. While these upgrades do not cover every site, and there are questions about whether they meet the threat in some cases, they provide an order of magnitude. It appears very likely that similar levels of security could be provided for all the nuclear weapon and weapons-usable nuclear material sites and transport operations in the world for an initial capital cost in the range of \$3-\$6 billion (much of which, of course, should be paid by the countries where these stockpiles exist, or by other donor states, rather than putting the entire burden on the United States). That does not include the costs of guard forces, security personnel, regulators, and all the other elements of an effective nuclear security system; and in some cases, the United States may wish to do more (as it has in the former Soviet Union), from re-employing nuclear scientists to paying to destroy stocks of HEU or plutonium, to strengthening countries’ ability to interdict nuclear smuggling. But the bottom line, as noted above, is that the risk can be reduced dramatically with investments that are tiny by comparison to what the United States and other countries routinely spend to provide for their security. Lack of money should not constrain the effort to keep these stockpiles out of terrorist hands.

³⁷ See Luongo, “Loose Nukes in New Neighborhoods: The Next Generation of Proliferation Prevention”.

³⁸ U.S. Congress, Government Accountability Office, *Nuclear Nonproliferation: Progress Made in Improving Security at Russian Nuclear Sites, but the Long-Term Sustainability of U.S.-Funded Security Upgrades Is Uncertain*, GAO-07-404 (Washington, D.C.: GAO, 2007; available at <http://www.gao.gov/new.items/d07404.pdf> as of 7 July 2008), pp. 12, 16.

³⁹ U.S. Congress, *Nuclear Nonproliferation: Progress Made in Improving Security at Russian Nuclear Sites, but the Long-Term Sustainability of U.S.-Funded Security Upgrades Is Uncertain*, p. 18.

APPENDIX: BUDGET HISTORY AND ASSESSMENT APPROACHES

HISTORICAL TOTALS, BY PROGRAM GOALS

An overview of historical spending on each of these threat reduction objectives is helpful to understanding the FY 2010 request, and prospects for the future. Congress launched the Nunn-Lugar initiative in FY 1992 by authorizing the Department of Defense to shift up to \$400 million from other programs to pay for programs to dismantle and control the Soviet Union's weapons of mass destruction, subject to certain restrictions and certification requirements. Over time, programs pursuing similar goals have been added at the Department of Energy and the Department of State, leading the total cooperative threat reduction budget to climb to roughly \$1.4 billion per year, as noted above.

The figures used in this section are drawn from the interactive budget database the Project on Managing the Atom developed and maintains with support from the Nuclear Threat Initiative. That database provides year-by-year appropriations data on all threat reduction programs since the establishment of the effort in FY 1992, and offers the user the opportunity to construct totals and subtotals of programs listed in alphabetical order, programs categorized by their program goals, or programs managed by each government department.⁴⁰

Most, but not all of that funding is devoted to nuclear weapons, materials, and expertise, while the rest goes to other threat reduction activities (see below for a detailed discussion of which programs we include in each of category of activity).

From FY 1992 through FY 2009, a total of nearly \$5.9 billion has been budgeted for Securing Nuclear Warheads and Materials, of which the largest single program, the Material Protection, Control, and Accounting program, has accounted for \$3.2 billion (from both the Departments of Defense and Energy). This has been far and away the best-funded aspect of controlling nuclear warheads and materials over the years.

From FY 1992 to FY 2009, programs working to Stabilize Employment for Nuclear Personnel have received a significant portion of funding. Since the earliest days of cooperative threat reduction with the former Soviet Union, in addition to securing the actual physical nuclear and other WMD material, the United States has been working to "secure" the human capital associated with the former Soviet weapons of mass destruction complexes—the weapons design expertise of scientists and engineers, and the workers with access to sensitive materials and facilities. During the Bush administration, these efforts expanded well beyond the former Soviet Union, including programs focused on providing civilian employment for former weapons scientists in Iraq and Libya, among others." All told, since 1992, the United States Government has allocated nearly \$1.3 billion for efforts aimed at stabilizing these "custodians" of nuclear and other knowledge and access. (Because in many cases only aggregated data is available, we have counted all of this funding under the category of controlling nuclear warheads, materials, and expertise, although a substantial fraction of these efforts has in fact gone to chemical, biological, and aerospace experts, not just nuclear experts.)

⁴⁰The database can be accessed by going to <http://www.nti.org/securingthebomb> and clicking on the "Threat Reduction Budgets" button.

Attempts to Reduce Stockpiles of Nuclear Material—both blending down of highly enriched uranium (HEU) and disposing of plutonium excess to Russia’s defense needs—has received some \$900 million in funding through FY 2009. This amount does not include the billions of dollars that have been transferred to Russia commercially under the HEU Purchase Agreement, under which the private U.S. Enrichment Corporation (USEC) acquires low enriched uranium taken from weapons HEU from Russia’s Rosatom State Atomic Energy Corporation (Rosatom), and resells this material on the commercial nuclear fuel market (although it does include \$325 million appropriated by Congress in 1999 for the U.S. Government to purchase uranium under the agreement to keep Russia from pulling out of the deal).

Another \$1.924 billion has been budgeted for Interdicting Nuclear Smuggling, a task that has received increased attention over the last several years. (Here, too, we have included the entire budgets of programs focused on controlling smuggling of weapons of mass destruction, even though only a portion of these focused on nuclear smuggling.) Roughly \$960 million has been budgeted for Ending Further Production of Nuclear Material in the former Soviet Union. Finally, some \$350 million has been devoted to Monitoring Stockpiles of nuclear warheads and material and attempted reductions to those stockpiles.

WHAT IS COUNTED, WHAT IS NOT, AND WHY

Different figures on how much has been spent on threat reduction to date are generally driven by differences in assumptions as to which programs are and are not included. Below, we describe which programs we have and have not included in our budget tabulations.

GUIDING PRINCIPLES

To the extent possible, we have used the government’s definitions of which programs are and are not cooperative threat reduction.⁴¹ In a few cases, however, we have added programs that clearly fit the definition of cooperative threat reduction but were not included in the government’s analyses. In a small number of other cases, we have excluded budget lines that some government analyses have included. We have done this using three key principles:

- First, only U.S. government expenditures are included, not the expenditures of other governments, or amounts spent in commercial transactions (such as the HEU Purchase Agreement). Ultimately it would be desirable to have a broader database including all government expenditures on these matters worldwide, but collecting that data comprehensively is quite difficult to do.
- Second, to the extent we have been able to identify them, all programs focused on dismantling or controlling weapons of mass destruction and related technologies and expertise in the former Soviet Union and elsewhere are included in our broad measures of cooperative threat reduction work, though some of these efforts are not focused in the specific areas included in Table 1. Thus, we have added to the total certain efforts such as funding for joint development with Russia of measures to verify warhead dismantlement, which are often not included in government totals of threat reduction spending.

⁴¹ For a useful listing of all what the government at one point included as threat reduction programs, see U.S. Department of State, “*Expanded Threat Reduction Initiative*” (Washington, D.C.: Department of State, March 1999).

- Third, we have generally not included programs whose principal focus is on controlling or reducing U.S. stockpiles. Thus, we have not included spending on programs to reduce U.S. stockpiles of plutonium and HEU—even though those programs may be important to Russian agreement to reduce Russia’s comparable stockpiles—because they are primarily focused within the United States. If these programs were to be included, then logically the costs of dismantling U.S. missiles and bombers, destroying the U.S. chemical weapons stockpile, securing U.S. nuclear weapons and materials, and the like should also be included, which neither the government nor other independent analysts ever do in their analyses of threat reduction budgets.
- Fourth, we do not include funds focused on verification of arms control agreements, such as the budget of the On-Site Inspection Agency or the U.S. contributions to the International Atomic Energy Agency (IAEA), the Comprehensive Test Ban Organization (CTBO) or the Organization for the Prohibition of Chemical Weapons (OPCW). Such verification arrangements are, of course, important to achieving nonproliferation objectives, but they are clearly distinct from efforts focused on helping foreign governments improve their capacity to control nuclear weapons, materials, and expertise.

Previously, we did not include programs whose focus is international but not within the former Soviet Union. We have now begun to show U.S. government funding for threat reduction programs anywhere in the world, as it is clear that the threats are global, and many programs have been expanded to cope with this broader perception of the threat, and are now operating in many countries.

Ultimately a broader analysis is needed that would include U.S. spending (both public and private) on securing and reducing its own nuclear stockpiles and facilities, as well as U.S. spending (and other countries’ spending) on similar activities around the world. Much of this data, however—particularly countries’ spending on securing their own nuclear weapons and materials—is secret, and would be nearly impossible to gather for a public database such as this one.

In reviewing these figures, it is also important to note that they represent the amount budgeted from the funds of a particular year, not necessarily the specific amounts spent in that year. Once Congress appropriates the funds, the administration typically has from one to three years to obligate those funds to specific contracts (though sometimes Congress makes the funds available indefinitely). Following that obligation of funds, the programs generally have five years to actually disburse the money that was set aside for those contracts (though again, this time limit can be set longer). As a result, the executive branch typically has significant balances of funding already budgeted that are awaiting obligation to a contract and then awaiting final disbursement to meet the terms of the contract. These carryovers do *not*, however, mean that these programs need no more money – in general, these funds are already committed, but are not spent until the programs confirm that the contracted work has been completed.

SIX CATEGORIES RELATED TO CONTROLLING NUCLEAR WARHEADS AND MATERIALS

Our focus is on improving controls over nuclear weapons and the materials needed to make them. Hence, we have attempted to identify, within the overall threat reduction effort, the sub-

set of programs focused on controlling those nuclear warheads and materials—and on stabilizing the human custodians of those warheads, materials, and the expertise needed to work with them. In nearly all cases this is a straightforward task, as programs are clearly identified as being focused on, for example, securing nuclear warheads, or ending production of plutonium. But in the areas of interdicting smuggling of materials and technologies related to weapons of mass destruction, and providing alternative employment to former weapons scientists, a number of the programs as they are now being implemented focus on all weapons of mass destruction, not just on nuclear weapons; rather than attempting to break out the nuclear portion—an enterprise that would inevitably be fraught with controversy—we have simply included the entire budgets for these efforts in our subset for controlling nuclear warheads, materials, and expertise. Thus, the total size of this subset is larger in our estimates than it is in reality, as we are including some spending that is in fact going to control chemical or biological weapons or expertise, or missile technologies and related expertise.

Within this subset of threat reduction programs, we have categorized the individual programs into six categories based on the goals of the individual programs, as described above:

- Securing Nuclear Warheads and Materials
- Interdicting Nuclear Smuggling
- Stabilizing Employment for Nuclear Personnel
- Monitoring Stockpiles and Reductions
- Ending Further Production of Nuclear Material
- Reducing Stockpiles of Nuclear Material

Table I provides a list of the programs we include in each of these categories. In the interactive budget database, threat reduction programs that are not within this subset focused on controlling nuclear warheads and materials have a seventh category, “Other Threat Reduction.”

We have attempted to provide enough information to allow users of the interactive budget database and the other tables and graphs to discern for themselves what is and is not included in the totals provided for particular categories, by providing detailed program names for each item included, along with footnotes to describe interesting or exceptional cases requiring explanation. The database offers lists of every program we included in each of these categories, and provides budget data for each of them. In addition, the interactive budget database allows users to ignore our definitions and create their own charts of data based on whatever subsets of programs they wish to choose. Interested readers are strongly encouraged to explore the database and to provide feedback about the information included in the database and the way it is presented. Some particular issues in each of the categories are described below.

SECURING NUCLEAR WARHEADS AND MATERIALS

This category includes funding information on the Material Protection, Control, and Accounting (MPC&A) program (both the current DOE funding and the DOD program from the early days of cooperative threat reduction) as well as programs to provide security upgrades for warhead storage sites. It also includes funding for the Global Threat Reduction Initiative, including work to convert research reactors around the world from highly enriched uranium to low enriched uranium fuel, such as the Reduced Enrichment Research and Test Reactor (RERTR) program, and to remove altogether fissile material from vulnerable sites around the world.

INTERDICTING NUCLEAR SMUGGLING

Here, the largest program included is DOE's Second Line of Defense program. (This shares an appropriation line with the MPC&A effort in official budget documents, but we track them separately, given their separate purposes.) Funding for DOD's International Counterproliferation Program and WMD Proliferation Prevention program are included in full here, even though they include objectives beyond simply nuclear smuggling, as there is no way to discern what is focused on nuclear material and what is not.

The State Department's Export Control and Border Security Assistance program provides assistance in both the former Soviet states and throughout the rest of the world. A substantial part of this program is focused on interdicting nuclear smuggling (including provision of radiation detection equipment), and in the absence of data specifying what portion relates to nuclear smuggling and what portion relates to other types of smuggling, we have included 100% of the effort in this category.

By contrast, we do not include DOE's International Nonproliferation Export Control and Border Monitoring program in the tally of programs focused on preventing nuclear smuggling, as this program is mostly focused on helping countries improve their export control laws and implementation, leaving nuclear smuggling to DOE's Second Line of Defense programs. The original DOD Export Control Assistance is not counted in this category for the same reason. Both are included as "Other Threat Reduction" in the database.

STABILIZING EMPLOYMENT FOR NUCLEAR PERSONNEL

The State Department's Global Threat Reduction program (which funds the International Science and Technology Centers) and Civilian Research and Development Foundation (CRDF), and the DOE's Initiatives for Proliferation Prevention do not solely focus on redirecting former Soviet scientists and engineers with nuclear expertise, but as noted above, their entire budgets are included here, because of the difficulty of breaking out how much of each is spent on nuclear scientists and engineers versus other scientists and engineers with WMD knowledge. The State Department's Biological Weapons Scientists Redirection program is not included here until the FY 2003 budget, when the program was merged into the Nonproliferation of WMD Expertise funding line (now Global Threat Reduction), making further distinction impossible.

REDUCING STOCKPILES OF NUCLEAR MATERIAL

A major distinction with the totals provided here and others provided elsewhere is that only the Russian components of the efforts to dispose of the HEU and plutonium declared excess to military needs are included; similar efforts by the United States to dispose of its own excess HEU and plutonium are not included here, for reasons described above. The U.S. program is a sizable and controversial effort; in the interactive budget database, we track the budgets for U.S. disposition programs under a separate category described as "not cooperative threat reduction."

OTHER THREAT REDUCTION

As noted above, this category in the interactive budget database includes all the threat reduction programs that are not focused on controlling nuclear warheads and materials. These

cover a wide range, from dismantling missiles and submarines to improving export controls to destroying chemical weapons to safeguarding collections of deadly biological agents. All DOD programs not listed in one of the nuclear categories but funded through the Former Soviet Union Threat Reduction account, the funding line at DOD used synonymously with the Nunn-Lugar program, are included in this category. Also included here is DOD's Arctic Military Environmental Cooperation program, aimed at remediation of the legacy of the weapons complex in the far north of the former Soviet Union.

The State Department's Nonproliferation and Disarmament Fund is set up to support projects with a legitimate, urgent nonproliferation or disarmament purpose that for whatever reason cannot be funded with other authorities or available resources. Typically, the fund is replenished with annual appropriations. Given the expanding global nature of threat reduction activities⁴² and the difficulty and arbitrariness of estimating the portion of a contingency fund that might go towards a particular activity in a particular geographic area, we have adjusted our database contents to include the entirety of funding replenishing the NDF each year.

A FEW EXAMPLES OF WHAT IS NOT INCLUDED

Efforts supported by DOE and the State Department to enhance the operational safety of reactors in the former Soviet Union are not included at all in this analysis, as they are focused on threats to safety in these individual countries, not on threats to the security of the United States. As noted above, funding for global nonproliferation organizations is not included. Similarly, DOE's Nonproliferation and Verification Research and Development efforts are not included, because these efforts are not focused on cooperation with other states to reduce and control nuclear, chemical, or biological weapons.

⁴² The increase in the FY 2009 Nonproliferation and Disarmament Fund budget request was to support dismantlement activities in North Korea. Department of State, Fiscal Year 2009 Budget Request Summary and Highlights, p.41; available at <http://www.state.gov/documents/organization/100014.pdf> as of 13 January 2009.

LINKS AND KEY RESOURCES

- **“Interactive Budget Database,”** in *Nuclear Threat Initiative Research Library: Securing the Bomb* (Cambridge, Mass., and Washington, D.C.: Project on Managing the Atom, Harvard University, and Nuclear Threat Initiative 2007). An on-line database providing funding for each U.S.-funded threat reduction program from 1992 to the present; users can select individual programs, all programs pursuing particular goals, or all programs at particular departments of the U.S. government.
<http://www.nti.org/securingthebomb>
- **Partnership for Global Security (PGS), Congress & Budget (Washington, D.C.: PGS, no date).** The PGS staff keep closely apprised of all legislative action concerning cooperative threat reduction programs, and provide excellent, detailed, well researched summaries of Congress and the administration’s budget actions from year to year.
<http://www.partnershipforglobalsecurity.org/Publications/Congress%20and%20Budget/index.asp>
- **Stephen I. Schwartz, with Deepti Choubey, *Nuclear Security Spending: Assessing Costs, Examining Priorities* (Washington, D.C.: Carnegie Endowment for International Peace, January 2009).** Estimates that the U.S. government spent some \$52 billion on nuclear-weapons-related programs in FY 2008, analyzes where the money went (including a small portion on threat reduction efforts), and makes recommendations for better allocations and more transparency in how this money is spent.
http://www.carnegieendowment.org/files/nuclear_security_spending_complete_high.pdf
- **Gordon Adams and Cindy Williams, *Strengthening Statecraft and Security: Reforming U.S. Planning and Resource Allocation*, MIT Security Studies Program, Occasional Paper, June 2008.** Identifies crucial problems in planning, resource allocation, and budgeting for countering nuclear terrorism (as well as other case studies) and offers recommendations for reform within the departments and agencies of the executive branch, in the White House, and in Congress.
<http://www.stimson.org/budgeting/publications/MIT%20mongraph%20Williams-Adams%20final%207.08.pdf>
- **Library of Congress, “Status of FY 2010 Appropriations Bills” *Thomas: Legislative Information on the Internet*.** Copies of all versions of bills and amendments considered and passed by Congress, all reports, and useful summaries of the actions taken on each bill.
<http://thomas.loc.gov/home/approp/app10.html>
- **U.S. Government Budgetary Documents.**
U.S. Office of Management and Budget (OMB);
U.S. Department of Defense (DOD), Office of the Under Secretary of Defense (Comptroller);
U.S. Department of Energy (DOE), Office of Management, Budget and Evaluation;
U.S. Department of State (DOS), Bureau of Resource Management.
Except where otherwise noted, data in this report is drawn from the official budget justifications for the Departments of State, Energy, and Defense.

OMB Home Page - <http://www.whitehouse.gov/omb/>

DOD Budget - <http://www.defenselink.mil/comptroller/budget.html>

DOE Budget - <http://www.cfo.doe.gov/budget/10budget/Start.htm>

DOS International Affairs Budget - <http://www.state.gov/s/d/rm/c6112.htm>

ABOUT THE PROJECT ON MANAGING THE ATOM

The Project on Managing the Atom (MTA) is the Harvard Kennedy School's primary group focused on reducing the risks of nuclear and radiological terrorism, stopping nuclear proliferation and reducing nuclear arsenals, lowering the barriers to safe and secure nuclear-energy use, and addressing the connections among these problems. The MTA project has been engaged since 1996 in research and analysis, public and policy-maker education, the development of policy proposals, and the training of pre- and post-doctoral fellows.

Principal Investigators

Matthew Bunn, Associate Professor of Public Policy
Henry Lee, Director, Environment and Natural Resources Program
Steven Miller, Director, International Security Program

Project Staff

Neal Doyle, Program Coordinator
Martin Malin, Executive Director
Andrew Newman, Research Associate
Hui Zhang, Research Associate

Complementing these core staff members are a broad team of research fellows, including pre- and post-doctoral students and former senior government officials.

Please visit us at <http://www.managingtheatom.org> or contact us by e-mail at atom@harvard.edu

Project on Managing the Atom
Belfer Center for Science and International Affairs
Harvard Kennedy School of Government
Harvard University
79 John F. Kennedy Street, Mailbox 134
Cambridge, MA 02138