

The International Security Implications Of U.S. Domestic Nuclear Power Decisions

Prepared for the Blue Ribbon Commission on America's Nuclear Future¹

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Summary & Recommendations

The United States makes decisions regarding the domestic uses of nuclear energy and the nuclear fuel cycle primarily based economic considerations, domestic political constraints, and environmental impact concerns. Such factors influence U.S. foreign policy decisions as well, but foreign policy decisions are often more strongly determined by national security considerations, including concerns about nuclear weapons proliferation and nuclear terrorism. As a political scientist who studies other states' weapons proliferation and nonproliferation decisions, I am acutely aware of how often U.S. domestic nuclear power decisions influence other states' nuclear energy decisions in complex ways that impact our security interests, through modeling good or bad behaviors, by strengthening or weakening our diplomatic persuasiveness, and by providing or not providing new tools that promote nonproliferation and security cooperation. U.S. policy-makers and scholars, however, too often ignore or underestimate the influence of U.S. domestic nuclear decisions on those of foreign governments. The Blue Ribbon Commission (BRC) should take advantage of the opportunity to focus national attention on specific U.S. domestic nuclear power policies and actions that would better promote our broader global nonproliferation and nuclear security interests.

This paper discusses specific examples of American decisions regarding treaty obligations, nuclear power, and the fuel cycle that can influence other countries' nuclear fuel cycle and security policy choices and therefore have important implications for the global nuclear nonproliferation regime. We have too often provided a bad example to non-nuclear weapons states (NNWS) or failed to place non-proliferation and security objectives among the top priorities in our considerations regarding domestic nuclear power policy. This paper first outlines the U.S. obligations and interests under the 1970 Treaty on the Non-Proliferation of Nuclear Weapons (NPT) and related institutions that were later created to address nuclear terrorism threats. The second part of the paper discusses past examples of how the NPT and specific U.S. policies have influenced foreign governments' decisions regarding their nuclear policies. The third part of the paper then identifies and recommends potential changes in domestic nuclear power policies under consideration in the United States today. These new policies could further improve our ability to set a good example and promote better standards of behavior, reduce claims that we behave hypocritically (not "practicing what we preach"), enhance our diplomatic bargaining positions, and ultimately strengthen the global nuclear non-proliferation regime and global measures to reduce nuclear terrorism risks.

My specific recommendations to the Blue Ribbon Commission are:

- The United States government supports efforts to enhance international control of sensitive fuel cycle facilities around the world and encourages non-nuclear weapons states (NNWS) to abstain from building national enrichment facilities, and if they do build them to place them under some form of multinational ownership. Yet our own policies sometimes set bad examples to others. **For the sake of setting a positive example and reducing the global perception that the U.S. practices double**

standards, the BRC should recommend that any new enrichment facilities in the U.S. should have multinational ownership.

The Nuclear Non-Proliferation Treaty (NPT) requires that non-nuclear weapons states (NNWS) accept International Atomic Energy Agency (IAEA) safeguards if they want to exercise their NPT Article IV right to acquire civilian nuclear energy. Every U.S. president since Lyndon B. Johnson has made offers to have some American civilian nuclear power facilities placed under IAEA safeguards, in an effort to demonstrate that the NPT does not unfairly burden NNWS and to help provide training of IAEA inspectors. Both these purposes remain strong and indeed are increasing in importance. Yet many facilities are kept off the “eligible facilities list,” for reasons varying from national security to the protection of technologies. **The BRC should recommend that the U.S. government carefully review these reasons, on a case by case basis, and increase the number of U.S. facilities, including new fuel cycle related facilities, which are on the “voluntary list” that the IAEA can choose from for their safeguard inspections.**

- The United States seeks to ensure that NNWS do not engage in sensitive nuclear fuel cycle operations, but it itself is already blurring the line between civilian uses of nuclear power and nuclear weapons by the use of such facilities as the Watts Bar reactor at Tennessee Valley Authority TVA for weapons related activities. **Whatever the BRC decides about the specific details of future sensitive fuel cycle facilities, it should seek to maintain a “bright line” between civilian and weapons related work and, at a minimum, not make this bad situation worse.**

- These efforts should be seen as part of all nations “shared responsibility” for nuclear weapons disarmament. Article VI of the NPT is often misinterpreted as stating that only the Nuclear Weapons States (NWS) must “work in good faith” toward eventual nuclear disarmament. In fact, it states that **all members of the NPT** must work in good faith toward this goal. The NWS are unlikely to be able to safely take the final steps toward nuclear disarmament if there are many states in the world that have sensitive nuclear fuel cycle facilities under national control. **The U.S. government should state, often and loudly, that all NNWS should enter into international negotiations for multinational control of the fuel cycle as part of their Article VI commitment to work in “good faith” toward a world free of nuclear weapons.**
- The U.S. has historically played an important role in promoting better physical protection of nuclear materials in foreign nations, in an effort to reduce the risks of nuclear terrorism. Although this paper focuses primarily on the non-proliferation and safeguards issues, I would be remiss, especially after the Fukushima accident, not to point out that changes in U.S. policies can help lead the way toward adoption of improved global safety and physical security standards. American nuclear safety and security systems should provide “the gold standard” to which other states should aspire, and the U.S. should assist other states in meeting these standards. **The BRC should recommend that the U.S. provide leadership on improving both nuclear security and nuclear safety standards by accelerating the use of interim storage of nuclear fuel in dry casks in the U.S. rather than spent fuel pond storage. The U.S. government should also provide leadership on improving global nuclear physical protection by being more**

transparent about its own successes and failures in physical protection and also by supporting even more fulsomely the International Atomic Energy Agency's physical protection programs and efforts of the World Institute for Nuclear Security (WINS) to promote global best practices regarding nuclear security. Congress should be urged to promptly pass the legislation recently introduced by the Obama administration to bring domestic law into compliance with two key international treaties on physical security and the prevention of nuclear terrorism, the Amendment on the Convention on the Physical Protection of Nuclear Material and the Convention for the Suppression of Acts of Nuclear Terrorism, thereby allowing the U.S. government to submit its instruments of ratification. Finally, the BRC should recommend that the U.S. government produces and publishes an unclassified detailed history of terrorist threats and responses, to increase transparency and help other governments understand the seriousness of the nuclear terrorism threat.

Reasonable people may well disagree about the value of specific policy proposals regarding nuclear power or on how best to evaluate trade-offs between policies that may promote achievement of one policy objective but retard another. But reasonable people should not ignore the important role that American nuclear policies have in shaping, even if they do not fully determine, the decisions made in foreign capitals about nuclear power, the fuel cycle, and nuclear security. U.S. leadership is critical to promote a safer and more secure global nuclear future. The Blue Ribbon Commission should encourage the U.S. government to place nuclear non-proliferation and nuclear terrorism prevention very high on its priority list of objectives as it

makes domestic nuclear energy decisions and ensure that U.S. officials more fully appreciate how much our policies influence the decisions made by foreign governments.

Background: U.S. Treaty Obligations & Nuclear Security Institutions

The NPT provides the foundation of the international nuclear nonproliferation regime. The treaty currently has 186 signatories, divided between Nuclear Weapons States (NWS) and Non-Nuclear Weapons States (NNWS). Virtually all states in the international system have signed and ratified the treaty: only Israel, India, and Pakistan have declined to sign, and North Korea is the only state that has joined the treaty, but later exercised its right to withdraw.

The NPT is designed to promote three main objectives: to limit the spread of nuclear weapons, to encourage eventual nuclear disarmament, and to encourage the spread of peaceful uses of nuclear energy. The key provisions of the NPT therefore outline rights and responsibilities for state parties in the area of nuclear nonproliferation, nuclear energy, and disarmament.² Article I states that no NWS may “transfer,” “assist, encourage or induce” any NNWS to “manufacture or otherwise acquire nuclear weapons.” Article II requires NNWS parties not to “receive,” “manufacture or otherwise acquire” nuclear weapons and “not to seek or receive any assistance in the manufacture of nuclear weapons.” Article IV protects the right of all states to peaceful nuclear energy, conditional on their being in compliance with their Article II commitment: “Nothing in this Treaty shall be interpreted as affecting the inalienable right of all the Parties to the Treaty to develop research, production and use of nuclear energy for peaceful purposes without discrimination and in conformity with Articles I and II of this Treaty.” Article VI of the NPT calls for all parties to work towards nuclear disarmament: “Each of the Parties to

² “The Treaty on the Nonproliferation of Nuclear Weapons,” *United Nations*, available at http://www.un.org/disarmament/WMD/Nuclear/pdf/NPTEnglish_Text.pdf.

the Treaty undertakes to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament.” As noted above, Article VI is often treated as exclusively applicable to NWS, though it clearly states that *each of the parties* to the treaty must pursue “negotiations in good faith”³ in pursuit of nuclear disarmament.

Support for the NPT is provided by the International Atomic Energy Agency (IAEA), an international organization dedicated to “safety, security, and safeguards” for civilian nuclear power facilities. Originally established in 1957 as an “Atoms for Peace” UN agency, the organization currently has 151 member states. The IAEA regular budget is \$447 million in 2011. The United States provides about 25% of that.⁴ The IAEA is often called a “watchdog” agency, charged with verifying compliance. However, under the standard safeguards agreement IAEA inspectors may do onsite inspections only of declared sites and with advanced notice. In order to provide stronger verification that states are in compliance with their non-proliferation commitments, the Additional Protocol (AP) was developed as a supplemental agreement that states could sign on to voluntarily. Most notably, the AP gives IAEA inspectors broader right of access, including the power to enter suspicious but undeclared sites. Many NNWS (most noticeably Brazil, Egypt, and South Africa) have not signed the AP, publicly arguing that current safeguards are sufficient, though some diplomats privately note that ratifying the Additional Protocol now would eliminate one of the few “nuclear bargaining chips” that they possess to encourage the nuclear weapons states to take further steps on the road toward nuclear disarmament.

³ Scott D. Sagan, “Shared Responsibilities for Nuclear Disarmament,” *Daedalus* 138:4 (Fall 2009):157-68.

⁴ “The Agency’s Budget Update for 2011,” *International Atomic Energy Agency*, August 2010, http://www.iaea.org/About/Policy/GC/GC54/GC54Documents/English/gc54-2_en.pdf. “NNSA Contributions to the IAEA,” *National Nuclear Security Administration*, September 2010, available at <http://nnsa.energy.gov/mediaroom/factsheets/factsheet201009>.

The danger of nuclear terrorism was not a prominent fear when the NPT was negotiated in the 1960s. The fear that a terrorist organization might seek nuclear materials or nuclear weapons, however, increased significantly in the 1970s. Not only did Palestinian terrorism become a global, not just a regional, phenomenon, but the Baader-Meinhoff gang in West Germany tried to steal nuclear weapons from a NATO base in 1977 and the Red Brigades in Italy questioned a hostage American military officer about the location of U.S. nuclear weapons and the physical protection systems maintained in that country in the early 1980s.

It was not until a full decade after the entry into force of the NPT that the 1980 Convention on the Physical Protection of Nuclear Material (CPPNM) was signed to “establish measures related to the prevention, detection and punishment of offenses relating to nuclear material.” The U.S. Senate ratified the CPPNM in 1981, and it currently has 145 parties. In July 2005 amendments to the convention were proposed, adding further requirements to make it “legally binding for State Parties to protect nuclear facilities and material in peaceful domestic use.” The amendments, however, have only 46 signatories, far short of the 97 required for their entry into force.⁵ After the September 11th attacks in the United States, Washington led the effort to increase IAEA support for all states to improve their physical protection of nuclear materials. The IAEA developed an important program, with American assistance, through which any member state can request what are called International Physical Protection Advisory Service (IPPAS) missions to have teams assess the strengths and vulnerabilities of any existing site that has nuclear materials. Over 40 such missions have been held, many of them with U.S. nuclear security specialists among the lead experts in the evaluation team.⁶

⁵ “Convention on the Physical Protection of Nuclear Material,” *International Atomic Energy Agency*, www.iaea.org/Publications/Documents/Conventions/cppnm.html.

⁶ See “International Physical Protection Advisory Service (IPPAS),” *International Atomic Energy Agency*, www-ns.iaea.org/security/ippas.asp?s=4&l=26.

During the 2008 General Conference of the IAEA, in response to the growing threat posed by terrorism to nuclear facilities, an additional nuclear security institution – the World Institute for Nuclear Security (WINS) – was founded. Initially supported by the Nuclear Threat Initiative (NTI), the U.S. Department of Energy (DOE) and the Institute of Nuclear Materials Management (INNM), WINS aims to improve the physical protection and security of nuclear materials worldwide through bringing together both government officials and industry personnel to address physical protection challenges. Among other activities, WINS provides “an international forum in which nuclear security professionals can discuss and exchange best security practices and learn from each other.”⁷ WINS supplements the existing IAEA security programs, bringing in new individuals and organizations into physical security analysis and discussions without the need to coordinate all activities with official government agencies.

The U.S. Influence on Nuclear Nonproliferation and Nuclear Security

There is a wide-spread tendency in the United States to underestimate the degree of influence – which can be both positive and negative – that our policies have on foreign governments’ decision-making regarding the nuclear fuel cycle and potential nuclear weapons proliferation. Indeed, some U.S. policy-makers and scholars have expressed deep skepticism whether the NPT itself has had a valuable role in reducing global nuclear proliferation.⁸ Richard Betts has made the most extreme argument about the alleged irrelevance of the NPT:

As useful as treaties are, it is a misconception to see them as a solution. They are effects of nonproliferation, not causes of it. The NPT and CTBT (Comprehensive Test Ban

⁷ “WINS Fact Sheet,” *World Institute for Nuclear Security*, available at www.wins.org.

⁸ See, for example: Jacques E.C. Hymans, *The Psychology of Nuclear Proliferation: Identity, Emotions and Foreign Policy* (Cambridge, UK: Cambridge Univ. Press, 2010); Dong Joon Jo and Eric Gartzke, “Determinants of Nuclear Weapons Proliferation,” *Journal of Conflict Resolution* 51:1 (February 2007): 167-194; Matthew Fuhrmann, *Exporting the Bomb: Technology Transfer and the Spread of Nuclear Weapons* (Ithaca, NY: Cornell University Press, 2010).

Treaty) *reflect* the intent of their adherents to abjure nuclear weapons. To date, the countries considered problematic – those that might acquire nuclear weapons – simply did not join the NPT (South Africa stayed out while it had a nuclear weapons program and joined when it decided to get rid of it). Or else they joined and cheated (Iraq and North Korea).⁹

This statement ignores how many states not considered “problematic” today were in fact feared potential proliferators in the past. In 1963, for example, National Intelligence Estimate 4-63 and a Robert McNamara Department of Defense report predicted that eight countries could develop nuclear weapons by 1973: China, India, Sweden, Australia, Israel, South Africa, Japan, and West Germany.¹⁰ Egypt was considered to have “moderate to high” motivation and a capability to acquire nuclear weapons later in the 1970s; Argentina, Brazil, Romania, Bulgaria, Hungary, and Yugoslavia were all feared to be able and interested in nuclear weapons development by the 1980s.¹¹ To understand the impact of the NPT, however, one needs to focus beyond the current “problematic” states that have recently acquired or are trying to acquire the bomb, and appreciate the much larger number of cases of “nuclear abstinence” (the estimated 160 states that refrained from ever starting a nuclear weapons program) and the many states (15 by my estimate) that gave up their early and experimental nuclear weapons programs, in many cases in anticipation of joining the treaty.¹²

Moreover, the NPT includes requirements for NNWS members to accept safeguards – inspections run by the IAEA – on their nuclear power facilities as a precondition for receiving peaceful nuclear assistance. This IAEA inspection system has caught a number of states (including Iran, North Korea, South Korea, and Egypt) either cheating on their NPT

⁹ Richard K. Betts, “Universal Deterrence or Conceptual Collapse? Liberal Pessimism and Utopian Realism,” *The Coming Crisis: Nuclear Proliferation, US Interests and World Order*, ed. Victor A. Utgoff (Cambridge, MA: MIT Press, 2000): 69.

¹⁰ Peter R. Lavoy, “Predicting nuclear proliferation: a declassified history,” *Strategic Insights* 3:1 (January 2004).

¹¹ Peter R. Lavoy, “Predicting nuclear proliferation: a declassified history,” *Strategic Insights* 3:1 (January 2004).

¹² For more details see Scott D. Sagan, “The Causes of Nuclear Weapons Proliferation,” *Annual Review of Political Science*, 14 (2011): 225-244, <http://www.annualreviews.org/doi/pdf/10.1146/annurev-polisci-052209-131042>.

commitments or engaging in ambiguous but suspicious weapons-related activities.¹³ Thus, the NPT should not be seen as ineffective or irrelevant because some states have not complied with their commitments, for it is the treaty that legitimizes the inspections that can catch violators.

It is important to note that NPT Article VI did not state that the U.S. and other nuclear weapons states must successfully complete the quest for nuclear disarmament; instead, the carefully negotiated language called for all states to “pursue negotiations in good faith” toward that lofty objective.¹⁴ At every NPT Review Conference (Rev-Con) – meetings held every five years to review recent successes and failures of the treaty – many of the NNWS have complained that the NWS have made insufficient progress toward their objectives, and the willingness of individual states to accept additional constraints on their nuclear policies (such as the Additional Protocol of the IAEA or reinterpretations of the Article X withdrawal clause) have been strongly influenced by their perceptions of how well the NWS have been keeping their commitments. The United States has played an especially important role in this regard. The failure to reach any agreement on steps to strengthen the treaty at the 2005 NPT Rev-Con was caused by widespread perceptions among the NNWS that the Bush Administration was not serious about pursuing arms control and disarmament. In contrast, the Obama Administration is credited with the successes of the 2010 NPT Rev-Con due to perceptions that the U.S. was now seriously working in good faith toward “a nuclear weapons free world.”¹⁵ When analysts complain that NNWS have not accepted all of the constraints on their freedom of action that the NWS would prefer, they fail to take into account the likely results of the U.S. being seen as not meeting its Article VI

¹³ James M. Acton, “Nuclear Power, Disarmament, and Technological Restraint,” *Survival* 51:4 (Aug-Sept 2009): 101-126.

¹⁴ Mohamed Shaker, *The Nuclear Non-Proliferation Treaty: Origin and Implementation 1959–1979*, Vol. 2 (London: Oceana Publications, 1980).

¹⁵ Harald Müller, “A Nuclear Nonproliferation Test: Obama’s Nuclear Policy and the 2010 NPT Review Conference,” *The Nonproliferation Review* 18:1 (March 2011), pp. 219-236. Harald Müller, “The Common Project of Nuclear Abolition,” *Shared Responsibilities for Nuclear Disarmament: A Global Debate*, (American Academy of Arts and Sciences, 2010): 28-31.

commitments in recent years. In short, success should be measured, not with respect to the failure to achieve idealized objectives, but rather against the more difficult counterfactual measure of how much worse the situation would have been without a vigorous U.S. disarmament diplomacy policy.¹⁶

A similar phenomenon occurs when policy makers and scholars underestimate the international effect of the U.S. decision to abandon plutonium reprocessing in the 1970s. Skeptics claim that the fact that France and Japan, especially, went forward with their ambitious plutonium reprocessing efforts somehow demonstrates that U.S. efforts to constrain the global growth were a failure. But a more appropriate standard (but again more difficult to measure) for assessing our influence would estimate the number of states that would have developed plutonium reprocessing capabilities if the U.S. had not actively discouraged such fuel cycle activities after Jimmy Carter's April 1977 order to cancel construction of commercial breeder reactors that employed a closed fuel cycle with plutonium reprocessing. The primary motivation behind the decision to postpone the development of this technology was a concern for the proliferation implications of the U.S. use of a closed fuel cycle.¹⁷ The Carter administration reasoned that the decision to end reprocessing in the U.S. would have two effects: first, the U.S. could no longer act as an exporter of related technologies, limiting their availability; and second, it would create a normative change that would redefine the behavior of a responsible nuclear power state.

Because we are estimating a counterfactual condition, it is not possible to measure definitively the effects of the Carter policy on the actual spread of reprocessing facilities around

¹⁶ Scott D. Sagan and Jane Vaynman, "Conclusion: Lessons Learned from the 2010 Nuclear Posture Review," *The Nonproliferation Review* 18:1 (March 2011), pp. 219-236

¹⁷ Jimmy Carter, "Three Steps toward Nuclear Responsibility," *The Bulletin of the Atomic Scientists*, October 1976, 32(8), p. 12.

the world. Of the twenty-one countries that at some point in their history pursued plutonium reprocessing, ten have finished large-scale facilities and use them today: U.S., China, Israel, France, UK, India, Japan, Pakistan, Russia, and North Korea.¹⁸ Algeria and the Czech Republic have a pilot-scale reprocessing plants, but have not moved towards further industrial development.¹⁹ Nine countries abandoned their reprocessing programs: South Korea, Taiwan, Germany, Iraq, Italy, Argentina, Brazil, Belgium, and Yugoslavia.²⁰ The causes of these reversal decisions were complex, but in many of the cases U.S. diplomatic pressure was an important factor and that pressure was made more credible and acceptable because the U.S. had given up its own civilian plutonium reprocessing programs. This “credibility” factor continues to be important today. South Korea is lobbying to renegotiate its agreements with the U.S. to be able to develop “pyro-processing,” a form of spent fuel reprocessing that supporters claim poses fewer proliferation risks than standard PUREX aqueous reprocessing. While this appears a challenge to the claim that the U.S. policy has had a positive influence, the very fact that the South Koreans are actively arguing that pyro-processing – unlike the PUREX process – does *not* separate out plutonium shows their awareness of the power of the norm against developing such technologies. While the U.S. government initially cooperated with South Korea on pyro-processing research, Richard Stratford (Director of the Office of Nuclear Energy Affairs in the Bureau of Nonproliferation, U. S. Department of State) recently stated that the technology

¹⁸ M.D. Zentner, G.L. Coles, R.J. Talbert, *Nuclear Proliferation Technology Trends Analysis*, Pacific Northwest National Laboratory (September 2005), http://www.pnl.gov/main/publications/external/technical_reports/PNNL-14480.pdf. Siegfried Hecker, “Lessons Learned from the North Korean Nuclear Crisis,” *Daedalus* 139:1 (Winter 2010): 44-56.

¹⁹ On Algeria, see Freidrich Steinhausler, “Infrastructure Security and Nuclear Power,” *Strategic Insights*, 2009, <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA534515&Location=U2&doc=GetTRDoc.pdf>. On the Czech Republic, see “Development of Advanced Reprocessing Technologies,” *International Atomic Energy Agency* (2008), http://www.iaea.org/About/Policy/GC/GC52/GC52InfDocuments/English/gc52inf-3-att4_en.pdf.

²⁰ M.D. Zentner, G.L. Coles, R.J. Talbert, *Nuclear Proliferation Technology Trends Analysis*, Pacific Northwest National Laboratory (September 2005), http://www.pnl.gov/main/publications/external/technical_reports/PNNL-14480.pdf. “Serbia,” *Stockholm International Peace Research Institute*, http://www.sipri.org/research/disarmament/nuclear/researchissues/past_projects/issues_of_concern/serbia/serbia_default#reprocessing.

“moved to the point that the product is dangerous from a proliferation point of view,” and that the DOE now “states frankly and positively that pyro-processing is reprocessing.” The U.S. government position against pyro-processing in South Korea today is made more credible by the fact that the U.S. does not reprocess spent fuel for commercial purposes.²¹

Current Policies and Global Security

As demonstrated above, what the U.S. does (and does not do) in the realm of nuclear power and nuclear diplomacy impacts the strength of the nuclear nonproliferation regime as a whole. What are specific examples today where potential changes in U.S. nuclear policy could have a positive influence on nonproliferation and physical security around the world? How could the BRC encourage decisions that are consistent with and supportive of our national security interests regarding nuclear proliferation and nuclear terrorism?

The first set of policy issues concerns IAEA safeguards, multinational versus national ownership, and the separation of military and civilian nuclear facilities. The United States government strongly supports the use of multinational fuel facilities for NNWS, strong safeguards – including acceptance of the IAEA’s Additional Protocol (AP) – and the maintenance of clear lines of separation in nuclear weapons states between military and civilian power facilities. Yet U.S. practices can undermine American leadership in reaching these objectives. To bolster the U.S. stand on multilateralism and nonproliferation, the U.S. government should take three steps: first, open more U.S. nuclear facilities for voluntary IAEA

²¹ Richard A. Stratford, comments during “U.S. Nuclear Cooperation: How and with Whom?”, panel at the 2011 Carnegie International Nuclear Policy Conference, March 28-29, 2011, www.carnegieendowment.org/events/nppCon2011/. For a thorough analysis of proliferation considerations involved in different fuel cycle schemes see Robert Bari et al., “Proliferation Risk Reduction Study of Alternative Spent Fuel Processing Technologies,” BNL-90264-2009-CP, 2009.

safeguards inspections; second, promote multinational ownership of U.S. enrichment facilities; and third, maintain a more clear division between U.S. civilian and military nuclear facilities.

In 1967 President Johnson stated: “we in the United States are not asking any country to accept safeguards that we are unwilling to accept ourselves. So I am, today, announcing that when such safeguards are applied under the Treaty, the United States will permit the International Atomic Energy Agency to apply its safeguards to all nuclear activities in the United States—excluding only those with direct national security significance.”²² Every U.S. president since then has made similar offers to have some American civilian nuclear power facilities placed under IAEA safeguards. These promises have two purposes. First, accepting safeguards shows the world that the U.S. is not pursuing a commercial advantage in nuclear energy, and demonstrates that the U.S. does not view these safeguards as limiting the pursuit of nuclear energy in any way.²³ Second, permitting IAEA inspectors to practice safeguard inspections on certain facilities in the U.S., according to IAEA statements, produces “valuable improvements in inspection procedures and equipment,” which in turn improves inspectors’ ability to deter or detect potential safeguard violations in NNWS.²⁴

The response to Johnson’s “voluntary safeguards” declaration offers another example of the impact of U.S. leadership in the realm of nuclear energy and nonproliferation. Shortly after Johnson’s declaration, the U.K. agreed to identical safeguards²⁵ In February 1978, France then

²² John F. Mahy, Jr. “International Safeguards and Domestic Safeguards Under the President’s Offer,” Paper Presented at the Institute of Nuclear Materials Management Twelfth Annual Meeting (June 29, 1971): 4, www.osti.gov/bridge/purl.cover.jsp;jsessionid=04C56215B4BEAD46202E6BEB040A096A?purl=/4715700-lkj3CN/.

²³ Frank S. Houck. “The Voluntary Safeguards Offer of the United States.” *IAEA Bulletin* (Summer 1985): 5, www.iaea.org/Publications/Magazines/Bulletin/Bull272/27203491318.pdf.

²⁴ Frank S. Houck. “The Voluntary Safeguards Offer of the United States.” *IAEA Bulletin* (Summer 1985): 4, www.iaea.org/Publications/Magazines/Bulletin/Bull272/27203491318.pdf.

²⁵ Agreement Between the United States of America and the International Atomic Energy Agency for the Application of Safeguards in the United States (and Protocol Thereto), dosfan.lib.uic.edu/acda/treaties/usiaaea1.htm.

agreed, followed in 1985 by the Soviet Union.²⁶ President George W. Bush, in his 2002 letter to congress concerning the ratification of the Additional Protocol (AP), wrote of the continued policy to accept IAEA safeguards of nuclear facilities, except those with national security implications.²⁷ Yet a number of non-weapons related U.S. facilities remain off the safeguards list. This includes the new GE-Hitachi SILEX laser enrichment plant in Wilmington, currently kept off the safeguards plant because of concerns that sensitive data may be revealed to the IAEA. As Edwin Lyman writes, “for the U.S. to deny the IAEA access for this reason appears inconsistent with the original rationale for its voluntary offer: namely, that the U.S. was willing to take the same risks that it was asking NNWS to accept. This could provide a precedent for other NWS to exclude the IAEA from advanced fuel cycle facilities by invoking the risk of disclosure of sensitive information.”²⁸ Expanding the list of U.S. facilities available for IAEA safeguards can therefore simultaneously promote transparency as a model to other states, signal the strong U.S. commitment to nonproliferation, encourage other NWS to follow suit, and improve the effectiveness of future IAEA inspections elsewhere. One promising policy for the U.S. government to follow would be to make acceptance of voluntary IAEA safeguards a condition of U.S. loan guarantees, or other financial support, for any new fuel cycle facility.

Part of the challenge that the U.S. faces in expanding its list of safeguarded facilities lies in the occasional blurry line between civilian and military uses of nuclear facilities, such as using the Watts Bar nuclear plant at the Tennessee Valley Authority (TVA) for weapons-related

²⁶ Frank S. Houck. “The Voluntary Safeguards Offer of the United States.” IAEA Bulletin (Summer 1985): 1, www.iaea.org/Publications/Magazines/Bulletin/Bull272/27203491318.pdf.

²⁷ “Message from the President of the United States, transmitting the Protocol Additional to the Agreement Between the United States of America and the International Atomic Energy Agency for the Application of Safeguards in the United States of America, with Annexes, Signed at Vienna June 12, 1998” (May 9, 2002).

²⁸ Edwin Lyman, “Resolving a Safeguards Paradox,” *International Atomic Energy Agency* IAEA-CN-184/324 (2010),

<http://www.iaea.org/OurWork/SV/Safeguards/Symposium/2010/Documents/PapersRepository/3244938985649764720068.pdf>.

activity. Since 2005 TVA facilities have been producing tritium for the U.S. nuclear weapons stockpile, as ordered by a 1993 presidential directive charging the DOE with reestablishing domestic tritium production. This led to the establishment of “a program that uses civilian nuclear reactors to produce tritium for use in the nation’s nuclear weapons.”²⁹ Maintaining this blurry line at one of our own nuclear facilities reduces the clarity and strength of the U.S. diplomatic message that other states must maintain a clear separation between peaceful uses of civilian nuclear power facilities and any potential military application.

The activities of the U.S. Enrichment Corporation (USEC) – formed after the privatization of the U.S. government’s uranium enrichment programs – further exacerbates this problem. USEC has been promoting its American Centrifuges Plant (ACP) as having an important role in maintaining “reliable nuclear deterrence” in the future: “The United States is at risk of losing its only future capability to enrich uranium to meet key national security needs.”³⁰ USEC and the U.S. government claimed, in a joint anti-dumping case against the French-owned Eurodif in 2008 that: “USEC is the sole supplier of LEU used to fuel the government-owned nuclear reactors that produce tritium... the defense department will need a domestic source of enriched uranium produced with U.S. technology to supply its needs. Today, and for the indefinite future, USEC is the only domestic company that employs uranium enrichment technologies available to meet U.S. defense needs.”³¹

This policy is deeply problematic. First, the U.S. government has not compellingly demonstrated that it needs new sources of highly enriched uranium (HEU) to provide for future nuclear weapons needs, especially at a time in which the U.S. is committed to reduce the size of

²⁹ “Tritium Production at TVA,” *Tennessee Valley Authority* (November 2003), www.tva.gov/news/tritium.htm.

³⁰ “National Security,” *The American Centrifuge Project*, www.americancentrifuge.com/nationalsecurity.htm.

³¹ *United States of America v. Eurodif S.A., et al and USEC, INC et.al, v. Eurodif S.S., et al*, Supreme Court of the United States No. 07-1059 and 07-1078, www.usec.com/Downloads/NewsRoom/USECSCOTUSBrief-20080716.pdf.

its nuclear stockpile. Second, claiming that the U.S. needs its own nationally controlled enrichment facility sends the wrong “non-proliferation message” to NNWS considering pursuing their own uranium enrichment facilities, as we are in essence “hedging,” hinting that we may one day want to increase our supplies of HEU for weapons and may want to do this from facilities that also serve civilian power needs. Loan guarantees for the American Centrifuge Plant could be made contingent on an agreement to apply IAEA safeguards to the facility. Whatever the BRC decides about the specific details of future sensitive fuel cycle facilities, it should seek, at a minimum, not make this bad situation worse.

Increasing the degree of multinational ownership of U.S. enrichment facilities could also serve an important model-setting function for other aspiring or existing nuclear power states. There are currently four enrichment facilities under construction in the U.S., two of which are currently under multinational ownership: the URENCO USA facility in Eunice, New Mexico; a General Electric (GE)-Hitachi facility in Wilmington, NC, in conjunction with Australia’s Silex Systems; Areva’s Eagle Rock Enrichment Facility in Idaho; and the ACP. Multinational ownership of enrichment facilities is one important step toward broader multinational control of the critical nuclear fuel cycle facilities. The U.S. supports multinational control schemes for other countries, for they typically add an additional barrier to potential diversion of fissile material and “break-out,” helping stem fears of nuclear proliferation from the spread of civilian technology. Promoting multinational ownership in the U.S. – and advertising this to others – can help set new standards for the spread of civilian nuclear technology.

A second set of policy issues in which the U.S. can provide more leadership concerns efforts to promote strong physical protection against nuclear terrorism. The U.S. nuclear security standards are widely considered to be the “gold standard” for physical protection around the

globe. We have not been as effective as we could be, however, in promoting these standards for us in other countries.

While the Obama Administration's 2010 Nuclear Security Summit, by asking foreign leaders to review and improve their national programs to secure nuclear materials, was certainly a positive step, there is much that the U.S. could do to promote further global physical security improvements. First, UN Security Council Resolution 1540 calls for all states to have "appropriate effective" physical protection systems, but the U.S. has never defined what that means nor, with partners, set up minimum standards to meet that requirement.³² Second, the U.S. has a rich experience in "trial and error" learning regarding adjustments made to our security procedures and design basis threats (DBT) after vulnerabilities were exposed after a terrorist attack or in response to a security violation. The U.S. government has not declassified a detailed history of terrorist plots or attacks against U.S. weapons facilities or power facilities. It would be a major step toward greater transparency, and would help other governments understand the seriousness of the threat, if the U.S. government produced and published such a detailed history of terrorist threats and responses.

Efforts at increased transparency in the U.S. also should remind the leaders of other governments that even the U.S. system is not perfect, and would encourage them to maintain continual vigilance about their own regulatory systems and nuclear protection measures. How has the US DOE and NRC reacted to the growing threat of terrorism? After the September 11 attacks, security at nuclear facilities throughout the U.S. was stepped up to address the growing threat of terrorists attack. According to the NRC, this included "increasing the number of

³² Matthew Bunn, "Reducing the Greatest Risks of Nuclear Theft and Terrorism," *Daedalus Special Issue: On the Global Nuclear Future*, 138: 4 (Fall 2009): 112-123. Matthew Bunn and Evgeny Velikhov, *Promoting Safe, Secure, and Peaceful Growth of Nuclear Energy: Next Steps for Russia and the United States*, Belfer Center for Science and International Affairs (October 2010).

security forces onsite,” “requiring greater training,” “strengthening the design basis threat,” integrating response training with federal, state, and local agencies,” and improving “emergency preparedness programs.”³³ Nevertheless, the case of Sharif Mobley – a former employee of six different nuclear plants arrested in March 2010 in Yemen on terrorism charges – highlights continued concerns about the security of U.S. nuclear power plants. An NRC investigation following Mobley’s arrest found that no reports were filed suggesting that he had become radicalized during his time working in nuclear power plants, from 2002 to 2008. However, some of his co-workers reported suspicious statements, including: “We are brothers in the union but if a Holy War comes, look out.”³⁴ He also made comments expressing his belief that non-Muslims were “infidels,” and perused “unusual” websites, including one displaying an image of a mushroom cloud.³⁵ The NRC review of the case recommended allowing the NRC direct access to background information on nuclear power plant employees; frequently checking employees to the terrorist watch list; improving the culture of security; and require disclosure of all foreign travel.³⁶

My point in raising this case is not to criticize the NRC. It is to call attention to the need for the U.S. government and the NRC to be more transparent in explaining U.S. physical security challenges, improvements over time, and procedures for evaluation and exercises to foreign governments, to encourage them to adopt similar procedures and make similar changes as new threats emerge. U.S. support for influential non-governmental organizations – such as WINS – and U.N. organizations – such as the IAEA – can further enhance their ability to promote strong

³³ “Remarks of NRC Chairman Gregory Jaczko at NRC Security Briefings,” *NRC News* (January 12, 2010), pbadupws.nrc.gov/docs/ML1001/ML100120363.pdf.

³⁴ “Audit of NRC’s Oversight of the Access Authorization Program for Nuclear Power Plants,” *Nuclear Regulatory Commission* (OIG-10-A-21), Sept. 30, 2010, <http://pbadupws.nrc.gov/docs/ML1027/ML102730072.pdf>, p.13

³⁵ “Audit of NRC’s Oversight of the Access Authorization Program for Nuclear Power Plants,” *Nuclear Regulatory Commission* (OIG-10-A-21), Sept. 30, 2010, <http://pbadupws.nrc.gov/docs/ML1027/ML102730072.pdf>.

³⁶ “Audit of NRC’s Oversight of the Access Authorization Program for Nuclear Power Plants,” *Nuclear Regulatory Commission* (OIG-10-A-21), Sept. 30, 2010, <http://pbadupws.nrc.gov/docs/ML1027/ML102730072.pdf>.

global standards and the implementation of physical protection of nuclear facilities and materials in transport and storage. Current standards for physical protection of nuclear facilities vary widely around the world, and are often overly reactive. Through active support and participation in WINS, U.S. companies and the U.S. government can help identify and promote global best practices for the use of Design Basis Threat methodologies, for training guard forces and emergency management teams, and for assessing risks to facilities. The IAEA safeguards inspections discussed above also have a less direct, but nonetheless important, role in promoting physical security. IAEA oversight and the promise of visits encourage vigilance and watchfulness.

The U.S. government could further improve nuclear security by increasing its funding to the Nuclear Security Fund (NSF), an IAEA body established to support activities related to the prevention, detection, and response to nuclear terrorism. Funded entirely by voluntary contributions from member states, the NSF has an annual operating budget of approximately \$33 million.³⁷ U.S. contributions to the Nuclear Security Fund have already risen by 59% from 2007 to 2010.³⁸ However, though the Obama Administration is currently seeking to raise its total voluntary contributions to the IAEA from \$65 million in 2010 to \$85 million in 2011 and to \$107 million in 2012, disputes in Congress over the FY 2011 budget may upend this plan.³⁹ The Blue Ribbon Commission could usefully weigh in on this issue, encouraging Congress to support increases in voluntary funding for the IAEA, recognizing the importance to national security of improving global standards for the control of nuclear material. The BRC should recommend that

³⁷ Mary Beth Nitkin, "Securing Nuclear Materials: The 2010 Summit and Issues for congress," *Congressional Research Service*, April 16, 2010, <http://www.fas.org/sgp/crs/nuke/R41169.pdf>

³⁸ "National Statement of the United States," Nuclear Security Summit, Washington, DC (April 2010), <http://www.whitehouse.gov/the-press-office/nuclear-security-summit-national-statement-united-states>.

³⁹ Daniel Horner, "Administration Budget Request for IAEA Rises," *Arms Control Today* (April 2009), http://www.armscontrol.org/act/2011_04/Brief_4.

the operators of all new U.S. facilities join WINS, in order to share best practices and learn from the experiences of others. Furthermore, the Congress should be urged by the BRC to pass the necessary legislation, including explicit criminalization of acts not currently covered by U.S. code, to bring U.S. laws into compliance with the International Convention for the Suppression of Acts of Nuclear Terrorism and the 2005 Amendment to the Convention on the Physical Protection of Nuclear Material, so that the U.S. may submit the instruments of ratification to the IAEA.⁴⁰ On April 13, 2011, the Obama administration submitted to Congress the legislation required to bring U.S. law into accordance with the provisions of the treaty, stating: “We call on Congress to pass these bills as swiftly as possible so that the United States can fully ratify these treaties and continue to lead the global effort to prevent the world’s most deadly weapons from falling into the hands of terrorists.”⁴¹ Working towards entry into force of these agreements represents an important step in standardizing global nuclear security measures.

While this paper has focused on nuclear safeguards and physical security, in the wake of the Fukushima-Daiichi accident in Japan, it is important to mention one way in which improved nuclear safety and improved nuclear security are connected. The Fukushima Daiichi nuclear reactor crisis should highlight the fact that fuel rods kept in spent fuel ponds inherently create a higher risk of producing an environmental catastrophe – whether caused by natural disaster or a terrorist attack – than are nuclear materials placed in interim dry cask storage.⁴² Currently 63,000

⁴⁰ “National Statement of the United States,” Nuclear Security Summit, Washington, DC (April 2010), <http://www.whitehouse.gov/the-press-office/nuclear-security-summit-national-statement-united-states>. “International Convention for Suppression of Acts of Nuclear Terrorism,” U.S. Senate Session, Exec. Rept. 110-23 (September 11, 2008).

⁴¹ “Statement by the Press Secretary on the Submission of Legislation Required for Four Key Nuclear Security Treaties,” Office of the Press Secretary, the White House, April 13, 2011, <http://www.whitehouse.gov/the-press-office/2011/04/13/statement-press-secretary-submission-legislation-required-four-key-nucle>.

⁴² See Robert Alvarez, “What About the Spent Fuel?” *Bulletin of the Atomic Scientists* 58:1 (Jan/Feb 2002): 45-47 and Hui Zang, “Radiological Terrorism: Sabotage of Spent Fuel Pools,” *INESAP: International Network of Engineers and Scientists Against Proliferation* 22 (December 2003): 75-78

tons of spent fuel sit in U.S. nuclear fuel facilities, and can remain on-site for 60 years beyond the licensed life of any reactor.⁴³ The U.S. Nuclear Regulatory Commission added extra safety and security measures and spent fuel panels after September 11, but it was only after the March 2011 crisis in Japan that the NRC was transparent about “having utilities prepare to use fire hoses to pump in extra water in the event ordinary cooling systems are knocked out” in the wake of a natural disaster or attack.⁴⁴ The NRC has not, however, provided detailed assessments of alternative measures, such as the use of long-lived batteries for back up power sources, to prevent loss of water circulation. Moreover, the Fukushima accident should lead to consideration of more fundamental changes. The U.S. should accelerate the use of dry cask storage, but not only because it would reduce risks of terrorist attacks or natural disasters in the U.S., but also because it would model better practices for the many other nations that keep their spent fuel for very long periods of time in, often overcrowded, fuel ponds.

Conclusions:

Specific nuclear energy policy proposals, and how best to evaluate trade-offs between competing objectives, can and should be debated in the United States. In these debates, however, it is important to recognize that American nuclear policies play an important role in shaping – if not fully determining – the decisions made in other capitals regarding nuclear power, the nuclear fuel cycle, and nuclear security. The U.S. has an opportunity to promote a safer and more secure global nuclear future by adopting policies that encourage other countries to restrict the spread of sensitive fuel cycle facilities and to adopt higher standards for nuclear safety,

⁴³ “Fukushima Shines Light on U.S. Problem: 63,000 Tons of Spent Fuel, *CNN* (March 31, 2011), available at <http://edition.cnn.com/2011/US/03/30/spent.nuclear.fuel/>. “NRC News,” *U.S. Nuclear Regulatory Commission* (September 15, 2010).

⁴⁴ Matthew L. Wald and Joseph Berger, “Regulator Says Fuel Pools at U.S. Reactors are Ready for Emergencies” (March 20, 2011), www.nytimes.com/2011/03/21/us/21nuke.html?scp=1&sq=jaczko%20terrorism&st=cse.

security and safeguards. The Blue Ribbon Commission should encourage the U.S. government to place nuclear non-proliferation and nuclear terrorism prevention very high on its priority list of objectives as it makes domestic nuclear energy decisions and should support steps that better contribute to global nuclear non-proliferation and global nuclear security.