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INSIDE | Obama Calls for Deeper Nuclear Cuts

IN THIS ISSUE

Dealing With South Korea’s Spent Fuel Challenges Without Pyroprocessing
By Ferenc Dalnoki-Veress and Miles A. Pomper

How the Private Sector Can Do More To Prevent Illicit Trade
By Daniel Salisbury

IN THE NEWS

U.S. Says Chemical Weapons Used in Syria
‘More Active’ Talks Needed, Rouhani Says
Nunn-Lugar Program Scaled Back
67 States Sign Arms Trade Treaty
NSG Revises List, Continues India Debate
Expert Group Coalesces On Cyberspace
U.S. Seeking Unity For N. Korea Talks

The Future of Plutonium Disposition
By Tom Clements, Edwin Lyman, and Frank von Hippel
Madeleine Albright
Noam Chomsky
Mikhail Gorbachev
Richard Holbrooke
John Kerry
Sergei Khrushchev
Ricardo Lagos
John McCain
Jeffrey Sachs
Joseph Stiglitz
Stephen Walt
Martin Wolf
Paul Wolfowitz
Fareed Zakaria

And more.

THE BROWN JOURNAL
WORLD AFFAIRS
Focus

Obama’s Nuclear Challenge
By Daryl G. Kimball

In Brief

Features

The Future of Plutonium Disposition
By Tom Clements, Edwin Lyman, and Frank von Hippel
The Obama administration is reviewing its current strategy of turning excess weapons plutonium into reactor fuel. That is promising news. There are several direct-disposal options that would avoid many of the costs, complications, and risks of plutonium-based fuels.

Dealing With South Korea’s Spent Fuel Challenges Without Pyroprocessing
By Ferenc Dalnoki-Veress and Miles A. Pomper
South Korea’s timetable for pursuing pyroprocessing, a variant of reprocessing, has been a source of unnecessary friction between Seoul and Washington. South Korea’s most pressing needs are to identify short-term measures for storing its spent fuel and to initiate a long-term plan for a spent fuel repository.

How the Private Sector Can Do More to Prevent Illicit Trade
By Daniel Salisbury
Efforts to make companies more aware of illicit procurement attempts and strengthen the firms’ ability to identify suspicious inquiries are proving crucial in the battle to prevent proliferation. Involving entire supply chains, rather than individual companies, greatly magnifies the impact of this approach.
News

The Middle East and Africa

29 U.S. Says Chemical Weapons Used in Syria
The U.S. intelligence community has “high confidence” that the Syrian regime used chemical weapons on a small scale, the White House said.

31 ‘More Active’ Talks Needed, Rouhani Says
Iran’s newly elected president, Hassan Rouhani, said he hopes to negotiate a settlement to end the international controversy over Tehran’s nuclear program.

Europe and the Former Soviet Union

33 Nunn-Lugar Program Scaled Back
Russia and the United States have replaced the 20-year-old Nunn-Lugar program to provide U.S. assistance to secure and dismantle Russia’s excess weapons of mass destruction with a more limited agreement.

The World

35 67 States Sign Arms Trade Treaty
A treaty that imposes new standards and reporting requirements on the global conventional weapons trade was opened for signature.

36 NSG Revises List, Continues India Debate
The Nuclear Suppliers Group completed a revision of its list of controlled exports and continued its internal debate on admitting India as a member.

37 Expert Group Coalesces on Cyberspace
A UN group of governmental experts for cyber issues reached a “landmark consensus” decision on how current international law applies to state behavior in cyberspace.

Asia and Australia

39 U.S. Seeking Unity for N. Korea Talks
The United States will focus on coordinating with partner countries in the region before negotiating with North Korea over dismantling its nuclear program, the U.S. special representative for North Korea said.
The United States and the Americas

41  Obama Calls for Deeper Nuclear Cuts
The U.S. president laid out his arms control agenda, prompting a cool reply from Russia and a partisan reaction from Capitol Hill.

43  Pentagon: New Missile Site Unneeded
The Pentagon said it does not need a new missile defense site on the East Coast, but the House approved funding for a new site, drawing a presidential veto threat.
Obama’s Nuclear Challenge

In his June 19 address in Berlin, President Barack Obama sought to jump-start progress on his second-term nuclear risk reduction agenda. The president declared, “So long as nuclear weapons exist, we are not truly safe. Peace with justice means pursuing the security of a world without nuclear weapons, no matter how distant that dream may be. Complacency is not in the character of great nations.”

Doing nothing in the face of grave nuclear weapons threats is not an option. Obama’s renewed call to action for further nuclear cuts and U.S. ratification of the Comprehensive Test Ban Treaty (CTBT) is welcome and overdue.

Obama’s centerpiece announcement was that he had completed a review of nuclear weapons employment guidance and determined that the United States can reduce the number of strategic nuclear weapons it deploys by up to one-third—from 1,550 under the New Strategic Arms Reduction Treaty (New START) to between 1,000 and 1,100—and would seek reciprocal Russian reductions through negotiations.

Unfortunately, the scope of Obama’s nuclear disarmament proposals is too modest and the pace of action too slow. The cuts outlined by the president are a good start, but a level of 1,000 to 1,100 is only 200 to 300 warheads below the number to which the United States was prepared to agree during the negotiations on New START four years ago if Russia had not insisted on setting a ceiling of 1,550 through the year 2021.

In the 21st century, 1,000 deployed strategic warheads provide more than enough nuclear firepower to deter any current or potential nuclear adversary. In April 2012, former Sen. Chuck Hagel (R-Neb.), who now is secretary of defense, endorsed a study recommending the United States move toward a nuclear force of 450 deployed strategic weapons by 2022.

In the weeks ahead, the president must follow up on his Berlin speech by making a stronger case for why much deeper strategic nuclear reductions improve U.S., Russian, and global security. Although a healthy majority of the American public and most U.S. senators support further reductions of nuclear weapons deemed in excess of deterrence requirements, some senators oppose reductions of any kind, while others insist that any further nuclear cuts should be made only through a new, formal agreement subject to Senate approval.

Congress surely needs to be consulted, but it should not put unnecessary roadblocks in the way of a more cost-effective and appropriately sized nuclear force. The Joints Chiefs of Staff, the Pentagon, and the White House already have determined that at least one-third of the current deployed strategic nuclear force is superfluous to U.S. nuclear military requirements.

Republican senators need to recognize that, by insisting on new treaty negotiations, they could give Russian President Vladimir Putin a veto over cuts of unnecessary and expensive U.S. strategic nuclear weapons. Even after the cancellation in March of U.S. plans for more-sophisticated missile interceptors in Europe, Moscow is reluctant to begin formal treaty talks. If talks do begin, they will be more complex and time consuming than New START.

U.S. and Russian leaders need not wait for a follow-on treaty. As they explore options for a new treaty, Obama and Putin should announce parallel, reciprocal reductions to 1,000 or fewer strategic deployed warheads within the next five years, to be verified using the monitoring provisions established by New START.

This strategy would help compel Russia to build down rather than build up its strategic nuclear forces. Russia, whose nuclear force already is below the New START limits, is developing a new, heavy intercontinental ballistic missile to match U.S. force levels. More-rapid reductions of U.S. and Russian nuclear forces, which comprise 95 percent of global stockpiles, also would increase pressure on China and other nuclear-armed states to join the nuclear disarmament enterprise, an objective that leaders in Russia and United States say they support.

By scaling back its nuclear force to 1,000 deployed strategic warheads, the United States can trim $39 billion from the Defense Department’s costly plan for new strategic submarines, missiles, and bombers over the next decade, according to a 2013 Arms Control Association analysis.

In Berlin, Obama pledged to “work with our NATO allies to seek bold reductions in U.S. and Russian tactical weapons in Europe.” Unfortunately, NATO has been unable to reach agreement on new proposals for tactical nuclear arms control. For its part, Russia says it will not consider limits on its far larger stockpile of tactical nuclear weapons until all such U.S. weapons are withdrawn from Europe.

More than 20 years after the end of the Cold War, there is no military rationale for Russia’s arsenal of 2,000 tactical nuclear warheads, nor is there any military requirement for the 180 U.S. nuclear bombs in Europe. Bolder action is required to break the impasse. Obama should call Russia’s bluff and announce he is prepared to withdraw the remaining U.S. tactical bombs within five years and put pressure on Russia to take reciprocal action.

To overcome the challenges standing in the way of a world free of nuclear weapons, Obama and his team will need to devote greater energy, creativity, and determination to the cause.
In BRIEF

Notable Quotable
“[N]ot all that we desire in [U.S. nuclear] modernization can be afforded, and what we do get, we may not get on original timelines.”

—John Harvey, principal deputy assistant secretary of defense for nuclear, chemical, and biological defense programs, Washington, June 13, 2013

Five Years Ago in ACT
New Presidents, New Agreements? Advancing U.S.-Russian Strategic Arms Control

“Despite the poor political atmosphere between Russia and the United States, there are good opportunities to achieve a timely replacement to START and to begin developing new joint cooperation on national missile defenses.”

—Alexei Arbatov and Rose Gottemoeller

BY THE NUMBERS

Goals for U.S. Nuclear Arsenal Size
(numbers of deployed strategic warheads)

1,700-2,200
Level set by President George W. Bush through the 2002 Strategic Offensive Reductions Treaty, to be achieved by 2012

1,550
Level set by President Barack Obama through 2010 New Strategic Arms Reduction Treaty,* to be achieved by 2018

1,000-1,100
Goal announced by President Barack Obama in June 2013

*Under New START, each heavy bomber is counted as one warhead because the United States and Russia do not typically place their nuclear bombs or cruise missiles on bombers, but rather keep those weapons in storage. Because bombers can carry multiple warheads, the number of deployable warheads allowed by the treaty actually is higher than 1,550.

Source: Arms Control Association
News Briefs

U.S., Allies to Strengthen WMD Initiative

The United States and other participants in the Proliferation Security Initiative (PSI) will seek new legal authorities to conduct interdictions of shipments of goods related to weapons of mass destruction (WMD) and will begin conducting more-regular interdiction exercises, the U.S. State Department announced in a May 28 press release.

The announcement came after delegates from 72 states met for a high-level political meeting in Warsaw May 27-28 to commemorate the initiative’s 10th anniversary and discuss its future. The PSI seeks to increase participants’ capacity to interdict illegal trafficking of nonconventional weapons, their delivery systems, and related materials through international cooperation.

The initiative, which was launched by President George W. Bush in May 2003, is an informal, voluntary arrangement without a permanent institutional structure. To date, 102 countries have endorsed the PSI.

At the Warsaw meeting, the United States pledged to finalize accession to the 2005 protocol to the Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation and the 2010 Convention on the Suppression of Unlawful Acts Relating to International Civil Aviation. The conventions criminalize the transportation by ship or aircraft of materials related to nuclear, biological, and chemical weapons.

The PSI itself does not create new law. Instead, it relies on existing legal instruments to give states the authority to conduct interdictions. The United States signed the maritime convention in 2006 and the aviation convention in 2010, but the Senate has yet to approve them.

The event in Warsaw was the first high-level meeting in five years. Most planning for the initiative takes place during meetings of the PSI Operational Experts Group, which occur more frequently. The experts group comprises 21 states, primarily from Europe and North America.

In its 2010 National Security Strategy document, the Obama administration pledged to turn the initiative into a “durable international effort.” A recent report from the Stockholm International Peace Research Institute said the initiative could benefit from reforms such as increasing the experts group’s geographic diversity. In a June 20 e-mail to Arms Control Today, a U.S. State Department official said there had been no discussion of reforming the experts group at the Warsaw meeting.

The official said that the United States is aiming to promote PSI participation in Southeast Asia, Africa, and the Western Hemisphere.

—IAN WILLIAMS

U.S. Pursues Penalty for Renouncing NPT

The U.S. government is “cautiously optimistic” that the parties to the nuclear Nonproliferation Treaty (NPT) will be able to reach agreement at the treaty’s 2015 review conference on “a meaningful way” to respond to countries that withdraw from the pact, a senior U.S. official said June 18.

Speaking at the George Washington University’s Elliott School of International Affairs, Thomas Countryman, assistant secretary of state for international security and nonproliferation, said the treaty parties are “very near consensus” that the issue should be addressed.

A key issue, as Countryman framed it, is that a country that joins the NPT can take advantage of the opportunity to receive peaceful nuclear assistance under the terms of the treaty but then withdraw and “apply those technologies for nuclear weapons purposes.”

Article X of the treaty says that a party has the right to withdraw on three months’ notice “if it decides that extraordinary events, related to the subject matter of [the NPT], have jeopardized [its] supreme interests.” The issue gained importance after North Korea announced its withdrawal from the treaty in 2003, an action that NPT members have not officially recognized.

Since the 2003 announcement, the United States has “aggressively” pursued the issue of how to respond to a party’s withdrawal, Countryman said. In the preparatory meetings for the 2015 conference, the United States is seeking to foster agreement that “withdrawal cannot be without consequences,” he said. “But there are so many ideas about how you deter and how you respond to a threat of withdrawal, that I think we have more work to do in the next two years,” he said.

At the most recent NPT preparatory meeting, held April 22-May 3 in Geneva, the parties discussed the issue of withdrawal, according to a summary by the meeting chairman, Cornel Feruta of Romania. The summary said that some countries “stressed” that a withdrawing country “remained responsible under international law for violations committed” while it was a party to the treaty, a point that often comes up in discussions of North Korea’s actions.

But the summary cited some parties as “affirm[ing] that they did not support efforts to reinterpret or restrict the sovereign
right of withdrawal” and “emphasis[ing] the importance of encouraging” countries to remain parties to the treaty, in part by “addressing the root causes that might lead [them] to withdraw.”

At the June 18 event, Countryman said he would include the United States among the countries that “do not wish to amend Article X.” He decried the “deliberate misunderstanding on the part of some to imply that we are trying to tinker with an important right that is contained within the treaty and to abrogate that right.” The U.S. goal, he said, is “a series of measures that would be an appropriate reaction to blatant, deliberate abuse of the treaty.” When the issue is framed that way, fewer states oppose it, he said.—DANIEL HORNER

GAO Studies IAEA Nuclear Security Funds

Efforts by the International Atomic Energy Agency (IAEA) to help countries improve nuclear security are hampered by a heavy reliance on so-called extra-budgetary contributions from member states, the U.S. Government Accountability Office (GAO) said in a report released June 17.

Relying on the extra-budgetary funds makes planning difficult for the IAEA, because the funding level fluctuates from year to year, the GAO said. IAEA member states provide such funds on top of their assessed contribution to the agency.

Another problem with the extra-budgetary funds is that the contributing countries often direct them to specific projects, the report said. The GAO, the investigative arm of Congress, recommended that the State Department “evaluate the nuclear security program’s long-term resource needs and assess whether the [IAEA’s] heavy reliance on extra-budgetary contributions is sufficient to plan and meet those needs.” In its response, published in the GAO report, the State Department disagreed. It acknowledged that “[b]y its nature,” extra-budgetary funding is “voluntary, unpredictable, and often comes with conditions,” but said that “given the limited regular budget for nuclear security, the IAEA will continue to rely heavily” on the extra-budgetary funds.

The report also covers the IAEA’s work to strengthen its safeguards program and establish a nuclear fuel bank.—DANIEL HORNER

Reports of Note

Iran After the Bomb: How Would a Nuclear-Armed Tehran Behave?

Alireza Nader, RAND Corporation, June 2013

In this report, Alireza Nader, an international policy analyst at the RAND Corporation, analyzes Iran’s possible course of action after acquiring nuclear weapons. Nader argues that although Iran’s acquisition of these weapons would provide its regime with the ultimate deterrent against the main U.S. allies in the region, namely Israel and the members of the Gulf Cooperation Council (GCC), the weapons would not change Iran’s fundamental goals and strategy. The report says that Iran is unlikely to engage in a nuclear exchange with Israel due to the latter’s superior conventional and nuclear military capabilities. Nuclear weapons also are unlikely to be useful in coercing the GCC states, given Tehran’s diminishing influence in the region in light of its weak economy and the Arab Spring, the report says. Nader also argues that Iran is unlikely to use its nuclear weapons to protect groups such as Hezbollah and Hamas or to share its nuclear technology with them because the groups’ goals often diverge from those of Iran. The report acknowledges that Iran’s possession of nuclear weapons is likely to have a destabilizing effect in the Middle East and that an accidental nuclear exchange with Israel is a dangerous possibility. Yet, it argues, even if the regime were to fall, there is not much evidence suggesting that rogue elements would have easy access to Iran’s nuclear weapons.—VICTOR SILVA

Strengthening the European Union’s Future Approach to WMD Non-Proliferation

Ian Anthony and Lina Grip, Stockholm International Peace Research Institute, June 2013

Ian Anthony and Lina Grip of the Stockholm International Peace Research Institute examine the European Union’s non-proliferation regime for weapons of mass destruction (WMD) and make recommendations for improving it. They argue that the 2003 EU WMD strategy, based on strengthening multilateral institutions and global norms, has been successful in many ways and has helped provide a balance to the militarily oriented counterproliferation strategy of the United States during the mid-2000s.

The report identifies several ways to improve the cohesion of the various efforts by EU states. For example, it describes how the free movement of materials throughout the EU could allow nonstate actors to acquire and traffic in sensitive, dual-use items. Anthony and Grip recommend that the European Commission objectively assess the hazards of WMD materials within the EU, create common EU standards limiting the availability of these sensitive items, and craft a strategy to effectively respond to and recover from WMD use. The report recommends expanding the role of the European External Action Service’s WMD Monitoring Centre to provide broader strategic oversight of EU WMD nonproliferation efforts.—IAN WILLIAMS

On the Calendar

<table>
<thead>
<tr>
<th>Date</th>
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<tbody>
<tr>
<td>July 29-</td>
<td>Conference on Disarmament, third part, Geneva</td>
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<td>September 13</td>
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<td>September 5-6</td>
<td>Group of 20 summit, St. Petersburg, Russia</td>
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<td>September 9-13</td>
<td>International Atomic Energy Agency Board of Governors meeting, Vienna</td>
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<td>September 10-13</td>
<td>Convention on Cluster Munitions meeting of states-parties, Lusaka, Zambia</td>
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<td>September 16-20</td>
<td>IAEA General Conference, Vienna</td>
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<td>September 26</td>
<td>High-level meeting of UN General Assembly on nuclear disarmament, New York</td>
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<td>September 27</td>
<td>Conference on facilitating the entry into force of the Comprehensive Test Ban Treaty, New York</td>
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The Future of Plutonium Disposition

In 2000 the United States and Russia signed a Plutonium Management and Disposition Agreement (PMDA),¹ in which each side agreed to dispose of at least 34 tons² of weapons plutonium made surplus by the reductions in its Cold War nuclear arsenal. President Barack Obama has described the combined 68 tons of plutonium as enough “for about 17,000 nuclear weapons.”³

In part, the PMDA was intended to demonstrate to other member states of the nuclear Nonproliferation Treaty that the large cuts in the Soviet and U.S. warhead stockpiles at the end of the Cold War were irreversible. An additional U.S. motivation was to minimize the risk that the plutonium made excess by the warhead reductions, especially in Russia, might become a target of nuclear theft.

The PMDA is in the news again today because the Obama administration announced in April in the Department of Energy budget request to Congress for fiscal year 2014 that the “current [U.S.] plutonium disposition approach may be unaffordable…due to cost growth and fiscal pressure” and that the administration “will assess the feasibility of alternative plutonium disposition strategies.”⁴ As detailed below, there are other issues in addition to funding that have arisen in connection with the U.S. and Russian plutonium disposition programs. The administration and congressional reviews of the program should deal with as many of these issues as possible without compromising the overall objective of reducing the global stockpile of weapons-useable separated plutonium.

Background
In the 2000 agreement, the United States committed to disposing of 75 percent of the 34 tons of plutonium by using it in mixed-oxide (MOX) fuel—so called because it is a mixture of uranium and plutonium oxides—and irradiating the MOX fuel in light-water reactors. The remaining 25 percent, which the United States judged too impure to use for MOX fuel fabrication, was to be “immobilized,” that is, it would be embedded in fission-product waste from military reprocessing plants at the Savannah River Site in South Carolina as that waste was “vitrified,” or mixed with molten glass.

Beyond the 34 tons of material covered by the PMDA, the United States also has declared excess an additional nine tons of plutonium from warhead pits and 12 tons of unirradiated plutonium that is impure, not weapons grade, or both.

Russia consented to the U.S. “dual track” plan although it had reservations about immobilization because, unlike irradiation of MOX fuel, it would not alter the isotopic mix of the plutonium from weapons grade. Yet, it is the view of
the U.S. nuclear weapons establishment that changing the isotopic mix of plutonium to that in power reactor spent fuel has little effect on the ability of an advanced nuclear-weapon state to utilize the plutonium for weapons.5

For its part, Russia was interested in using its excess weapons plutonium to fuel liquid-sodium-cooled fast-neutron reactors that had not yet been built. The United States argued that this would unduly delay disposition, and Russia reluctantly agreed to dispose of its plutonium in parallel with the United States, mostly in MOX fuel in existing water-cooled power reactors.6

In 2002 the Bush administration decided to cancel one of the two U.S. tracks as a cost-saving measure. Internal Energy Department analyses found that immobilization would be less costly than irradiation of MOX fuel. In view of Russia’s objection to immobilization, however, the department concluded that it had to choose the more costly MOX option. Elimination of the immobilization track reduced costs, but the need to add chemical processing lines to remove troublesome impurities from plutonium that originally had been slated for immobilization is one of many reasons for the subsequent cost escalation of the MOX program from an estimated total cost of $3.1 billion ($3.9 billion in 2012 dollars)6 to $18 billion for the plant and its operations during disposition of the 34 tons of plutonium.7

To implement the agreement, both countries needed to construct costly facilities to fabricate MOX fuel and to adapt operating reactors to utilize it. Without full external funding, however, Russia was not willing to pursue a plan it did not fully support. As the estimated costs of both MOX plants increased, the funding that the United States and its allies were willing to commit to Russia for this purpose became insufficient.

In 2010, therefore, Russia and the United States concluded a revision of the PMDA under which Russia would be allowed to use its excess weapons plutonium to fuel its operational BN-600 and under-construction BN-800 demonstration fast-neutron reactors. In the revised PMDA, the United States committed to support and monitor the Russian plutonium-disposition program with up to $400 million “subject to the U.S. budgetary review process and the availability of appropriated funds.” At least $100 million of this amount is reserved, however, for activities relating to verification of the disposition of Russia’s plutonium.7

The National Nuclear Security Administration (NNSA)—the semiautonomous arm of the Energy Department whose responsibilities include the plutonium-disposition program—has opened negotiations with Rosatom, the government-owned company that runs Russia’s nuclear-energy and nuclear weapons programs, on “milestones” at which installments of the $400 million could be disbursed.8

Thus far, however, Russia has been financing by itself the construction of a MOX fuel fabrication facility at Zheleznogorsk for its fast-neutron reactors.9

The intention of Russia’s nuclear establishment is to use its fast-neutron reactor program to launch what Glenn Seaborg, chairman of the U.S. Atomic Energy Commission during the 1960s, called a “plutonium economy” in which plutonium would be used to fuel fast-neutron “breeder” reactors that would produce more plutonium than they fissioned and in whose fuel cycle the plutonium would be separated and recycled indefinitely.9

Therefore, Russia does not intend the disposition of its excess weapons plutonium to be permanent. The revised

The partially completed facility in South Carolina for turning excess U.S. weapons plutonium into mixed-oxide fuel for nuclear power reactors is shown in this March 29 photo. The U.S. government is reassessing its plans for the facility.
PMDA commits Russia, however, to not reseparate the plutonium covered by the agreement until all 34 tons have been irradiated. Before that time, Russia can reprocess up to 30 percent of the fuel discharged by the BN-800, provided that it was made with plutonium other than disposition plutonium. Russia has been separating an average of 1.4 tons of civilian plutonium per year at its Mayak reprocessing plant since 1996 and, as of the end of 2011, had 50 tons of separated civilian plutonium in addition to its excess weapons plutonium. At this point, the primary way in which the PMDA is affecting Russia’s plutonium program is by assuring that Russia will use its excess weapons-grade plutonium in breeder reactor fuel before its civilian “reactor-grade” plutonium.

The United States began construction of its MOX fuel fabrication facility in 2007 at the Energy Department’s Savannah River Site. As work progressed, however, the estimated cost of the U.S. MOX program continued to grow rapidly, and in April 2013, the Obama administration decided to look at alternatives. The British and Japanese also have encountered major problems with their MOX programs, and even France’s program is not problem free (see sidebar, page 12).

Decisions about plutonium disposition have been and are being made in the context of a 40-year-old international debate over the proliferation implications of civilian spent fuel reprocessing, that is, the separation of plutonium from spent power-reactor fuel and its use in fresh fuel. That debate was triggered by India’s use in its 1974 “peaceful nuclear explosion” of plutonium nominally separated for breeder reactor research and development. In part due to U.S. diplomatic efforts and the poor economics of separating plutonium and recycling it into reactor fuel, today only one non-nuclear-weapon state, Japan, reprocesses its spent fuel.

When the Clinton administration committed to a MOX program in 1997, it tried to make clear that the U.S. MOX plant should not be seen as a justification for the separation and recycling of plutonium, the approach that France has taken. Areva, the French government-owned company that designed and has been a lead contractor for the U.S. MOX plant, apparently has not accepted the U.S. policy. Areva lobbied the Bush administration to buy a reprocessing plant and has been encouraging the employees and neighbors of the Savannah River Site to think of the MOX program as a first module in a massive, commercial spent fuel reprocessing program that would guarantee the site’s future.

U.S. Reassessment

In April 2013, the Obama administration revealed that, as the result of a “bottom-up review” of the MOX project, the project contractor, Shaw Areva MOX Services, had found that the estimated cost for building the MOX facility had increased from $1.1 billion in 2002 and $4.8 billion in 2008 to $7.7 billion in 2013. The NNSA estimates that the facility is 60 percent complete. As noted above, the estimated total cost for disposing of the 34 tons of excess U.S. plutonium covered by the PMDA, including the costs of operating the MOX facility but not the cost of extracting the plutonium from excess weapons “pits” or the cost of disposing of the spent MOX fuel, has climbed to $18 billion. (Extracting the plutonium from the pits will be a very costly project in its own right. The costs may partly depend on which disposition option the United States chooses, but this article does not discuss those costs.)

In its detailed justification for its budget request for fiscal year 2014, the NNSA announced that “considering the preliminary cost increases and the current budget environment,” the administration is conducting an assessment of alternative plutonium disposition strategies in fiscal year 2013 and identifying options for fiscal years 2014 and onward. As a result, the NNSA

All [the direct-disposal] options would avoid the costs and risks of transport, storage, and utilization of unirradiated MOX fuel.
maintain strict compliance with certain NRC material control and accounting regulations, for example, the requirement that items containing two kilograms or more of plutonium be inspected on a periodic basis to verify their presence and integrity. Such corner-cutting undermines U.S. efforts to strengthen the security of nuclear weapons-usable materials worldwide.

Third, Russia and the United States agreed in their 2000 PMDA that the International Atomic Energy Agency (IAEA) would verify their plutonium disposition once the plutonium was in unclassified form, but negotiations with the IAEA on the verification arrangements have stalled. In April, at the 2013 Carnegie International Nuclear Policy Conference, IAEA Director-General Yukiya Amano could only report that “[r]ounds of discussions have taken place. And we are continuing these efforts.”

The PMDA will have to be renegotiated again if the United States decides not to proceed with its costly MOX program and switches to direct disposal of the plutonium without irradiation in a reactor. Because it is not a treaty, it can be changed simply by mutual agreement in writing. A first meeting between U.S. and Russian negotiators to discuss the potential need for changes to the agreement took place on April 25.

Alternatives to the MOX Program
The two main alternatives to the use of reactor fuel for plutonium disposition are continued storage and direct disposal.

Each of these could be the subject of an in-depth analysis with regard to cost, technical readiness, occupational risks, security from diversion, verifiability, and perceptions of irreversibility on the parts of Russia and the rest of the concerned international community. The description and analysis below are intended to serve as a brief overview and introduction to the policy discussion.

With regard to storage, most U.S. excess plutonium currently is in weapons pits stored inside insulated double containers in bunkers at the Energy Department’s Pantex warhead assembly-disassembly plant outside Amarillo, Texas. Most of the remaining plutonium covered by the PMDA is among the 13 tons stored, mostly in the form of plutonium dioxide powder, in double-walled containers in the K-Area Material Storage facility, located in an old reactor building at the Savannah River Site. These storage arrangements are relatively safe and secure and could continue for a decade or more, but they are not a permanent solution.

With regard to direct disposal, the alternatives include disposal in the Energy Department’s Waste Isolation Pilot Plant (WIPP), immobilization with high-level reprocessing waste, and immobilization in a ceramic matrix and disposal in a deep borehole.

All these options would avoid the costs and risks of transport, storage, and utilization of unirradiated MOX fuel. The immobilization options, however, would require interim storage pending geological disposal.

\[\text{Disposal in WIPP. The Energy Department already is disposing of plutonium-contaminated waste in caverns mined out of a salt deposit 650 meters under southeast New Mexico. About five tons out of a projected total of 10 tons of plutonium in waste had been emplaced there as of 2009.}\]

In addition, the Energy Department has approved the shipment of up to 0.585 tons of contaminated plutonium to WIPP from the Savannah River Site after converting it into oxide powder, diluting it with a classified “inert” material, and placing it in double-walled containers for a resulting container volume of 1.4 cubic meters per kilogram of plutonium. An official at the Savannah River Site has estimated that this disposal route costs about $100,000 per kilogram of plutonium, about one-fifth of the current per-kilogram cost estimate for the MOX project.

The work of diluting and packaging the waste plutonium is being done in the Savannah River Site HB-line glove box facility. Operating on a one-shift basis, the throughput of this facility would be 0.6 tons per year. The HB line is not a “Category I” facility with security arrangements for processing weapons quantities of plutonium. As a small facility, perched on top of the H-Canyon reprocessing building, however, it might be possible to upgrade it to Category I.

The Energy Department could dispose of more plutonium in this manner, but as of the end of fiscal year 2013, about 85,000 cubic meters of plutonium-contaminated waste already had been emplaced in WIPP, half of the limit of 175,600 cubic meters of transuranic waste that the Waste Isolation Pilot Plant Land Withdrawal Act of 1996 imposes. The
Plutonium Disposition: The International Context

The original reason for industrialized-country initiatives to launch large-scale civilian reprocessing in the 1970s was to obtain plutonium fuel to start up liquid-sodium-cooled plutonium “breeder” reactors that were to be deployed by the thousands by the year 2000. In fact, breeders were not deployed. They were found to be costly and unreliable, and they were a solution to a problem of costly uranium that did not materialize. Of the 31 countries with operating nuclear power plants today, only India and Russia are building new demonstration breeder reactors (one each). Due to institutional inertia, four more countries are still separating plutonium in civilian spent fuel reprocessing programs. France is reprocessing on a large scale and China on a small scale. The United Kingdom recently decided to wind down its large reprocessing plant in the village of Rokkasho would separate about eight tons of plutonium per year. If the reprocessing plant begins loading fresh MOX fuel.4

Operating at design capacity, Japan’s new reprocessing plant in the village of Rokkasho would separate about eight tons of plutonium per year. If the reprocessing plant begins operations next year as currently planned, Japan’s domestic stockpile of separated plutonium will grow very rapidly.

The United Kingdom had about 90 tons of its own civilian separated plutonium as of 2011, plus 28 tons of foreign plutonium, primarily Japanese.5 Starting in 2001, the United Kingdom operated a MOX plant at its Sellafield reprocessing site to fabricate MOX fuel for its foreign reprocessing customers, but the plant was able to produce at an average of only about 1 percent of its design capacity and was abandoned in 2011. The currently preferred plan of the British Department of Energy and Climate Change is to have Areva build a new MOX plant in the United Kingdom, but a final decision cannot be made until contracts to use the MOX fuel that it would produce can be signed.6 This process will take years because the United Kingdom currently has only one light-water power reactor, which could absorb only about half a ton of plutonium in MOX fuel per year.7 The British government currently is trying to provide incentives to foreign vendors to build additional light-water reactors in the United Kingdom to replace its aging gas-cooled reactors.– FRANK VON HIPPEL

ENDNOTES


7. Sizewell B, the United Kingdom’s only LWR, requires about 20 tons of uranium in its fuel per year. LWRs not specifically designed to use MOX fuel typically can replace only about one-third of their conventional fuel assemblies with MOX fuel assemblies containing about 6 to 8 percent plutonium.
Energy Department has said that WIPP has only 19,700 cubic meters of space that is not already allocated for identified waste at the department’s sites. At 1.4 cubic meters per kilogram, this space could accommodate an additional 14 tons of plutonium. It would take a 25 percent increase in the WIPP volume limit to accommodate the remaining 31 tons of plutonium that the United States has declared excess. Yet, raising the volume limit on WIPP would be controversial in New Mexico and in Congress.

In an influential 1994 study of plutonium disposition options by the National Academy of Sciences (NAS), considerable emphasis was put on the “spent fuel standard.” The idea was that disposition plutonium should be embedded in a waste form that generates a “self-protecting” gamma radiation barrier like that surrounding the plutonium in spent fuel. The waste packages in WIPP do not have such a radiation barrier.

The Energy Department now argues that emplacing excess plutonium in WIPP protects plutonium “from theft, diversion, or future reuse in nuclear weapons akin to that afforded” by the spent fuel standard. The department should provide further justification for this assertion. In any event, until the WIPP repository is closed, the security there of the excess plutonium being processed into containers at the Savannah River Site will depend on active monitoring to assure that none of the inner canisters holding the plutonium are removed.

Another concern with the current arrangements for WIPP is the lack of IAEA verification of the amount of plutonium being entombed there. As the first country disposing of significant quantities of plutonium in an underground repository, the United States should be setting an example of international transparency. IAEA verification of the amount of plutonium being deposited in WIPP and the absence of its diversion thereafter should be added to the current plan for disposal of plutonium-contaminated waste and any plan for disposal of additional plutonium in WIPP.

Immobilization with high-level waste. The immobilization option proposed in the 1994 NAS study was to mix plutonium into high-level radioactive waste as the waste was being mixed into molten glass. The Energy Department concluded, however, that plutonium could not simply be metered into the existing melter at the Savannah River Site. The department opted for a “can-in-canister” approach in which the plutonium first would be immobilized in cans of glass or ceramic. Those cans would be placed on a rack inside standard canisters after which molten high-level-waste glass would be poured into the canisters (see figure 1). In that conception, each canister would hold about 28 kilograms of plutonium.

This option is still very much available. At 28 kilograms of plutonium per canister, it would take 2,000 canisters to dispose of 56 tons of plutonium. In fiscal year 2012, 275 canisters were filled at the Savannah River Site, bringing the cumulative total of canisters filled with high-level waste there to 3,526. Yet, only a small fraction of the cesium-137 originally in the waste tanks at the Savannah River Site has been vitrified. The cesium-137 would provide a protective gamma-radiation barrier around the canisters containing the immobilized plutonium. There is therefore still enough cesium-137 available at the Savannah River Site for a few thousand canisters of immobilized plutonium.

A facility for producing the cans of immobilized plutonium would be required. In the past, the Energy Department has identified facilities such as the K-Reactor building at the Savannah River Site that could be adapted for this purpose. This building would be convenient because it currently is the site’s plutonium-storage facility. Alternatively, the department could consider repurposing the partly constructed MOX fuel fabrication facility for plutonium immobilization. It is likely that only a part of the building would be required because immobilization does not require that the plutonium feed be purified as extensively as for fabrication into MOX fuel.

Immobilization without high-level waste. Plutonium could be embedded in a ceramic matrix and then stored securely pending disposal. One option for disposal could be putting the immobilization form inside a welded-shut container with spent fuel and emplacing the container in a deep repository. Alternatively, the Energy Department could dispose of the immobilization form in boreholes, three to five kilometers deep, from which retrieval would be extremely difficult. The NAS study addressed this option two decades ago, but, at the time, considered it “less fully developed” than vitrification and MOX fuel fabrication. There has been continuing interest in a number of countries in deep boreholes for disposal of radioactive waste, and the Energy Department now argues that emplacing excess plutonium in WIPP protects plutonium “from theft, diversion, or future reuse in nuclear weapons akin to that afforded” by the spent fuel standard.
Department is currently examining this approach as an alternative to a mined repository for disposal of spent fuel.  

Optimized immobilization forms have been developed in which the radiation damage to the crystal structure of the ceramic would be self-healing and that would release plutonium very slowly into the water that would be expected to seep into a deep geological repository or borehole.  

The United Kingdom is currently constructing a facility to immobilize contaminated plutonium in ceramic using a hot isostatic pressing process that takes eight to nine hours to turn a container of powder into a smaller ceramic cylinder with a volume of five liters.  

Such a cylinder of ceramic could easily accommodate two kilograms of plutonium. For a single cylinder per shift, operating one shift 250 days per year, it would be possible to immobilize 0.5 tons of plutonium a year.  

At the moment, the United Kingdom expects to immobilize less than a ton of plutonium in this way, but the program could be expanded to immobilize all of the approximately 100 tons of separated plutonium that the United Kingdom has to dispose of.  

A variant of this option would be to utilize portions of the MOX fuel fabrication facility in South Carolina to produce what a British screening study described as “low-specification” MOX fuel: sintered fuel pellets that are not chemically pure or fabricated to the rigorous quality assurance standards required for reactor fuel. These pellets could be put in tubes for disposal with spent fuel or embedded in a larger matrix for disposal down a deep borehole.  

Conclusion  

The Obama administration’s April announcement that it is “conducting an assessment of alternative plutonium disposition strategies” is welcome news. It is indeed time to look seriously at the alternatives. Given the commitment that the Energy Department’s Office of Fissile Materials Disposition and Areva have to the MOX option, the administration, Congress, or both should require an independent study of the costs and benefits of the alternatives.  

Based on the analysis above and the data on which it draws, such an independent review probably will find direct disposal much less costly and simpler to execute than the current MOX strategy. A MOX pellet must be formed from chemically pure materials and ground to very precise dimensions. Because a single pellet contains less than a gram of plutonium, more than a million must be manufactured to dispose of a single ton of plutonium. By contrast, direct disposal of a ton of plutonium would require the production of only hundreds to thousands of immobilization forms with much less stringent chemical and mechanical specifications. Furthermore, as the NNSA, Japanese utilities, and the United Kingdom’s Nuclear Decommissioning Authority are learning, even after one has fabricated MOX fuel, finding a reactor to use it can be extremely difficult.  

Finally, because Japan, the United Kingdom, and the United States all have encountered difficulties in executing MOX programs, it would make sense for them to collaborate in research and development on direct disposal options. The United States and Japan could, for example, learn from the United Kingdom’s ongoing program to immobilize its impure plutonium.  

ENDNOTES  


2. As used in this article, “tons” means “metric tons.”  

3. Office of the Press Secretary, The White House, “Remarks by President Obama at Hankuk University,” March 26, 2012,  


5. “[A]dvanced nuclear weapon states such as the United States and Russia, using modern designs, could produce weapons from reactor-grade plutonium having explosive yields, weight, and other characteristics generally comparable to those of weapons made from weapon-grade plutonium.” U.S. Department of Energy, “Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives,” DOE/NN-0007, January 1997, p. 39,  


6. These figures do not include estimated credits of $0.9 billion from sale of the mixed-oxide (MOX) fuel and from recovery of highly enriched uranium from composite pits.  


7. For a copy of the PMDA revision, see http://fissilematerials.org/library/PMDA2010.pdf.  


11. See Kurt Campbell, Robert Einhorn, and Mitchell Reiss, eds., The Nuclear Tipping Point  


14. Derived from $7.7 billion construction cost for the MOX fuel facility, $8.2 billion for
operations and construction costs over 15 years, $0.4 billion for construction of the associated Waste Solidification Building, and $1.9 billion for its operation over 20 years. NNSA 2014 budget request, pp. DN-119, DN-147, DN-148.

15. Ibid., p. DN-119.


18. A fuel assembly for a pressurized water reactor contains about 450 kilograms of heavy metal. MOX fuel made with weapons-grade plutonium would contain about 5 percent plutonium, which translates into about 20 kilograms of weapons-grade plutonium per fuel assembly. The Nagasaki bomb contained 6.1 kilograms of plutonium.


21. The National Academy of Sciences (NAS) 1994-1995 study on plutonium disposition had an entire volume on the use of different reactor types as alternatives to the use of MOX fuel in existing light-water reactors (LWRs), but concluded that these alternatives had no important advantages and that choosing reactors that did not yet exist would delay the program and make it more costly. NAS Committee on International Security and Arms Control, “Management and Disposition of Excess Weapons Plutonium: Reactor-Related Options,” 1995, http://www.nap.edu/openbook.php?record_id=4754&page=R1.


26. A glove box is a sealed box within which workers can process dangerous materials, such as plutonium oxide powder, with their hands in gloves that cover holes in the walls. The air in the box is at less than ambient pressure so that any air leakage is into the box. Air leaking into the box is pumped out through high-efficiency particulate filters.


30. The U.S. stockpile in 1994 was 99.5 tons. Of that amount, 61.5 tons has been declared excess, including 9.6 tons already committed to WIPP and 7 tons in spent fuel, leaving 44.9 tons for disposal.


36. Steve Thomas, e-mail communication with Tom Clements, March 22, 2013.


Dealing With South Korea’s Spent Fuel Challenges Without Pyroprocessing

Seeking to head off a potential rupture in bilateral nuclear trade, the U.S. and South Korean governments agreed in April to extend their current nuclear energy cooperation agreement for two years, until March 2016. If the two countries’ legislatures endorse the agreement, it will provide Seoul and Washington with some breathing space to agree on new terms for nuclear trade to replace their previous agreement from the early 1970s.

The two countries will seek to use this opportunity to overcome the key stumbling block in the talks: U.S. resistance to South Korean demands for advance consent to alter U.S.-obligated nuclear material through uranium enrichment or spent fuel reprocessing. In particular, South Korea had been hoping to win support to engage in pyroprocessing, a form of reprocessing developed in the 1960s that has never been commercialized.

The technology has appealed to some South Korean scientists because of the country’s problems in storing spent fuel. Many of South Korea’s reactors will likely reach their capacity for storing highly radioactive waste in their pools by the end of this decade, but the South Korean government has yet to designate additional storage capacity that would ensure continued operation of the reactors. The prospect of shipping the material to a new pyroprocessing facility is seen as a means of responding to that concern.

The United States has objected because of regional and global nonproliferation concerns. Regionally, Washington fears that a South Korean pyroprocessing program could undermine efforts at convincing North Korea to abandon its nuclear weapons program; reprocessing technology is at the heart of Pyongyang’s nuclear weapons program. During a time of heightened tension on the Korean peninsula, given the launch of a long-range missile last December and the underground nuclear test in February, Washington also worries that Seoul might be motivated to use the technology to provide fissile material for its own nuclear weapons program. Globally, the United States is concerned that South Korean acquisition of this sensitive fuel-cycle technology runs counter to U.S. efforts to limit the spread of such technologies. The U.S.-South Korean dispute has become politicized and at times heated, with some South Korean politicians objecting to U.S. efforts to limit their “peaceful nuclear sovereignty.”

The disagreement is unnecessary and misplaced, failing to meet the true interests of either side. South Korea’s most pressing needs are to identify short-
term measures for storing its spent fuel and to initiate a long-term plan for a spent fuel repository, neither of which requires pyroprocessing or raises the kind of nonproliferation concerns that pyroprocessing does. The two countries should take advantage of the anticipated extension of their agreement to address these immediate challenges, leaving aside further resolution of the pyroprocessing issue until more research is carried out into this still-experimental technology.

Pyroprocessing treats spent fuel by removing the extremely radioactive but relatively short-lived constituents, such as strontium and cesium, and storing these separately from the spent fuel. It then burns the remaining material, including the comparatively long-lived transuranic elements plutonium and other actinides, in fast-neutron reactors. South Korean researchers point to the potential benefits of pyroprocessing in reducing the overall quantity and heat load of waste requiring permanent storage. Other experts point to the added management challenges that arise from increasing the number of waste streams, developing still-conceptual and expensive fast-neutron reactors, and qualifying a new type of fuel for these reactors, while saying that long-term interim storage can provide many of the same benefits.

The inability of Seoul to acquire additional storage capacity is largely a result of domestic politics. Public opposition to previous attempts to resolve the issue has left South Korea’s politicians reluctant to make politically or diplomatically risky decisions to address the problem. The political issues are exacerbated by South Korea’s high population density and lack of free space for storage, which makes identifying and building a permanent repository even more complicated than in most other countries with nuclear power plants. Local populations worry that any interim storage facilities ultimately will become permanent.

South Korean officials argue that pyroprocessing should not be considered equivalent to traditional reprocessing, which originated in weapons programs. These officials say that South Korea does not plan to separate pure plutonium from the spent fuel and, in any case, that pyroprocessing cannot produce a product suitable for nuclear weapons. U.S. officials disagree and consider pyroprocessing to be equivalent to reprocessing, with corresponding nonproliferation challenges.

Both sides of the discussion continue to see pyroprocessing as being in the developmental stage and do not have sufficient information to determine if it is appropriate for the larger throughput required to minimize South Korea’s spent fuel inventories effectively. Despite the ongoing debate, the discussion of pyroprocessing remains somewhat premature. Seoul and Washington acknowledge that they lack sufficient information to determine whether pyroprocessing, which is only now being tested on an engineering scale, makes technical or economic sense on an industrial scale. They also are working with the International Atomic Energy Agency to see if they can develop appropriate safeguards to prevent proliferation—a difficult challenge in all reprocessing facilities. Higher, industrial-scale throughput levels would be required if pyroprocessing were to be used for minimizing South Korea’s growing stockpile of spent fuel.

At the end of 2010, the two sides agreed to a joint study to evaluate the technical, economic, and nonproliferation feasibility of the process. The ongoing joint study, which the two sides formally began in 2011, is supposed to look at safe and comprehensive ways of dealing with spent fuel and examine pyroprocessing within that context. Although the 10-year study was supposed to consider a wide range of “back-end” alternatives,
South Korea has been willing to support work only on pyroprocessing. Moreover, that part of the study effectively had ground to a halt amid the clash over the nuclear cooperation agreement. In any case, even under the most optimistic scenario, pyroprocessing and the associated fast-neutron reactors will not be available options for dealing with South Korea’s spent fuel on a large scale for several decades. Seoul will need to find other options, most urgently for managing spent fuel in the short to medium term. In the long term, it will have to find a permanent answer to the question of properly managing its spent fuel or the high-level waste that will remain after pyroprocessing.

South Korea’s new government has the opportunity to do better. Its first priority should be to seek broad and open discussion with the public and other relevant stakeholders. A year ago, the Ministry of Knowledge and Economy (now the Ministry of Trade, Industry, and Energy) promised to set up a Stakeholder Engagement Commission by March of this year. However, the establishment of this commission, which would be similar to the recent U.S. Blue Ribbon Commission on America’s Nuclear Future, has been delayed for several months.

This commission, which would include technical and social science experts, as well as representatives of nongovernmental organizations and communities near nuclear power plants, is a useful step in widening the public discourse in South Korea. Until now, that discourse has been dominated by engineers and scientists with a vested interest in one technological approach or the other. In addition, South Korea should consider the following particular policies over the short, medium, and long terms.

**Shorter-Term Storage Options**

The building of short- to medium-term storage facilities at reactors or at other locations should be a major focus of the South Korean nuclear authorities in the immediate future. With or without pyroprocessing, South Korea will need additional storage capacity. South Korean nuclear authorities already have instituted several procedures to boost spent fuel storage capacity in existing pools. These methods include increasing fuel burn-up so such spent fuel remains in the reactor longer before entering a pool, and reracking spent fuel to pack fuel into the pools more tightly.

The nuclear utilities also have moved spent fuel within plants from older, saturated pools to newer reactors with more storage capacity, actions recommended by the Korean Nuclear Society. These techniques, however, have their limitations, and the pools will likely reach their capacity within a decade, and the Korean nuclear industry has recommended the construction of new interim storage facilities no later than 2024. Furthermore, densely packing spent fuel pools raises nuclear safety and security concerns.

Fundamentally, the obstacles to finding additional storage space are political, not technical, and could be overcome if South Korean policymakers were willing to tackle political challenges. Spent fuel from South Korea’s light-water reactors (LWRs) could be stored in dry casks at current reactor sites or at a central site for 60 years or more, as advocated last year by South Korea’s Atomic Energy Commission (AEC). Dry casks are modular units designed to cool spent nuclear fuel with air rather than with water, and in this sense, the casks are less vulnerable to external conditions.

At South Korea’s Wolsong plant, dry-cask storage units have been built for that plant’s spent fuel. South Korea should consider using similar technology at additional plants, and the United States could provide important technical assistance in this regard. The option of safely relying on dry-cask storage for longer periods than previously thought possible has raised the possibility that this technology could be used to prolong the operating lifetime of current South Korean facilities.

Storage of spent fuel in dry casks appears to be safe and secure for decades more than originally thought and is a proven technology used at numerous sites around the world. In the 1980s, the U.S. Nuclear Regulatory Commission (NRC) estimated that spent fuel “could be stored safely for at least 30 years after a reactor’s operating license expired.” That estimate was pushed further out in 1990, when the NRC stated that it was safe “30 years beyond a 40-year initial license and a 30-year license renewal period, for a total of at least 100 years.”

Additional storage sites could be available if South Korean policymakers were willing to overcome the political obstacles against shipping fuel from a plant site in one jurisdiction to a plant site in another. Currently, political uncertainties even could block the shipment of fuel from parts of the Kori site to the adjacent Shin-Kori site because the two groups of reactors are in different jurisdictions.

Overcoming these political obstacles will require efforts by the political and technical communities to inform the public of the safety and security benefits that might come from dry-cask storage. Previous efforts to win public support have tended to be top-down approaches.
that did not involve substantial public input or explanation of relative risks and benefits. Continuing this tradition by claiming that pyroprocessing represents a technical solution to what is inherently a political problem, rather than an intriguing if still untested research program, is unlikely to be successful.

Moreover, the various strands of South Korea’s spent fuel management system need to be integrated into a comprehensive approach with decisions on fuel burn-up, storage of spent fuel at reactors or offsite facilities, and possible long-term solutions tied together to provide plausible paths forward, while providing South Korean policymakers and the public with the maximum range of policy options. By contrast, South Korean policy to date has been hampered by bureaucratic infighting and confined to an unnecessarily narrow set of choices.

Long-Term Storage Options
As noted above, South Korea is interested in reprocessing, particularly pyroprocessing, as a means of long-term spent fuel management. As part of this plan, South Korea needs to develop reactors capable of burning the fuel created in pyroprocessing. Seoul’s current efforts build on the considerable experience that the United States has had in developing the Integral Fast Reactor.15 Fast-neutron reactors have been under development in many countries for decades, but have yet to be successfully commercialized. Their use also would require South Korea to develop, qualify, license, and fabricate commercially a new type of fuel.

South Korea partly justifies its push for reprocessing by citing the need for nuclear “sovereignty” and energy self-sufficiency. Yet, the development of a reprocessing capability in South Korea might not be economically feasible. The research is not at a stage where a definitive decision can be made about the viability of these techniques. Therefore, South Korea should favor an approach that will leave options open and give it time to investigate various technologies before making any decisions about commercial-scale deployment.

Among the notions that could be explored is “extended storage” beyond the many decades currently envisioned by the South Korean AEC, the U.S. NRC, and others. Due to delays in many countries in siting repositories for final disposition of spent fuel or high-level waste, interest has grown in possibly extending storage for periods lasting centuries or more. To be sure, this concept, known as “indefinite,” or extended, storage, has a number of problems in comparison to other long-term options because safety and security are guaranteed only if continuing maintenance is assured in perpetuity, an assurance that is nearly impossible to give. Nevertheless, extended storage has its benefits. These include postponing the high costs of developing reprocessing facilities or disposal sites and the political problem of siting a disposal location while still safely storing these materials for a long period of time. Extended storage also would allow for the continued availability of other future options, including reprocessing.

In any case, South Korea would benefit from participating in research aimed at assessing the technical feasibility of extended storage.

Even without extended storage, spent fuel will need to be stored in South Korea for decades because of the period required for cooling of the spent fuel before further treatment of it or because advanced treatments, such as pyroprocessing, cannot be implemented on a large scale for many years. If spent fuel is to be stored for a long time, then various conditioning methods are available to reduce the volumes to be stored and ultimately disposed of and to avoid unacceptable long-term degradation of the spent fuel or its packaging.

Still, geological disposal is currently the only recognized long-term strategy guaranting safety and security without continual care and maintenance. Regardless of whether South Korea opts for a strategy based on direct disposal of spent nuclear fuel or some reprocessing of its fuel, Seoul definitely faces the challenge of implementing a multyear program leading to ultimate geological disposal. Yet, experience in numerous national programs has illustrated vividly that geological disposal is a contentious issue that can severely affect the overall public acceptance of a nuclear power program. In some countries, the public will accept nuclear power only if a geological repository is constructed, while in other countries activists oppose the construction of geological repositories in order to prevent the expansion of nuclear power.16

One broad question on geological disposal is whether to employ a mined geological repository or deep borehole disposal. Mined geological repositories are located several hundred meters underneath the earth’s surface in stable geological formations and include engineered barriers and natural barriers such as rock, salt, or clay. By contrast, deep borehole disposal involves the emplacement of waste packages in the bottom sections of holes drilled to depths of several kilometers, much deeper than mined geological repositories. The upper kilometers of the holes are not used for disposal, but backfilled and sealed so any nuclear waste is at least three kilometers below the surface.

One advantage of a mined repository is that it is by far the more established technology, with decades of research conducted by numerous countries around the world. South Korea’s program ultimately envisions such a repository. Compared to conventional mined geological repositories, however, deep borehole disposal reduces the need for specific types of geology that are particularly good at containing radionuclides. Also, a greater depth may diminish the likelihood of failure scenarios in which radionuclides are able to mix with groundwater and eventually propagate into the environment.

Moreover, it appears likely that deep borehole disposal would offer benefits similar to the ones that pyroprocessing advocates claim for the reduced-area repository that they say would be sufficient to dispose of the spent fuel. Under some scenarios, placing intact spent fuel in deep boreholes could require one to two times the surface area of a reduced-area repository as conceived by South Korean scientists, but with the added advantage that the high-heat producers do not need to be chemically separated from the fuel.17

Deep borehole disposal should be regarded as a viable alternative to the mined repository concept. At this point, however, deep borehole disposal is more expensive and will likely stay so until
there are advances in technologies used to drill holes and place waste in them. One critical question for South Korean policymakers in this regard is whether they want materials in the repository to be retrievable, something that is not really possible for deep boreholes but could still be an option with a mined repository.

One of the main tasks when looking at geological disposal is choosing the type of system that best fits the available or appropriate site. Generally, finding a suitable and acceptable site for a geological disposal facility is the most difficult aspect of the whole program. It is important for the geological disposal program to maintain a flexible approach to design before a site or geological environment is identified and to begin public discussion about the need for and nature of such a site as early as possible.

**Recommendations**

South Korea could take a number of actions that would allow it to tackle its short- and medium-term spent fuel challenges while providing it with flexibility with respect to its ultimate choices in handling spent fuel and high-level waste.

**Short- to medium-term approaches.** In the short and medium term, the primary focus needs to be on moving older spent fuel out of reactor pools in order to allow continued operation. At the same time, Seoul has to take steps to arm itself with more information on and options for addressing longer-term concerns. In the short term, South Korea’s planned Stakeholder Engagement Commission is an important step forward. Making this process as transparent as possible is crucial. The commission should seek to educate communities near current reactor sites about the safety and security benefits of dry-cask storage. As an additional benefit to the communities, the commission could offer to establish a clear link between interim storage and the lifetime of nuclear reactors by promising to remove spent fuel from a plant site as soon as that reactor complex shuts down. It is not clear at this point if a forthcoming five-year government plan will call for the construction of new domestic reactors beyond those already planned at existing sites. Should this be the case, however, Seoul could consider tying the winning bid for the next nuclear power plant site to a community’s willingness to host an interim storage facility or at least to accept spent fuel from other sites.

After the Stakeholder Engagement Commission’s two-year mandate expires, current plans envision the establishment of a Site Selection Commission that might pick appropriate future sites for spent fuel. It is essential that the commission undertake an active engagement program with the residents and businesses in the areas considered appropriate for hosting storage facilities so that these communities are involved in the decision-making. In the case of a centralized storage facility, one incentive that some have suggested Seoul could offer, which the U.S. Blue Ribbon Commission on America’s Nuclear Future also proposed, is to pledge that communities hosting such a facility would not also host a geological repository.

Looking toward the longer term, the Site Selection Commission should seek to initiate discussions of potential permanent disposal sites and look for hosts for centralized interim storage facilities.

Internationally, South Korea should work with the United States to carry out a more comprehensive 10-year back-end study on new approaches to spent fuel disposition. The focus of this study should go beyond pyroprocessing and include issues such as research and development on fast-neutron reactors, disposal and storage options such as deep borehole disposal and extended storage, and discussions of possibilities for multilateral facilities in or outside of South Korea. In addition, Seoul should study the implications of different fuel-cycle strategies on the timing and the technology needed for final repository implementation and make the results of this analysis a major factor in decisions on future policies.

**Long-term approaches.** By the end of next year, the Stakeholder Engagement Commission is supposed to provide recommendations on spent fuel management to South Korea’s Ministry of Trade, Industry, and Energy and the AEC. The AEC is then supposed to establish a Basic Plan for Radioactive Waste Management. In this basic plan, Seoul should develop and publicize a national strategy and accompanying road map for a process leading credibly after several decades to a national repository, should no other viable options be developed in the intervening period. Although South Korea’s current preferred strategy is pyroprocessing, Seoul should acknowledge that, for this strategy too, a final disposal solution in a geological repository will be needed.

In addition, South Korea should continue and broaden cooperation on research on deep borehole disposal.
that it has just begun with Sandia National Laboratories in the United States. Such research could touch on pilot testing of practical boreholes, waste package handling methodologies and technologies, borehole sealing and drilling, development of safety assessment scenario analyses and development of technical requirements for a deep borehole disposal program.

Conclusion
The political tensions and rhetorical battle between South Korea and the United States over pyroprocessing and the renewal of the nuclear cooperation agreement have obscured some of the technical issues involved, particularly when it comes to the handling of spent nuclear fuel. The pending two-year extension could provide an opportunity to reshape the debate on the issue to focus on South Korea’s immediate and long-term spent fuel needs, while deferring discussion on pyroprocessing. At a time of high nuclear tension on the Korean peninsula, it is counterproductive for policymakers to focus on deciding whether to move forward with a process that raises many nonproliferation red flags yet has not proven its technical or economic viability. Both countries should take advantage of the window promised by the expected extension to lower the political temperature on this issue and focus on pragmatic and cooperative spent fuel solutions that can offer benefits today.

ENDNOTES
1. “U.S.-obligated material” includes material transferred from the United States, as well as special nuclear material produced overseas through the use of U.S-supplied nuclear material or reactors. South Korea’s light-water reactors are largely based on U.S. designs and include important U.S. components. Therefore, even though the majority of its reactors were constructed by South Korean companies, those reactors are legally considered to have been supplied by the United States. “Advance consent” or “programmatic consent” means that the United States provides approval for sensitive nuclear activities for the life of a nuclear cooperation agreement rather than considering each case individually. See Fred McGoldrick and Duyeon Kim, “Decision Time: U.S.-South Korea Peaceful Nuclear Cooperation,” KEI Academic Paper Series, March 13, 2013, http://www.keia.org/publication/decision-time-us-south-korea-peaceful-nuclear-cooperation.


4. Fast-neutron reactors have a different neutron spectrum than conventional (thermal) reactors. They allow operators to use recycled material from spent fuel more efficiently to generate electricity and if operated in “burner” mode, decrease the quantity of actinides in the fuel.


7. The Nuclear Regulatory Commission defines high-level waste as being “highly radioactive materials produced as a byproduct of the reactions that occur inside nuclear reactors.” High-level waste can take two forms: as waste from the reprocessing of spent nuclear fuel or as the spent nuclear fuel itself. See http://www.nrc.gov/waste/high-level-waste.html.


12. Chaim Braun of Stanford University’s Center for International Security and Cooperation has pointed out that the CANDU spent fuel assemblies are small and have low burn-up while the spent fuel assemblies from South Korea’s pressurized-water reactors (PWRs) are large with high burn-up, thus requiring different types of interim storage. He has suggested the United States and South Korea could cooperate on a demonstration program for the PWR assemblies. Chaim Braun, “ROK-U.S. Prospective Nuclear Energy Cooperation Measures” (remarks, Washington, DC, May 17, 2013).


14. Ibid.

15. The Integral Fast Reactor was a prototype reactor that was co-located with a pyroprocessing line, fuel fabrication facility, and waste handling facility and that immediately burned recycled spent fuel. Congress ended funding for that effort in 1994.


17. This calculation simply estimates the number of boreholes needed for a total spent fuel inventory of 53,000 metric tons of spent nuclear fuel in the year 2050. The total area occupied by the borehole field is about 1 square kilometer, corresponding to 520 boreholes. This should be compared to 0.8 square kilometers for the Korean Atomic Energy Research Institute’s proposed reduced-area repository if pyroprocessing is employed. See Seong Won Park, “Why South Korea Needs Pyroprocessing,” Bulletin of the Atomic Scientists, October 26, 2009, http://www.thebulletin.org/why-south-korea-needs-pyroprocessing. See also Jongyoul Lee et al., “Concept of a Korean Reference Disposal System for Spent Fuels,” Journal of Nuclear Science and Technology, Vol. 44, No. 12 (2007): 1565-1573.
The nuclear and missile programs of Iran and North Korea provide a continuing reminder of the importance of preventing illicit trade in proliferation-sensitive technologies. Last month’s UN panel of experts final report on the implementation of sanctions on Iran, for example, concluded that “Iran continues to seek items for its prohibited activities from abroad by using multiple and increasingly complex procurement methods, including front companies, intermediaries, false documentation and new routes.”

How the Private Sector Can Do More to Prevent Illicit Trade

An extensive and growing web of trade controls—UN sanctions, embargoes, and export controls—has been put in place to impede the efforts by those countries and others to acquire unconventional weapons and embargoed military technologies.

In many cases, these controls are based on the lists and guidelines on which international export control regimes have agreed. National governments implement them through domestic legislation, an export licensing process, and enforcement actions, when necessary.

For export controls to work effectively in slowing down programs of concern, the private sector must comply with their requirements. Ensuring compliance can be a complex and labor-intensive process. It is increasingly clear, however, that even full compliance does not always prevent the transfer of goods to countries that are under sanctions. Proliferators are dynamic and responsive, reacting to the controls in place to find ways of circumventing them and duping exporters into unwittingly doing so.

Creating conditions in which each element of the supply chains that deal in proliferation-sensitive technologies and hence are most likely to be targeted by proliferators is resistant to illicit trade therefore is crucial in preventing proliferation. The creation of these conditions relies on better coordination and understanding between governments and the private sector. In the summer of 2011, Project Alpha, an initiative sponsored by the British government, was launched to instigate a dialogue between the private sector and government on nonproliferation and export-compliance issues and to find ways in which the two sides might better work together to prevent proliferation-related trade.

Over two years, the team has conducted discussions and worked with more than

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300 firms and trade bodies in the United Kingdom and overseas, collecting data on suspicious inquiries made to these firms by potential customers, producing and disseminating guidance material, and hosting training seminars for the sectors and their supply chains that are most at risk of being the target of illicit procurement schemes. The analysis below is drawn from this experience and seeks to highlight findings and suggest ways to apply those lessons.

Illicit Trade: An Ongoing Risk

Illicit procurement in the support of nuclear and missile programs is not a new phenomenon. In fact, it has been a common response of states facing international efforts to block their access to technologies. The history of international attempts to control sensitive technologies has a cyclical quality: shocks to the system, tightening of certain controls in response, and attempts by proliferating countries and entities working on their behalf to circumvent these controls.

One historical example of this cycle of shock leading to increased efforts to control technology relates to the Nuclear Suppliers Group (NSG). The group was formed in the aftermath of the 1974 Indian nuclear test, which used plutonium produced in a Canadian-origin reactor and U.S.-supplied heavy water. The creation of a list of dual-use items to supplement the original trigger list, as it is commonly known, of more-sensitive items came in response to the discovery of Iraq’s procurement efforts following the 1991 Persian Gulf War. More recently, the framework established in 2004 by UN Security Council Resolution 1540, which legally obliges states to take measures to prevent nonstate actors from acquiring or facilitating the acquisition of weapons of mass destruction (WMD), followed the discovery of the Abdul Qadeer Khan black market network.

Illicit procurement also is responsive. A large number of states have used similar techniques in their attempts to acquire unconventional weapons and their means of delivery. According to a 2007 report, Argentina, Brazil, Egypt, India, Iraq, Israel, Libya, Pakistan, South Africa, and Syria have used illicit procurement methods to advance their nuclear programs in the past. The Iranian and North Korean nuclear and missile programs of today are based significantly on goods obtained from the international marketplace in breach of national export controls or sanctions.

States have used such illicit procurement techniques to acquire goods to use in advanced military programs. The Soviet Union, for example, mounted an extensive and heavily organized effort involving multiple Warsaw Pact intelligence agencies to procure a large number of sensitive technologies of use in military programs during the Cold War, sometimes rendering the exporter in breach of existing controls. More recently, Iran and North Korea have mounted similar efforts to acquire military goods, seeking to benefit from the willingness or naïveté of private firms to enable a breach of the arms embargoes put in place by Security Council Resolution 1929 in 2010 and Resolution 1718 in 2006.

Thanks largely to Resolution 1540, the international community now has a more extensive legal framework in place to counter proliferation procurement.
This framework includes increasingly universal export control systems and provisions to counter proliferation financing and facilitate the sharing of information between states. Nevertheless, the situation is still fraught with difficulty.

Multilateral efforts and national controls cannot prevent proliferation alone. Exporters must play a role, one that goes beyond compliance with controls and implementation of sanctions. Thanks in part to WikiLeaks, more information than ever before on illicit procurement now is publicly available. There is also a greater information base relating to business experiences of being targeted by illicit procurement in part as a result of greater interest in these issues in the media and the work of nongovernmental organizations (NGOs) to highlight them. By building on this increased information base, the private sector, governments, and NGOs can work to find new ways to assist the private sector in addressing the problem.

**Going Beyond Compliance**

There are clear legal, financial, and reputational risks to the private sector for being found noncompliant with export controls and sanctions. Unfortunately, ensuring compliance with the controls is not always straightforward. There are not always easy answers when it comes to determining the appropriate control level for a given technology and conducting due diligence to verify the bona fides of potential end users. Besides these difficulties, the private sector is forced, through the licensing system, to place a great deal of emphasis on the judgments and specific intelligence of governments. Without significant resources or access to the knowledge and understanding of illicit activities held by governments, firms often have no option other than to fill out a license application and rely on the national authority’s judgment regarding the risks.

It is becoming increasingly clear, however, that although industry’s compliance with export controls and sanctions is complex, labor intensive, and important, compliance alone is not sufficient to prevent illicit trade. With regard to exports of sensitive technologies, there are two main issues that compliance with the controls cannot address.

First, there is the issue of proliferators seeking noncontrolled goods. It is impractical and runs counter to the spirit of a system of international trade based on “free market” economics to control all goods that could be used to develop a WMD program. For example, it would be impractical to control certain industrial control systems used in most large factories worldwide purely because proliferators were seeking them for just a small number of facilities. There is often no obligation for a company to apply for a license to export noncontrolled goods if the potential exporter does not foresee a WMD-related end use. Without such an obligation, governments are not always given sight of such transactions before they occur. All of the nuclear-related cases investigated by the UN panel of experts on Iran sanctions in its 2013 report, including valves and industrial control systems, involved at least some items not listed in Security Council Resolution 1929.

A second issue relates to the risk of diversion of controlled goods. If the national authority that is evaluating the license application is not aware of the risks posed by entities named on the license application, such a diversion can occur once an export license has been issued. As part of an export license application, an exporter often has to attach an end-user certificate, which is provided by the end user and details the intended use of the goods. End users or exporters sometimes provide falsified end-use certification to try to dupe exporters and national authorities. National governments have attempted to address the use of front companies based in major transshipment hubs, such as Hong Kong and the United Arab Emirates, designating and sanctioning entities that they believe to be involved in diverting goods to WMD programs. Proliferators, however, are adaptive, changing their names and varying their routes and methods in order to continue to divert goods.

In terms of elements of the private sector that work to enable trade, such as banks and insurance and shipping companies, compliance has slightly different requirements. These types of companies frequently screen against lists provided by the U.S. Department of the Treasury and others with the purpose of avoiding proliferation financing, terrorism financing, or money laundering. Yet, entities that have been listed for their involvement in proliferation-related activities often engage in transactions by utilizing front companies that cannot be detected using lists alone. This often makes it difficult for these firms to be certain they are not facilitating illicit transactions.

To address these potential gaps in export and trade control systems, firms can take a number of measures to go beyond compliance and mitigate the risk that they are involving themselves in illicit trade. These beyond-compliance principles have been described as “anti-proliferation” principles. Exporters of sensitive technologies should have in place a compliance program, the organizing principles of which relate equally to legal compliance and broader proliferation and related reputational risks. In practice, this means technical and compliance staff working to ensure that their order management system highlights proliferation-sensitive
noncontrolled goods alongside controlled goods when an inquiry is received from a customer.

Exporters should also ensure that they have in place structures and processes to deal with suspicious inquiries. These are the e-mails, letters, and telephone calls that companies may receive, asking whether they are able to supply proliferation-sensitive technologies to customers whose bona fides they are unable to verify. Sometimes these are easy to identify, and sometimes they are not. Effective due-diligence processes are important here. The information contained in these inquiries can prove to be hugely valuable open-source intelligence to national governments.

The initial focus of efforts to ensure that companies put in place these beyond-compliance measures to prevent illicit procurement should be on the companies that produce the most sensitive choke-point items. These are items that proliferators would have great difficulty manufacturing themselves and that are produced by only a small number of specialty firms around the world. Examples include specialized corrosion-resistant alloys, composites with high tensile strength, vacuum components, and specialized machine tools. Taking such steps, however, should not be limited to exporters of these products, but could benefit firms throughout the defense, nuclear, and aerospace supply chains.

For each firm, taking such steps to go beyond compliance does not come without cost. One aspect of this is lost business. There also are costs associated with organizing and running a compliance program, purchasing screening software, and training staff. More broadly, a 2009 British government survey of more than 500 exporters based in the United Kingdom reported that 82 percent of firms saw this as constituting 1 to 10 percent of revenue, while 12 percent saw it as constituting more than 10 percent.9

Banks, insurers, and shipping companies also can take steps to go beyond compliance and prevent their involvement in illicit trade, although these steps have been more difficult for companies to identify. A starting point for these companies is to integrate nonproliferation principles into their corporate social responsibility or broader governance, risk management, and compliance frameworks.10 More-proactive companies in these sectors may wish to get involved in efforts by NGOs and academic groups to further understand how these issues affect their industries and what steps they can take to mitigate risks.

Supply-Chain Links

The crucial challenge lies in motivating the exporters at risk of being targeted by proliferators for the most sensitive choke-point items to improve their capacity to conduct due diligence and identify suspicious inquiries before they have a bad experience and potentially make a material contribution to a program of

The UN Security Council adopts Resolution 1929 on June 9, 2010. The resolution imposed new sanctions on Iran for its refusal to suspend certain nuclear activities.
and distributors of these at-risk firms, sometimes also smaller firms, need to put these measures in place too. There is likely to be little nonproliferation benefit in a company putting in place beyond-compliance practices when its suppliers or distributors do not.

There is a real opportunity for exploiting supply chain linkages and business relationships to spread beyond-compliance practices and make supply chains resistant to illicit procurement. Generally speaking, the most robust export-compliance programs in terms of funding and human resources tend to be in large defense, nuclear, and aerospace conglomerates. The nature of their goods—large and expensive finished items as opposed to unfinished dual-use products and components—means that they are less likely to be targeted by attempts at illicit procurement. Yet, they could play a pivotal role in nonproliferation efforts.

The companies that are more likely to be targeted and produce choke-point technologies often form part of these firms’ supply chains. For example, suppliers of aerospace-grade aluminum of the type that Iran has sought for use in centrifuges, missiles, and combat aircraft likely are suppliers primarily to the civilian or military aerospace market in the United States, Europe, and Asia. A military-grade electronic manufacturer’s primary market would likely be Western defense companies.

In motivating firms to call on their business partners to take these measures, reputational risk be a driving factor. In business in the Internet age, where media relations are difficult to manage and news stories are readily accessible almost indefinitely, it is clear that reputation matters more than ever. The implication of the supplier of a large defense or aerospace firm in supplying Iran’s nuclear and missile programs could generate negative publicity for all firms involved. More importantly, however, it would likely raise serious concerns about the continuity and reliability of supply if a supplier is to be fined or suffer damage to its reputation. The combination of the recognition of the importance of reputation and the role that these large conglomerates play as important customers of at-risk firms puts them in a perfect position to work as nonproliferation champions and spread the beyond-compliance principles.

The determination of the best way to take advantage of these linkages involving the supplier, manufacturer, distributor, and customer largely depends on the industrial sectors and, more specifically, the business relationships in question. It also depends on the cost-benefit analysis of those involved. A good starting point would be to require as a condition of business that companies that export sensitive goods have a proliferation-resistant compliance system in place and a nonproliferation statement on their website. In the United Kingdom, Project Alpha has been working to produce guidance to help firms implement such compliance systems and to disseminate that guidance. Firms with more-advanced or longer-standing business relationships may wish to be more proactive in inviting their suppliers’ or distributors’ compliance staff to train with their own. This would help to mitigate reputational risk for all firms involved and, for example, allow the distributor’s staff to better understand the sensitivity of its supplier’s products.

Going beyond compliance can be beneficial for a firm’s reputation. Perhaps that is one reason that some companies have started to put compliance beyond-compliance principles. There is a real opportunity for them in programs of concern. There is a lot to be gained across the board from sharing and drawing on this experience.

**Practical Ways Forward**

Companies can take steps individually and, crucially, in conjunction with their supply chains to prevent involvement in illicit trade. There also are a number of areas in which governments and other actors, such as NGOs and universities with knowledge and understanding of proliferation, can help the private sector to fulfill these roles. There are, however, some difficulties with governments alone seeking to provide such assistance.

Governments certainly need to be more proactive in helping industry go beyond compliance by providing free nonproliferation-focused resources, such as guidance on best practices to help companies assess the risks of potential business activities. Current government-provided resources often are focused on compliance with export-control legislation rather than a broader and more holistic mitigation of proliferation risks.

The information that the government provides to the private sector is also often limited. For example, in the United Kingdom, the only government-provided list for exporters is the so-called Iran list. This is a list of entities based in Iran that are linked to Iran’s WMD programs, present a diversion concern, or have been refused export licenses on these grounds by the British national authority in the past.11 For political and diplomatic reasons, the government is reluctant to speak publicly about the risks associated with other countries, such as those...
that might pose a transshipment risk. In short, the guidance provided in this regard often relates to the obvious rather than less straightforward areas.

In the United States, the approach often seems to be heavily focused on entities that are judged to present a risk of diverting sensitive goods to programs of concern. A focus on lists of entities can be unhelpful because it can seem to imply that illicit trade is conducted only by listed entities. In reality, the first thing that an entity is likely to do when it discovers that it has been placed on a blacklist is to change its name. One notable example is the notorious Chinese supplier to Iran’s missile program, Li Fang Wei; a U.S. court’s indictment of him listed 13 company names and eight individual aliases.12 Another example is the ongoing case of the Tsais, who are alleged to have set up and used two alternative company names after the U.S. Treasury Department placed their original company, Trans Merits, and them personally on its Specially Designated Nationals list. This is a list combining entities identified by the U.S. government for their alleged involvement in a variety of illicit activities, including WMD proliferation.

Rather than focusing on providing information on specific entities, governments, assisted by NGOs and academic institutions, should concentrate on helping exporters to put in place systems and processes to identify suspicious inquiries, to conduct due diligence more effectively, and to conduct risk assessments of prospective business with entities based in different countries. Guidance on beyond-compliance best practices should be made freely available to firms and in a user-friendly way to reduce costs and the time that it takes to read and implement the guidance. Firms that produce high-specification goods and that are prone to being targeted by illicit procurement are often small and medium-sized enterprises. Therefore, it is hugely important that any guidance ensures that costs are kept down.

Beyond this, governments need to establish mechanisms to allow companies to share the information contained in suspicious inquiries with government and among themselves. Any arrangement in this regard will have to address issues relating to commercially sensitive information. Due to fear of prosecution, there is likely to be some reluctance by firms to share information on suspicious inquiries with governments and one another, even if these inquiries went unfulfilled. Information-sharing mechanisms need to be built on the principle of trust and, most likely, anonymity. Information detailing the types of entities that are trying to obtain proliferation-sensitive goods, the products that they are seeking, and the methods they are using to obtain the products would be of great use to firms in a given sector.

Iran’s Natanz uranium-enrichment plant is shown in this April 2007 photo. According to a recent report, Iran continues to use front companies, intermediaries, and false documentation to obtain goods for its nuclear program.
There already is considerable experience in industry that could form the basis of an effort to codify best practices. There are clear benefits in having NGOs or university-affiliated organizations working to this end. Project Alpha has been seeking to draw together the best practices from different firms and packaging these practices so that they are available to others. There also are distinct advantages in using a neutral third party to gather the information and process it, in part by removing the elements that could identify the company that provided it. This could help to overcome business concerns regarding commercial sensitivities and possible prosecution as a consequence of sharing information. A neutral third party also could overcome some of the political and diplomatic sensitivities in providing exporters with valuable information for assessing the risks associated with certain counties, such as transshipment hubs.

In the United Kingdom over the past two years, Project Alpha has been working to develop a partnership initiative. Companies can become “Partners Against Proliferation” by taking certain actions, such as pledging to implement best-practice beyond-compliance principles, ensuring that their business partners do the same, and sharing information relating to suspicious inquiries with the project team. There are precedents for establishing third-party organizations to assist firms with trade control compliance. One example is the Center for Information on Security Trade Controls in Japan, which was set up in the aftermath of Toshiba’s involvement in illicit machine tool procurement by the Soviet Union in the 1980s. Academic institutions in the United States and elsewhere also have been playing important roles in this regard. Increased coordination among NGOs that are working in this area would benefit broader efforts. The first steps in this direction were seen at a March conference in London attended by NGO, government-affiliated, and UN experts.

Conclusion

It has become commonplace to describe the private sector as the first line of defense against proliferation. Nevertheless, there are few efforts to make practical contributions to assist industry in fulfilling this role in countries around the world. Developing comprehensive and organized ways to raise companies’ awareness of illicit procurement efforts and to improve the capacity throughout supply chains to identify suspicious inquiries could be crucial in the battle to prevent the proliferation of the world’s most dangerous weapons.

Exporters and other businesses involved in trade, such as financial service providers and transportation companies, can help to prevent proliferation not only by making sure they do not supply or enable programs of concern, but also by working to share information with governments and with their competitors within industry to help prevent illicit trade. The British experience has shown that companies are often keen to do this if cost-effective and confidential ways are found. Individual companies acting alone can make a difference, but tangible nonproliferation benefit comes from involving entire supply chains.

Neutral third parties are a desirable way to organize outreach efforts to compile guidance, gather and disseminate information, and help firms throughout supply chains to better understand proliferation risks. This could mean a tangible and increasingly important role for NGOs and academic institutions. As with many aspects of nonproliferation in which such actors play a part, coordination among them to ensure the most efficient use of resources is important. There also is much to learn from previous and current efforts to engage industry in nonproliferation efforts and to facilitate firms’ beyond-compliance processes. By refining the efforts to involve industry, all the parties involved can help to slow down the development of WMD programs such as those in Iran and North Korea and buy more time for governments to pursue diplomatic solutions.

ENDNOTES


2. For more information regarding the objectives and work of Project Alpha, see http://www.acss.info.


6. 2013 Resolution 1929 panel report.


12. For the indictment, see http://graphics8.nytimes.com/packages/pdf/nyregion/08INDICT.pdf.

13. For more information about the partnership program, see http://www.acss.info.

14. The conference was hosted by Project Alpha at King’s College London in March 2013.
U.S. Says Chemical Weapons Used in Syria

The U.S. intelligence community has “high confidence” that the Syrian regime used chemical weapons on a small scale against opposition forces multiple times over the past year, the White House said in a June 13 statement.

In the statement, Ben Rhodes, deputy national security adviser for strategic communications, said that physiological samples and reporting from multiple sources within Syria were consistent with exposure to chemical weapons, including the nerve agent sarin. The United States worked with its partners, allies, and individuals inside Syria to obtain and evaluate this information, he said.

Syria is not a member of the Chemical Weapons Convention (CWC) and has not disclosed the size and composition of its chemical weapons stockpiles. However, the U.S. intelligence community has estimated that the regime of Syrian President Bashar al-Assad possesses a large and complex chemical weapons program, including several types of nerve gases that can be delivered by missiles and bombs. After a Syrian government spokesman publicly acknowledged the existence of its chemical weapons last summer, President Barack Obama called the use or movement of chemical weapons within Syria a “redline” for U.S. action. (See ACT, September 2012.)

The United States has been evaluating claims of Syrian chemical weapons use for several months. In an April 25 letter to members of Congress, Miguel Roriguez, Obama’s director of legislative affairs said that the U.S. intelligence community had determined with “varying degrees of confidence” that the Assad regime had used chemical weapons against the Syrian population. More evidence was needed to confirm the use, the letter said, because there were doubts over the “chain of custody” of the evidence. (See ACT, May 2013.)

The June 13 statement described the evidence of use as “credible.”

Independent analysts have raised questions about the change in the U.S. assessment. In a June 18 interview, Amy Smithson, a senior fellow with the James Martin Center for Nonproliferation Studies, said the statement does not explain the increase in confidence.
since the April 25 letter or describe the chain of custody for the underlying evidence. Moreover, she said, the U.S. government has not provided evidence that rules out the possibility that rebel forces, who may want to incriminate the Assad regime, are responsible for the cases of small-scale use to date.

Jean Pascal Zanders, a former research fellow with the European Union Institute for Security Studies, said in a June presentation in Brussels that the United States, like France and the United Kingdom, had provided “virtually no factual details on the nature and provenance of the samples or the laboratory results” that were the basis for its conclusions, “making independent assessments impossible.” It is not clear if, in its June 13 statement, the United States is drawing on the British and French evidence or its own analysis, he said in a June 19 interview.

Crossing Redlines
Rhodes said the intelligence community findings cross “clear” redlines and violate international norms. Accordingly, Obama changed his calculus on Syria and already increased nonlethal assistance to the opposition, he said. A number of “legal, financial, diplomatic and military responses” also are available, according to Rhodes.

In a follow-up press call June 13, Rhodes said that the U.S. aim is provide assistance that has “direct military purposes” and is “substantively different” from past aid. He would not confirm specifics of the assistance package. News outlets quoted unnamed administration officials as saying that small arms would be provided to the Syrian opposition forces.

Rhodes’ statement followed reports by the United Nations and France that each had concluded that chemical weapons were being used in Syria.

French Foreign Minister Laurent Fabius said June 4 that there was “no doubt” that Assad used sarin on several occasions. The French government tested samples smuggled out of Syria that confirmed the use of sarin, Fabius said.

The June 4 UN report said that there are “reasonable grounds” to believe that chemical weapons were used in Syria on two occasions in March and two in April but that it was not possible to identify the chemical agents or determine who used them.

After allegations that chemical weapons were used near Aleppo on March 19, Assad requested that the UN investigate the claims. Secretary-General Ban Ki-moon said that the UN would investigate in conjunction with the World Health Organization and the Organisation for the Prohibition of Chemical Weapons (OPCW), which oversees implementation of the CWC.

Syria has yet to allow investigators into the country due to a disagreement over the scope of the UN inquiry. Syria wants to restrict the investigation to the March 19 incident. Ban said the mission must be allowed to investigate “all the allegations” made by member states. (See ACT, May 2013.)

Syrian opposition forces have claimed that the Assad regime used chemical weapons in the March 19 incident. France and the United Kingdom have asked Ban to include other sites where the rebels have said the Assad regime used chemical weapons.

In the June 13 statement, Rhodes said that Washington briefed the head of the UN team, Åke Sellström, on its evidence and sent a letter to Ban informing him of the intelligence community’s evidence and assessments. The United States also is pushing for the UN team to have “immediate and unfettered access to conduct on-site investigations” in Syria, he said.

UN Probe Stalled
After Ban’s announcement, Sellström’s team assembled in Cyprus. But because of “the continued absence of an agreement” with the
Syrian government on the terms of the team’s access, the team has left that country, UN spokesman John Ennis said in a June 19 e-mail to Arms Control Today:

The team “has been continuing to monitor developments and collect available information,” and Sellström has “visited capitals and has also been assessing other options for fact-finding activities outside of Syria, including in neighbouring countries,” Ennis said. In spite of the considerable time that has elapsed since the alleged March 19 incident, it is important for the team to be able to conduct an investigation in Syria because “[t]here are a range of possible on-site activities extending beyond the collection of environmental samples, which still could provide information on whether or not chemical weapons were used,” Ennis wrote.

Some evidence of chemical weapons use from the environment or from samples—for example, from the blood or urine of victims—is fleeting, but postmortem specimens of brain tissue will indicate the chemicals that caused death, Smithson said. Furthermore, she said, although environmental samples degrade, they do so along known chemical pathways, and gas chromatography-mass spectrometry can reliably identify these degradation by-products.

She cited the case of the 1988 gassing of the Iraqi town of Halabja by Saddam Hussein’s forces. More than four years later, she recalled, a team from Physicians for Human Rights collected samples that then were analyzed by the United Kingdom’s top chemical defense laboratory and found to contain degradation by-products of sarin and mustard gas.—KELSEY DAVENPORT and DANIEL HORNER

‘More Active’ Talks Needed, Rouhani Says

Iran’s newly elected president, Hassan Rouhani, said he hopes for “more active negotiations” with six world powers over Tehran’s controversial nuclear program after he takes office on Aug. 3.

In a June 17 press briefing, Rouhani said that the nuclear issue can “only be resolved through negotiations” and that the parties can find “mutual trust” to reach a solution. Rouhani was elected June 14.

In a June 24 interview, a former Iranian official said Rouhani will be better placed than his predecessor, Mahmoud Ahmadinejad, to make a deal on limiting Iran’s nuclear program in exchange for relief from international sanctions. Iran’s economy is under considerable pressure from sanctions primarily imposed by the European Union, the United Nations, and the United States for failing to comply with UN Security Council resolutions requiring Iran to suspend sensitive nuclear activities. The former official said Iranian Supreme Leader Ayatollah Ali Khamenei still will have the final say but that Khamenei is more likely to trust Rouhani than Ahmadinejad and give him latitude to negotiate.

In a June 15 press release acknowledging Rouhani’s victory, White House Press Secretary Jay Carney said that the United States is ready to “engage the Iranian government directly” to reach a diplomatic agreement that will “fully address” international concerns about Iran’s nuclear program.

Rouhani served as Iran’s nuclear negotiator between 2003 and 2005 and is widely considered supportive of the clerical regime, even though he was cast as the most moderate of the six contenders on the presidential ballot.

Iran is negotiating with six countries—China, France, Germany, Russia, the United Kingdom, and the United States—over the nuclear program, which it claims is entirely peaceful. The six powers, or PS+1, are concerned that Iran is progressing toward a capability that would allow the country to develop nuclear weapons rapidly if it chose to do so.

Iran and the PS+1 held two rounds of talks in February and April, but have been unable to reach an agreement. No further talks have been scheduled, although officials from several PS+1 countries expressed support for resuming talks in August after Rouhani takes office.

According to U.S. and Iranian sources familiar with the negotiations, Iran wants the PS+1 to recognize its right to pursue uranium enrichment and to provide sanctions relief. A principal PS+1 concern is halting Iran’s production of 20 percent-enriched uranium and limiting the size of its stockpile of that material. (See ACT, May 2013.)

Uranium enriched to 20 percent is more easily converted to weapons grade than reactor-grade uranium, which is enriched to less than 5 percent.

Rouhani will not give up uranium enrichment, but as long as the United
States “does not expect too much” and is willing to put meaningful sanctions relief on the table, a deal could be made that limits enrichment to reactor grade and increases transparency, the former official said. Such a deal would allow Rouhani and Khamenei to “claim a victory” in the negotiations while meeting the most pressing concerns of the West, said the former official, who now lives in the United States.

At his June 17 press conference, Rouhani pledged greater openness. Although he maintained that Iran’s nuclear plans are “fully transparent,” he said that Tehran is “ready to show more transparency” to make clear to the world that its nuclear program is in line with international standards.

**Iran-IAEA Talks Stalled**

Two weeks before Rouhani’s press conference, Yukiya Amano, director-general of the International Atomic Energy Agency (IAEA), told the organization’s Board of Governors at its quarterly meeting that talks with Iran are “going around in circles.”

Iran and the IAEA are negotiating an approach for the agency’s investigations into the possible military dimensions of Iran’s nuclear activities. The two sides have met 10 times since January 2012 in an attempt to reach agreement on the scope and sequence of the investigations. The IAEA first laid out its suspicions about Iranian nuclear efforts allegedly relating to weapons development in a November 2011 report to its board. (See *ACT*, December 2011.)

In the U.S. statement to the board at the June meeting, Joseph Macmanus, U.S. permanent representative to the IAEA, said Amano’s assessment that talks between the agency and Iran are not making progress was convincing. If there is no progress before the next board meeting, which is in September, the United States will work with other board members “to consider further action” against Iran, he said.

Macmanus did not specify what actions the United States would pursue, but the board could request that the UN Security Council take further action to censure Iran or impose additional sanctions.

The United States has made similar statements in the past. At the board meeting last November, the United States said it would urge action at the next meeting, in March, if no progress was reported on the Iran-IAEA negotiations. Despite Amano’s statement to the board during the March meeting that Iran and the IAEA had not made any progress, no action was taken. (See *ACT*, April 2013.)

**IAEA Report**

The IAEA’s most recent report to the board, dated May 22, found that Iran is continuing to move forward with its nuclear program, while failing to provide information on the possible military dimensions.

According to that report, Iran’s stockpile of uranium enriched to 20 percent was 182 kilograms. Experts estimate that approximately 250 kilograms of uranium enriched to this level, when further enriched to weapons grade, is enough for one bomb.

Iran has an additional 113 kilograms of uranium enriched to 20 percent that has been converted into powder, which Tehran claims it will use for fuel to produce medical isotopes. The powder can be converted back into gas form for further enrichment, but experts say it is unclear how much material would be lost in the process.

Iran is continuing to install advanced centrifuges at its Natanz enrichment plant, although they are not yet producing enriched uranium. Iran had installed casings for nearly 700 machines, the May 22 report said.

According to a June 3 UN panel report on the implementation of Security Council sanctions on Iran, there is little public information on Tehran’s ability to indigenously produce components, including centrifuges, for its nuclear activities.

The panel, established in 2010 by Security Council Resolution 1929 to monitor compliance with UN sanctions and provide recommendations on implementation, noted that several states reported attempts by Iran in recent months to buy goods prohibited by UN sanctions because of their potential use in sensitive nuclear activities. These items included ring magnets and high-quality aluminum alloys, which can be used for centrifuges. The panel found that Iran continues “to seek items for prohibited activities from abroad” through “increasingly complex” methods of procurement.

The UN Security Council first voted to impose sanctions on Iran in December 2006 with Resolution 1737, after Tehran failed to comply with an earlier resolution to halt certain nuclear activities. Subsequent resolutions in 2007, 2008, and 2010 expanded these sanctions, primarily targeting Tehran’s ability to procure items that could be used in its nuclear and ballistic missile programs.—**KELSEY DAVENPORT**
Russia and the United States on June 14 agreed to a pared-down replacement for a 1992 pact that formed the basis of their joint efforts to control or destroy Russian weapons of mass destruction and related material and delivery vehicles.

The Obama administration described the new pact as a recalibrated extension of the old agreement. But some current and former congressional staffers said they saw it more as the sunset of the Cooperative Threat Reduction (CTR) program, commonly known by the names of the authors of the 1991 legislation that established the effort, Sens. Richard Lugar (R-Ind.) and Sam Nunn (D-Ga.).

The new accord replaces the so-called CTR umbrella agreement, which expired June 17.

Cooperation between the two countries will continue “in a broad array of nuclear security and nonproliferation areas,” such as security of nuclear and radiological material and conversion of research reactors from using highly enriched to low-enriched uranium fuel, according to a June 19 State Department summary of the agreement. But Russia “will assume the costs [of] and complete without further U.S. assistance” two main parts of the CTR effort—destruction of ballistic missiles and chemical weapons—the summary said.

That shift is reflected in the roster of “executive agents” listed in the agreement. For Russia, the list includes the State Corporation for Atomic Energy, commonly known as Rosatom, which is the principal Russian agency for the work on nuclear materials security and nonproliferation, but does not include the Ministry of Defense, which was responsible for the work on ballistic missiles, or the Ministry of Industry and Trade, which was the main Russian agency for CTR work on chemical weapons destruction.

For the U.S. side, the executive agents are the Energy and Defense departments. The June 19 summary includes the State Department on its list of agencies that “will remain involved.”

The new agreement “reflects the evolution” of the U.S.-Russian partnership, the summary said. In a June 25 interview, a State Department official said that the effort has developed into “more of an equal partnership” than it was at its inception. Russia is “more comfortable” with that form of the relationship, and so is the United States, the official said.

Russian media reported last year that Moscow may not want to continue the CTR agreement at all because it no longer needs Washington’s financial assistance to carry out the program and does not want to risk revealing sensitive information to the United States. According to Western experts, Moscow had resented being dependent on Washington to pay for securing its own weapons.

The State Department official said that some parts of the program are “winding down,” but described the new agreement as a “continuation of the relationship, just in a different form.”
In a June 17 statement, Nunn, who is now co-chairman and CEO of the Nuclear Threat Initiative, acknowledged that “key elements of what we have known as Nunn-Lugar will not be carried forward under this umbrella agreement” and said that “[w]e must find ways beyond this agreement to work together” on issues relating to weapons of mass destruction.

Thomas Moore, a former Lugar staffer who is a senior fellow at the Center for Strategic and International Studies, said in a June 21 interview that the joint effort “was going to end sometime, and now it has.” The new agreement “marks the final chapter in the end of the Cold War,” he said.

A Republican congressional staffer expressed a similar view in a June 25 e-mail to Arms Control Today, saying that “[t]he programs that are ending are largely completed, at least as much as the Russians are going to allow us to do. And those that are continuing should continue. Do I have confidence that the Russians will match our standards? No. But I hope they will be good enough. I don’t see that we have any option.”

Paul Walker, a former House Armed Services Committee staffer who heads the environmental security and sustainability program at Global Green USA, had a mixed response. In a June 24 e-mail to Arms Control Today, he said the new agreement is “a positive step forward,” but he cautioned that “there... remain thousands of nuclear warheads and millions of chemical weapons to dismantle, as well as hundreds of strategic launch systems.”

“Russia no doubt decided that the meager funds weren’t worth the foreign intrusion at their most sensitive military sites,” said Walker, who is a member of the Arms Control Association Board of Directors.

He said he hoped that Russia and the United States “can still work out bilateral agreements specific to projects, for example, to finish construction at the chemical weapons destruction facilities at Shchuch’ye and Kizner so that Russia does not continue to fall behind in [its] destruction schedule.”

The Russian embassy in Washington did not respond by press time to a request for comment.

In addition to the programmatic changes, a key difference between the new agreement and its predecessor is in its liability provisions.

Under the original agreement, the U.S. government and its contractors were shielded from virtually all liability for accidents that could occur under the program’s work in Russia. In 2006, when the agreement was being renewed for the second time, the deal reportedly was on the verge of collapse due to Moscow’s concerns over liability.

Under the new agreement, Russia is to notify the United States when it believes it has grounds for a liability claim against the United States or its employees or contractors. The two sides “shall... attempt to achieve a mutual understanding within 90 days” of the notification. If they do not reach this understanding, Russia can begin legal proceedings.

The liability arrangements are described in a protocol to the 2003 Framework Agreement on a Multilateral Nuclear Environmental Programme in the Russian Federation (MNEPR), which replaces the CTR umbrella agreement as the underlying legal basis for the threat reduction work. The MNEPR has traditionally outlined the legal underpinnings for countries to assist Russia with spent nuclear fuel safety and radioactive waste management.—DANIEL HORNER and TOM Z. COLLINA
67 States Sign Arms Trade Treaty

Senior diplomats from 67 European, Latin American, Asian, and African states signed the Arms Trade Treaty (ATT) at the United Nations on June 3.

The result of seven years of negotiations, the ATT is the first global treaty to establish common international standards that must be met before states may authorize transfers of conventional weapons or may export ammunition and weapons parts and components. The ATT also prohibits transfers that would lead to war crimes and attacks on civilians, and it requires states to report annually on all authorized arms exports.

Addressing the delegates at the signing ceremony, UN Secretary-General Ban Ki-moon declared that “the world has decided to finally put an end to the free-for-all nature of international weapons transfers.” In 2012, states engaged in arms transfers totaling more than $85 billion, according to the Congressional Research Service. That figure does not include transfers through the black market.

Many leading arms-supplier states, including the United Kingdom, Germany, and France, signed the treaty, as did many developing states in conflict zones. Several treaty supporters including the United States did not sign immediately, but are expected to do so in the coming months.

In a written statement read at the ceremony, U.S. Secretary of State John Kerry said the treaty “is an important contribution to efforts to stem the illicit trade in conventional weapons, which fuels conflict, empowers violent extremists, and contributes to violations of human rights.”

Kerry said the United States “welcomes the opening of the Arms Trade Treaty for signature, and we look forward to signing it as soon as the process of conforming the official translations is completed satisfactorily.” At a June 17 forum in Washington, Thomas Countryman, assistant secretary of state for international security and nonproliferation, said, “I think we’ll be ready to sign the treaty” when that process is complete.

U.S. and UN officials told Arms Control Today that the process for ensuring the treaty text is identical in all six official UN languages will be formally completed by Aug. 28. At the June 3 ceremony, no other state raised concerns about conforming the translations.

As of June 25, a total of 74 states had signed the treaty; 50 states must sign and ratify it to trigger its entry into force.

The ATT is the product of nearly two decades of advocacy and diplomacy. The process began with a Nobel laureates’ initiative in 1995, in which eight peace prize winners called for tight regulation of the global weapons trade. It advanced in the United States with the 1999 International Arms Sales Code of Conduct Act, which was championed by Kerry, who was then a senator. That law required the U.S. president to begin negotiations on a multilateral arms export regime.

In October 2009, Secretary of State Hillary Rodham Clinton announced that the United States would support the arms trade treaty negotiation process and would vote in favor of a General Assembly resolution creating a treaty conference. The conference formally convened in July 2012, but fell short of reaching consensus on a final text.

Beginning in 2010, the United States, the world’s largest arms supplier, played a key role in the negotiations, especially during the final two-week-long March 2013 diplomatic conference, which failed to reach agreement due to opposition from Iran, North Korea, and Syria. Washington and other key capitals then moved the treaty for a vote at the UN General Assembly on April 2, where it was approved 156-3 with 22 abstentions. (See ACT, May 2013.)

Two major arms suppliers, China and Russia, did not attend the signing ceremony. China supported the treaty text during the final negotiating conference, but did not vote for the treaty at the UN General Assembly because it said it favored agreement by consensus. Russia has said the ATT does not include strong enough prohibitions against diversion to nonstate actors and that it is reviewing the treaty.

India, the world’s largest arms buyer, did not attend the signing ceremonies. New Delhi objected to the deletion of a provision during the March negotiations that would have allowed defense trade agreements to supersede ATT
requirements.

Nevertheless, nongovernmental campaigners were encouraged. “The signing of the Arms Trade Treaty gives hope to the millions affected by armed violence every day,” said Anna Macdonald of the humanitarian group Oxfam in a statement delivered at the June 3 gathering. “For generations the arms trade has been shrouded in secrecy, but from now on, it will be open to scrutiny,” she said.

Several governments highlighted the work necessary to achieve entry into force and effective implementation of the treaty. The states-parties must bear “[t]he primary responsibility” for effective implementation and ensure that the treaty “is not a mere decoration in our bookshelves,” said Ramadhan M. Mwinyi, Tanzania’s deputy permanent representative to the UN. “This treaty should provide…a break from a spiral of violence currently being exacerbated by illicit arms and arms trade…particularly in Africa,” he said.

Alistair Burt, undersecretary of state at the British Foreign and Commonwealth Office, called on all states to sign and ratify the ATT and begin the process of treaty implementation. Burt said that “the world has already waited too long and we should not and will not lose the momentum gained. Our goal is early entry into force and universal application.”—DARYL G. KIMBALL

NSG Revises List, Continues India Debate

The Nuclear Suppliers Group (NSG) has completed a revision of its list of controlled exports, the group announced in Prague on June 14 at the end of its annual plenary meeting.

At the meeting, representatives of the 48 member states continued to wrestle with the question of whether to admit India as a member, according to people familiar with the discussions. President Barack Obama proposed that step during a visit to India in November 2010. (See ACT, December 2010.)

The revision of the list, which covers nuclear-specific and dual-use goods, took three years to complete, the June 14 statement said.

The lists “are not static” and must keep up with “the main security challenges, advances in technology, [and] market trends,” said Veronika Kuchyňová Šmigolová, head of the Czech permanent mission to international organizations in Vienna and the chair of the NSG for the coming year, in a June 25 e-mail to Arms Control Today. After last year’s meeting in Seattle, U.S. Deputy Energy Secretary Daniel Poneman, the 2012-2013 NSG chairman, said completing the review was his highest priority. (See ACT, July/August 2012.)

The country that chairs the NSG starts its term by hosting the plenary meeting. The group is not a formal organization, and its guidelines are not binding, but members are expected to incorporate the guidelines into their national export control laws.

The June 14 statement said that the meeting participants discussed the role of the private sector in preventing proliferation and how NSG members could interact with companies that export nuclear goods.

In her e-mail, Kuchyňová highlighted the importance of companies’ internal compliance programs to ensure that the firms “do not inadvertently violate national laws and thereby subject themselves to sanctions and reputational damage.” Interaction with the private sector is “an important focus of our outreach,” she said.

Another target of her outreach efforts will be “non-NSG supplier states, including India, Pakistan and Israel,” she said. Those three countries never have joined the nuclear Nonproliferation Treaty (NPT) and maintain unsafeguarded nuclear programs.

In September 2008, in a move led by the United States, the NSG eased long-standing restrictions on nuclear trade with India by the group’s members. NSG rules generally forbid the sale of nuclear goods, such as reactors and fuel, to non-NPT countries.

With those restrictions lifted, Indian membership in the NSG is the “next logical step,” Ashley Tellis, a senior associate at the Carnegie Endowment for International Peace, said in a June 21 interview. While in the U.S. government, Tellis was a principal architect of the U.S. policy shift toward India that led to the
2008 NSG decision and a similar change in U.S. law. Like the 2008 decision, the idea of admitting India is controversial within the NSG, which makes its decisions by consensus. The issue of Indian membership "raises some very difficult questions and needs to be discussed further," a western European diplomat said in a June 26 interview. Tellis and the diplomat each listed France, Russia, the United Kingdom, and the United States among the strong supporters of Indian membership and China as a leading opponent.

A key criterion for NSG membership is that a country is a party to and complying with the NPT or a nuclear-weapon-free-zone treaty. India would be the first country that did not meet that criterion.

A British discussion paper on Indian membership argues that the NSG process for accepting new members "offer[s] the flexibility" to allow India to join. In the paper, which was obtained by Arms Control Today, the United Kingdom said it "believes that the NSG is best served by the inclusion and membership of India" because New Delhi has "an important civil nuclear industry" and "continues to uphold the international non-proliferation architecture."

Tellis said that, with the 2008 decision, "the debate about principle is over." The countries that were uneasy about admitting a non-NPT state with a nuclear weapons program "conceded" on the principle at that time, he said. "At the end of the day, they'll make the same judgment they did in 2008," he predicted.

The western European diplomat said his country is approaching the issue "with an open mind" but wants "a serious discussion" that "com[es] to grips with the implications" of the decision, for example, what it would mean for the implementation of NSG guidelines.

He said it might be possible to find a formulation that is not "damaging" to the NPT regime but "brings India closer." India could "take a couple of steps toward the NPT community," he said. One example would be signing the Comprehensive Test Ban Treaty, an "extremely high-value symbolic step" that would have little immediate practical effect on India, in part because the treaty has not entered into force and will not do so until India and seven other key countries have ratified it, he said. Also, he said, there already are other legal and political constraints on India's ability to conduct a nuclear test.

The June 14 statement did not provide any information on the India discussions, repeating the language used in 2011 and last year. Kuchyněová also declined to provide details.—DANIEL HÖRNER

Expert Group Coalesces on Cyberspace

A group of governmental experts from 14 countries, including the United States, Russia, and China, produced a "landmark consensus" report affirming "that international law, especially the UN Charter, applies to cyberspace," according to a State Department statement released June 7.

"This consensus sends a strong signal: States must act in cyberspace under the established international rules and principles that have guided their actions for decades—in peacetime and during conflict," the statement declared.

The report, which has not yet been made public, came out of a meeting held June 3-7 at the United Nations. The meeting was the last of three held since August 2012 by the UN Group of Governmental Experts on Developments in the Field of Information and Telecommunications in the Context of International Security. The panel examined existing and potential threats from behavior in cyberspace and possible cooperative measures states can undertake to address them.

In a June 19 interview, a State Department official familiar with the discussions said the United States had fallen short of gaining consensus on the applicability of international law to behavior in cyberspace during meetings of an earlier group of governmental experts in 2009 and 2010. This time, the United States achieved its original goals and more, the official said.

The UN experts affirmed that the law of state responsibility applies to cyberspace, which means states must hold nonstate actors—terrorists, criminals, and activist hackers—
accountable for wrongful acts in cyberspace that originate from the states’ territory, the official said. It also means that states should not use these actors to commit wrongful acts in cyberspace on their behalf, the official said. According to many experts, both of these issues have long divided the United States from Russia and China with regard to establishing norms for behavior in cyberspace.

The report contains detailed recommendations on transparency and confidence-building measures that states can implement to help reduce the risk of conflict in cyberspace, the official said, emphasizing that this is an important difference from the report that resulted from the 2009-2010 meetings. The new report, the official said, calls for “increasing predictability and reducing misperception” by establishing high-level communication and timely sharing of information on potential malicious activity between countries.

The official said the report by the experts group would provide a basis for further discussions by the international community about how to apply international law to cyberspace. The goal is to have more states join the consensus and to consider what norms should apply below the level of armed conflict in cyberspace, said the official.

Some of this discussion may already be taking place. The Washington Post reported June 7 that President Barack Obama and Chinese President Xi Jinping discussed cybersecurity during their two-day summit in California.

In recent public statements by China and the United States, each has claimed it was the victim of cyberattacks by the other. In a report sent to Congress earlier this year, the Pentagon publicly accused the Chinese government and military for the first time of being directly behind many of the intrusions into U.S. networks. (See ACT, June 2013.) Two days before the June 7 Obama-Xi meeting, Huang Chengqing, director of China’s network emergency response center, told the English-language China Daily that China has “mountains of data” if it wanted to accuse the United States of cyberattacks, “but it’s not helpful in solving the problem.” He said that “the issue can only be settled through communication, not confrontation.”

The United States and China plan to hold regular, high-level talks on standards of behavior for cybersecurity, according to a recent report in The New York Times, with the first meeting set for July.

One area in which countries need to come to an agreement is “to not deliberately destroy critical infrastructure with their cyber capabilities,” said John Steinbruner, a professor of public policy at the University of Maryland who chaired a National Academy of Sciences panel on deterring cyberattacks.

Deliberate attacks against a country’s power grid or transportation sector could cause further escalation of a conflict beyond the cyberspace realm and into more traditional types of armed conflict, he said, adding that Russia, China, and the United States are all investing in capabilities to attack one another’s critical infrastructure with cyber weapons. Although it is likely that whatever agreement China and the United States produce will be “marginal,” there is still an opportunity to limit these capabilities before they are used, said Steinbruner, who is chairman of the Arms Control Association Board of Directors.—TIMOTHY FARNSWORTH

U.S. Cyberspace Operations Detailed

In a secret U.S. policy document, President Barack Obama has outlined details of how the United States conducts offensive operations in cyberspace against other countries.

The classified document, known as Presidential Policy Directive 20, was leaked to and published by the British newspaper The Guardian on June 7. Signed by Obama in October 2012, the directive declares that all offensive operations in cyberspace intended to produce effects outside the United States with “significant consequences” must have presidential approval, except in emergency situations. The document gives authority to the secretary of defense to conduct emergency cyberactions “necessary to mitigate an imminent threat or ongoing attack” against U.S. national interests when there is not enough time for presidential approval.

The document orders senior national security and intelligence officials to “identify potential targets of national importance” outside the United States where offensive operations in cyberspace “can offer a favorable balance of effectiveness and risk as compared with other instruments of national power.” It also says that the United States will conduct these operations in accordance with existing international laws and norms, including its right to self-defense.

Some details of the directive on the Defense Department’s role in operating in cyberspace were declassified in January 2013. (See ACT, January/February 2013.) The document published by The Guardian provides new details on the criteria for these U.S. government operations.

When considering such operations, U.S. officials must weigh the possibility of intelligence gain or loss, the risk of retaliation, and the impact on foreign policy relationships, according to the directive. The document generally requires the United States to “obtain consent from countries in which cyber effects are likely to occur or those countries hosting U.S. computers and systems,” but allows the president to make exceptions.

The document recognizes that these operations can have unintended consequences in locations other than the intended target and could affect U.S. national interests in many locations.

The directive establishes a process for discussing and changing policies related to offensive and defensive operations in cyberspace by creating a Cyber Operations Policy Working Group, where agencies can raise “unresolved or ambiguous” policy questions.—TIMOTHY FARNSWORTH
The U.S. special representative for North Korea policy outlined Washington’s current strategy for dealing with North Korea’s nuclear program, saying last month that the United States will place a high priority on efforts to coordinate with partner countries in the region so they speak with “one voice” before negotiating with Pyongyang on denuclearization.

Glyn Davies, speaking at the Woodrow Wilson International Center for Scholars on June 14, said Washington has not tried a “concerted multilateral effort” that will send “common signals” to Pyongyang from China, Japan, Russia, South Korea, and the United States, the countries that had negotiated with North Korea in the so-called six-party talks. Those talks began in 2003 and continued intermittently until April 2009 when Pyongyang withdrew without having completed the dismantlement of its nuclear program. North Korea had committed to the dismantlement in 2005 in return for steps including economic cooperation, a U.S. guarantee not to invade or attack North Korea, energy assistance, and possible future assistance on a peaceful nuclear energy program.

Davies said the current U.S. approach for multilateral talks differs from the six-party process, which he described as a looser “umbrella” for negotiations with less coordination among the countries negotiating with Pyongyang.

Under the new approach, when multilateral negotiations with North Korea begin, Pyongyang will not be able to “exploit” any differences of opinion between the countries involved, Davies said.

Davies met with his Japanese and South Korean counterparts in Washington June 18-19. During a June 19 press briefing, State Department spokeswoman Jen Psaki said that the parties had agreed to continue “very close coordination on North Korea” and that U.S. consultations with China and Russia would “deepen.”

In a June 21 interview, Joel Wit, a former U.S. negotiator with North Korea, said that the United States is pursuing this strategy because Washington thinks it has China “in its corner.”

Wit cautioned against this assumption, saying that although there have been changes in China’s policy toward North Korea, it is “too early to judge the significance” of these changes.

Generally, Beijing is seen as more supportive of North Korea than other countries in the region are, providing much-needed economic assistance, despite Pyongyang’s failure to comply with UN sanctions calling for it to dismantle its nuclear and ballistic missile programs. At their June 7 meeting in California, President Barack Obama and Chinese President Xi Jinping agreed to “deepen” their countries’ cooperation on North Korea and continue to apply pressure on Pyongyang to denuclearize, U.S. national security adviser Tom Donilon said in a June 8 press briefing.

Wit described the current situation as a “struggle for China’s heart and mind.” The United States is trying to encourage China to increase pressure on North Korea, he said, while Pyongyang is attempting to maintain Chinese support, as evidenced by the
May 22 visit of a high-level North Korean official to Beijing and a June 16 North Korean request for talks with the United States.

Pyongyang’s Proposal
In a June 15 statement from the National Defense Commission, which controls the armed forces, a North Korean official said that bilateral talks with the United States would “ease tensions” on the Korean peninsula and “establish regional peace and security.” The statement reaffirmed that Pyongyang is committed to denuclearization of the Korean peninsula but warned that North Korea will not give up its nuclear weapons until “the nuclear threat from the outside is completely terminated.”

Davies said that although there are no plans “at the moment” for the United States to talk with North Korea bilaterally or multilaterally, Washington is not opposed to future diplomatic engagement. But there must be a “sufficient basis to make progress,” Davies said.

Referring to North Korea’s June 15 offer of talks, Psaki said in a June 17 press briefing that the United States has seen “no evidence” that North Korea will participate in negotiations that “produce credible denuclearization actions.” The United States will meet with North Korea as part of the six-party process only when Pyongyang takes “credible steps” toward denuclearization, she said.

Wit said if the United States sets preconditions for talks, North Korea will respond with its own preconditions, “and that is going to lead nowhere.”

In 2012 the United States did attempt to make a deal directly with North Korea that was not based on denuclearization. Known as the Leap Day agreement because it was concluded on Feb. 29, North Korea agreed to refrain from nuclear and missile testing in exchange for aid from the United States. (See ACT, April 2012.) The deal broke down in April 2012 after Pyongyang attempted to launch a satellite. The failure of the agreement led the United States to set tougher conditions for negotiations to begin, Davies said.

Since the Leap Day agreement fell through, Pyongyang successfully launched a satellite into orbit last December and tested a nuclear device Feb. 13.

Bilateral Talks
Davies said that the United States will not get to a “better place” with North Korea until the relationship between that country and South Korea improves.

North and South Korea were set to hold their first high-level talks in six years in Seoul, but Pyongyang pulled out of the June 12 talks at the last minute.

According to a statement run by the official North Korean news agency June 13, Pyongyang was insulted that Seoul chose its vice unification minister, Kim Nam-sik, rather than Unification Minister Ryoo Kihl-jae to lead the South Korean delegation. Pyongyang’s delegation was to be led by Kang Ji Yong, director for the secretariat of the Committee for the Peaceful Reunification of Korea.

In a June 13 press release, a spokesman for the South Korean Ministry of Unification said that the cancellation was “regrettable.” Seoul chose the vice minister to “reach parity” between the chief delegates from the two sides after North Korea said it would not send a ministerial-level official and chose Kang, the spokesman said, declaring that the “attitude of the North” derailed the talks.

In the June 13 statement, North Korea said Seoul’s impolite and “provocative behavior” would prevent dialogue in the near future.—KELSEY DAVENPORT

Chun Hae-sung of the South Korean Unification Ministry speaks in Seoul on June 9 before leaving for a meeting to prepare for planned June 12 talks with North Korea. Pyongyang pulled out of those talks at the last minute.
President Barack Obama last month outlined a nuclear arms control agenda for his second term, calling for negotiated arms reductions with Russia, a fourth nuclear security summit, and a renewed push for treaties banning nuclear testing and the production of fissile materials.

In a June 19 address at the Brandenburg Gate in Berlin, Obama said, “We may no longer live in fear of global annihilation, but so long as nuclear weapons exist, we are not truly safe.” Obama’s initiatives build on the goals he announced in his April 2009 speech in Prague and on the 2010 New Strategic Arms Reduction Treaty (New START), which mandates reductions in U.S. and Russian nuclear arsenals by 2018.

While noting that New START would reduce deployed nuclear warheads “to their lowest levels since the 1950s,” Obama said, “[W]e have more work to do.”

“To move beyond Cold War nuclear postures,” Obama said he would seek to reduce the numbers of U.S. and Russian deployed strategic nuclear weapons by up to one-third. If implemented, the reductions would trim the two countries’ strategic nuclear arsenals from the limit of 1,550 deployed warheads mandated by New START to about 1,000 to 1,100.

Obama announced that the United States would host a nuclear security summit in 2016, aimed at protecting nuclear material around the world from theft or diversion by terrorist organizations or rogue states. It would be the fourth such gathering of Obama’s presidency. The third summit is scheduled to be held in the Netherlands next year. Until Obama’s announcement, it was unclear if the summits would continue beyond 2014.

The president pledged “to build support in the United States to ratify the Comprehensive Nuclear Test Ban Treaty,” echoing a promise he made in Prague four years ago. Obama also renewed his call for negotiations on a treaty that would end the production of fissile materials for nuclear weapons.

Obama did not provide any details about how he would promote the test ban treaty, which was rejected by the Senate in 1999. He also provided no specifics on advancing a fissile material treaty in the 65-nation Conference on Disarmament, which has been thwarted by objections from Pakistan.

Obama promised to work with NATO allies “to seek bold reductions in U.S. and Russian tactical weapons in Europe,” where the United States now maintains an estimated 180 nuclear warheads. The alliance’s 2012 Deterrence and Defence Posture Review document links changes in the alliance’s nuclear posture to Russia’s nuclear policy by stating that “NATO is prepared to consider further reducing its requirement for non-strategic nuclear weapons assigned to the Alliance in the context of reciprocal steps by Russia.” (See ACT, June 2012.)

The president announced that, after a “comprehensive review,” he approved new nuclear weapons employment guidance...
The guidance directs the Pentagon to align U.S. military plans with the policies of Obama’s 2010 Nuclear Posture Review, which resulted in a report stating that the U.S. government will consider the use of nuclear weapons only in extreme circumstances to defend the vital interests of the United States or its allies and partners. Sources familiar with the review say that it was completed approximately 18 months ago.

The resulting strategy, says the summary, “will strengthen regional deterrence, and reassure U.S. allies and partners, while laying the groundwork for negotiations with Russia on how we can mutually and verifiably reduce our strategic and nonstrategic nuclear stockpiles.”

Administration sources say that senior U.S. and Russian officials soon will begin discussions on the options for further strategic nuclear reductions. “We are in close contact with our Russian counterparts and will be in the days and weeks and months ahead,” State Department spokeswoman Jen Psaki told reporters June 20.

In their public comments, senior Russian officials have responded coolly to Obama’s proposal. On June 23, Russian Foreign Minister Sergey Lavrov suggested that reductions beyond the levels in New START will make nuclear arsenals of the United States and Russia comparable to those of other countries with nuclear weapons.

“This means that further moves possibly proposed for reduction of actual strategic offensive arms will have to be reviewed in a multilateral format. And I’m talking not just official nuclear powers, but all countries that possess nuclear weapons,” Lavrov said on Rossiya 1 television. Russia has insisted that further offensive nuclear reductions also depend on a resolution of its concerns about U.S. strategic missile defense plans.

Obama’s speech was met with praise and criticism in the U.S. Senate. In a June 19 statement, Sen. Dianne Feinstein (D-Calif.), who chairs the intelligence committee, said that “the world will be better off without an unnecessarily high number of these powerful weapons. The Cold War is long gone and the United States and Russia must do more to adjust their deterrents to practicable standards.” Feinstein, along with 22 other Democratic senators, wrote to Obama earlier this year to encourage further action on nuclear reductions, the test ban treaty, and securing nuclear materials.

In a separate June 19 statement, Sen. Bob Corker (R-Tenn.), the ranking member of the Foreign Relations Committee, warned that additional limitations of the U.S. nuclear arsenal without modernization of existing forces could amount to “unilateral disarmament.” The same day, Corker and 23 other Republican senators wrote a letter to Obama insisting that “any further reductions in the U.S. nuclear arsenal should only be conducted through a treaty subject to the advice and consent of the Senate.”
Arms control advocates have said reciprocal, parallel reductions in strategic deployed nuclear forces can be implemented without a treaty and verified under the inspection procedures established by New START. A November 2012 report from the secretary of state’s International Security Advisory Board recommends a similar approach if the United States and Russia cannot agree on a new treaty. The report suggests the United States could accelerate its reductions under New START, allowing both sides to avoid “costly or destabilizing” programs to modernize strategic forces. (See ACT, November 2012.)

In his statement, Corker said Secretary of State John Kerry had assured him that any further reductions would occur in bilateral treaty negotiations subject to the advice and consent of the Senate. But a State Department spokesman denied that, saying Kerry had only agreed that the Senate would be “consulted.” “At this point, it’s premature to speculate on precisely what such agreement...might encompass or how it would be established,” the spokesman said.—JEFFERSON MORLEY and DARYL G. KIMBALL

In a setback to congressional proponents of a new missile interceptor site on the U.S. East Coast, senior military officials wrote in June that there is no military requirement for such a site and that the funds would be better spent on improving sensor capabilities for the existing system of interceptor sites in Alaska and California.

“There is no validated military requirement to deploy an East Coast missile defense site,” wrote Vice Adm. James Syring, director of the Missile Defense Agency (MDA), and Lt. Gen. Richard Formica, commander of the Joint Functional Command for Integrated Missile Defense, in a June 10 letter to Sen. Carl Levin (D-Mich.). They told Levin, chairman of the Armed Services Committee, that a decision to build such a site should wait until an environmental review of possible locations, required by the fiscal year 2013 National Defense Authorization Act, is complete. In May, Syring testified that this review, which would start in early 2014, could take up to two years.

Compared to another missile interceptor site, investments in “discrimination and sensor capabilities” would be a “more cost-effective” way to better protect the United States from long-range ballistic missiles, Syring and Formica wrote. Independent experts have criticized the U.S. system for not having the sensors, such as X-band radars, that would be necessary to distinguish actual threat warheads from missile debris and other decoys. Michael

An interceptor missile is put in place at Fort Greely in Alaska on December 18, 2005.
Gilmore, director of operational testing and evaluation at the Pentagon, testified May 9 that “[i]f we can’t discriminate what the real threatening objects are, it doesn’t matter how many ground-based interceptors we have. We won’t be able to hit what needs to be hit.”

The United States already has two missile interceptor sites on the West Coast, at Fort Greely in Alaska and Vandenberg Air Force Base in California, with a total of 30 ground-based interceptor (GBI) missiles to blunt potential limited attacks from North Korea or Iran. North Korea has long-range missiles that may be capable of reaching the United States; Iran could have such capabilities by 2015 with foreign assistance, according to U.S. intelligence agencies.

In response to recent North Korean nuclear and missile tests, the Pentagon announced in March that it would field an additional 14 GBI missiles in Alaska by 2017 at a cost of $1 billion, using funds that would have been allocated for the now-canceled Standard Missile-3 (SM-3) IIB missile that had been planned for deployment in Europe. (See ACT, April 2013.) The GBI missiles would also be effective against future missile threats from Iran, according to the Defense Department.

Madelyn Creedon, assistant secretary of defense for global strategic affairs, testified in May that the East Coast is already “well protected” by the 30 GBI missiles now deployed and that the plan for another 14 interceptors “provides additional protection” against “anything from North Korea as well as anything from Iran, should that threat develop.”

The combat effectiveness of the current GBI system has not been proven. The system has not successfully intercepted a test target since 2008, with two failures in 2010. (See ACT, October 2012.)

Meanwhile, the Senate Armed Services Committee approved its version of the defense authorization bill June 13. Like last year, the Democratic-led Senate did not authorize an East Coast site. Instead, reflecting the June 10 letter from the Pentagon, the committee’s bill authorizes $30 million to deploy an additional X-band radar to support target discrimination. The administration had not requested those funds. Overall, the committee authorized $9.3 billion for missile defense, $150 million more than what the administration had requested.

Levin told reporters June 13 that his committee had authorized funds to build “advanced sensors” that would be “more effective than just missiles.” Levin said the sensors would be cheaper than a new missile interceptor site and that “they can be fielded faster.”

Despite the Pentagon’s position, on June 14 the full Republican-controlled House of Representatives voted, as it did last year, to fund an East Coast missile defense site in its fiscal year 2014 defense authorization bill, providing $140 million to begin site construction. The House Appropriations Defense Subcommittee put $70 million in its 2014 spending bill for the same purpose.

The House authorization bill says a new site is needed “to deal more effectively with the long-range ballistic missile threat from the Middle East,” particularly Iran. Missile defense proponents in the House say that the need has increased since the Obama administration canceled the SM-3 IIB program, which would have been fielded in Poland to intercept potential long-range missiles from Iran aimed at the United States.

On June 11, after a House Armed Services Committee vote, the White House threatened to veto the House defense bill on the grounds that the call for an East Coast site “presumes a validated military requirement…when none exists.”

An East Coast site would cost at least $3.4 billion to build and operate over five years, according to a June 11 Congressional Budget Office estimate. A 2012 report by the National Research Council, the operating arm of the National Academy of Sciences, said that the total 20-year cost for a new system at two sites would be up to $25 billion and that the United States has already spent about $40 billion on the system on the West Coast. The report recommended replacing the existing system with an entirely new technology, which could take a decade or more to develop.

Once the full Senate approves its defense authorization bill, the House and Senate bills will have to be brought into agreement by a conference committee before being sent to President Barack Obama. —TOM Z. COLLINA
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