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Statement before the House Foreign Affairs Committee

"NUCLEAR COOPERATION AND NONPROLIFERATION: RECONCILING COMMERCE AND SECURITY"

A Statement by

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Thank you, Mr. Chairman, Ranking Member Ros-Lehtinen and members of the Committee for inviting me to be a witness today on the subject of nuclear cooperation and nonproliferation. Your committee is providing vital oversight of nuclear commerce and controls, which sometimes seem at odds with each other. The task before us is to ensure that peaceful nuclear energy remains just that – and not a pretext for developing a latent nuclear weapons capability.

The title of this hearing, "Nuclear cooperation after Khan and Iran: Are We Asking Enough of Current and Future Agreements" suggests that we might need to alter the way we conduct our own nuclear cooperation in response to proliferation developments. And it is certainly true that the Khan network and Iran's clandestine program have highlighted the proliferation risks of the diffusion of sensitive technology, such as uranium enrichment and spent fuel reprocessing.

The unfortunate truth is that for the past seven years since the discovery of the Khan network and Iran's program, efforts to create real restrictions on the nuclear fuel cycle have encountered roadblocks. Some of these have been from U.S. allies and competitors. Some have been from states that do not even now have nuclear power. Both supply-led and demand-led attempts have largely failed.

There are several reasons for this. *First,* global enthusiasm for nuclear energy is at an all-time high, as it is seen by many as an antidote to climate change and energy dependence. *Second,* although top suppliers agreed for a few years to restrict enrichment and reprocessing transfers, efforts failed because consensus within the Nuclear Suppliers Group (NSG) has dangerously eroded. One has only to look at China's intended sale of reactors to Pakistan, and to the objections to more stringent requirements for enrichment and reprocessing transfers raised by Canada, Argentina, Brazil, South Africa, and Turkey, among others. The failure of the NSG to reach a consensus is not surprising after the U.S.-India nuclear cooperation deal. *Third,* most of the proposals under discussion for the past five years, from fuel banks to enrichment bonds and multinationalization of facilities, involve marginal changes to the current system of supply, offered by the supplier states. On the front end of the fuel cycle – enrichment and fuel fabrication – the message from the advanced nuclear suppliers is that the market works and we should not distort competition. On the back end of the fuel cycle, the message has been that if you want nuclear power, you have to take care of the waste yourself.

The newcomers to nuclear power – those states that do not now have nuclear power but have declared an interest in acquiring nuclear power reactors -- (and there may be as many as 60 of them, according to the International Atomic Energy Agency) approach the restrictions differently. They see the global nuclear industry as an oligopoly, and most fuel assurance efforts as a way to keep them dependent on the advanced nuclear states. If they have to deal with the waste, they may consider all their options, including sending it abroad for reprocessing or reprocessing it at home.

Many non-nuclear weapon states are anxious to keep their fuel cycle options open as the nuclear industry talks up the prospect of a nuclear renaissance. And with few legal restrictions in place, it is unclear how far sensitive technology might spread in the future. In its 2003 report

on the Future of Nuclear Power, a Massachusetts Institute of Technology study group suggested that as many as 54 countries could have a nuclear capacity above 10 GWe (about 10 large reactors) by 2050, creating a case for domestic enrichment of uranium. And although 30 countries plus Taiwan now have spent nuclear fuel, not a single one – including the United States – has directly deposited that spent fuel in a long-term, geologic repository. States are currently debating the pros and cons of recycling their spent fuel to get additional fissile material resources out of it, to expand packaging options for high level waste, and possibly, to reduce the footprints of geologic repositories. Although the United States continues to advocate long-term storage (100+ years) of spent nuclear fuel, it is not clear which states will be following us.

U.S. Leadership and Nuclear Industry

In 1978, when the Nuclear Nonproliferation Act was passed, U.S. commercial nuclear leverage was still considerable. In 1974, U.S. reactor exports accounted for close to 60% of the world market and four companies produced reactors – Babcock & Wilcox, Combustion Engineering, General Electric, and Westinghouse. While the development of nuclear power in the United States slowed down, development elsewhere, particularly in France, Russia, Japan, and Korea ramped up. The gaseous diffusion process for uranium enrichment developed in the United States is now obsolete, and the gas centrifuge process that was developed in Europe and Russia is predominant. Fuel fabricators in the United States are led by Westinghouse, a company owned by a consortium led by Toshiba. And General Electric has become GE Hitachi. The Toshiba subsidiary Westinghouse is the only nuclear reactor vendor that is successfully selling reactor technology developed in the United States. In 2008, the U.S. nuclear energy industry exported $285.7 million, most of it in fuel and fuel-related supplies.[1] This compares to a $14 billion procurement from domestic sources for U.S. nuclear power plants.

On the back end of the fuel cycle, commercial reprocessing halted in the United States more than thirty years ago and despite efforts of the Bush Administration, has not really been resuscitated. In its place, there is research and development conducted by the Department of Energy on a "modified open" fuel cycle, which could include recycling techniques deemed to be more proliferation-resistant than the dominant PUREX process.

Nonetheless, strong U.S. patent and export laws will continue to exert leverage over some nuclear commerce. In the words of one UAE official, without a U.S. nuclear cooperation agreement, "you find yourself in a licensing scenario where every component and every piece of material has to be licensed separately. It is very difficult to manage a project in those circumstances." Moreover, "ultimately much of the technology has a US thumbprint on it."[2] This is why Westinghouse will be involved in Korea's construction of four nuclear power plants for the United Arab Emirates. This leverage may not last for long, however, as South Korea plans to sell completely indigenous reactors abroad by 2015.

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[1] See "Trade Mission, Agreements Promote U.S. Nuclear Technology in Eastern Europe," available at: http://trade.gov/publications/ita-newsletter/0810/nuclear-tech-trade-mission.asp

[2] "UAE set nuclear precedent as "gold standard," *The National*, August 23, 2010, found on-line at UAE Interact, http://www.uaeinteract.com/docs/UAE_set_nuclear_precedent_of_â€˜gold_standardsâ€™/42290.htm.

Another potential source of leverage is foreign interest in new nuclear power development in the United States. The French company AREVA is now a major fuel fabricator in the United States, and other foreign countries are exploring opportunities to fabricate nuclear fuel in the United States. Korea Nuclear Fuel has contracted with Westinghouse to provide fuel for U.S. reactors.[3] Mitsubishi and AREVA have also announced sales of nuclear power plants to operators in the United States. The table below gives examples of foreign interests in U.S. nuclear concerns.

TABLE 1: Foreign investment in U.S. nuclear capacity, 2010

Project	Operator / Owner	Foreign investment	Domestic Ownership	Reactor Supplier
Calvert Cliffs, Unit 3	UniStar Nuclear (a joint venture by Constellation Energy and EDF)	EDF (85% owned by French govt) EDF owns 50% of UniStar; EDF also owns 9.5% of U.S. firm	Constellation Energy	AREVA***
South Texas Project, unit 1&2	Attempt by CAMECO (Canadian firm) to acquire 25.2% of South Texas Project unit 1 & 2 was unsuccessful			
South Texas Project, unit 3&4	Nuclear Innovation North America (NINA): nuclear company jointly owned by NRG Energy and Toshiba NRG owns 88%, Toshiba 12%	NINA's: 83.175% Toshiba: about 10% Tokyo Electric Power Company (TEPCO): 9 % Total foreign: 19 %	CPS Energy: 7.6%	Toshiba
Nine Mile Point, Unit 3	UniStar Nuclear (a joint venture by Constellation Energy and EDF)	At least half	Constellation Energy	AREVA
National Enrichment Facility (New Mexico)	URENCO	URENCO owns 100% of the National Enrichment facility		
IDAHO Enrichment Facility	AREVA joint venture with Northrop Grumman	At least half is reported to be owned by AREVA		
USEC		Noble Group = 5.1% Chinese sovereign wealth fund = 15% of Noble		

Source: Various, including New York Times, Nuclear Information & Resource Service.

U.S. Nuclear Cooperation and Nonproliferation Objectives

The United States has long had a global policy of discouraging enrichment and reprocessing by states that do not already have the technology.[4] More than thirty years ago, President Ford called on all nations to avoid transfers of sensitive nuclear technology for a period of at least

[3] Personal communication from KNF officials, July 2010.

[4] Statement of James TImbie, U.S. State Department, before the Blue Ribbon Commission on America's Nuclear Future, September 21, 2010, available at www.brc.gov

three years.[5] When the United States could not get the Nuclear Suppliers Group, newly formed then, to agree to a moratorium on such transfers, it settled for a policy of restraint.

In U.S. nuclear cooperation agreements, there is generally a provision that prohibits the transfer of restricted data (some enrichment technology is classified as restricted data) and sensitive nuclear technology unless provided for in an amendment to the agreement. U.S. 123 agreements therefore do not generally include provisions for sharing enrichment or reprocessing technology. An exception is the 1999 U.S.-Australian agreement to allow for SILEX enrichment technology transfer from Australia to the United States.

However, there is another issue at stake here – encouraging the use of reprocessing through providing programmatic consent for reprocessing. For a few countries, the United States has provided programmatic consent to reprocess U.S.-origin spent fuel. Some Members of Congress argued in the past that that policy, adopted in the 1980s, is at odds with the intent of the 1978 Nuclear Nonproliferation Act.[6] Japan and EURATOM enjoy this privilege, and pursuant to the subsequent arrangement recently negotiated, so will India. It is worth noting that the United States provided advance consent in the U.S.-UAE agreement for storage and reprocessing abroad and will confront this challenge when it renegotiates the U.S.-South Korean agreement.[7]

The "UAE Model" and Lessons from the US-India Deal

The U.S.-UAE nuclear cooperation agreement has been called the "gold standard" and the UAE's nuclear program called "peaceful by design." Its principle virtues are the UAE's renunciation of domestic enrichment and reprocessing in favor of external fuel supply, both in the preamble and in Article 7, and a provision to terminate the agreement should the UAE conduct domestic enrichment or reprocessing, among other things. Two potential drawbacks, however, are provision of advance consent for the UAE to send its spent fuel overseas, either for storage or reprocessing and the inclusion of a provision for amendment should an agreement signed by the United States with another Middle Eastern country be less restrictive. This last provision was adopted from the 1981 U.S.-Egypt agreement and is likely to be a feature of all future agreements in the Middle East. Reportedly, Jordan, which has signed nine

[5] See the detailed analysis by Fred McGoldrick, "The Nuclear Suppliers Group and Multinational Arrangements for Uranium Enrichment Facilities: Past, Present and Future," prepared for the MIT Workshop on Internationalizing Uranium Enrichment Facilities, October 20-21, 2008, p. 3.

[6] In the Nuclear Proliferation Assessment Statement prepared for the UAE agreement, and submitted by the Secretary of State, which can be found in House Document 111-43, there is an analysis on pages 16 to 18 of how advance consent for reprocessing is not at odds with the 1978 Nuclear Nonproliferation Act. The analysis even suggests that "timely consideration of prior approval" can be equated with programmatic consent.

[7] According to President Obama's letter transmitting the UAE agreement to Congress on May 21, 2009, "The Agreed Minute to the Agreement provides U.S. prior approval for retransfers by the UAE of irradiated nuclear material subject to the Agreement to France and the United Kingdom, if consistent with their respective policies, laws, and regulations, for storage or reprocessing subject to specified conditions, including that prior agreement between the United States and the UAE is required for the transfer of any special fissionable material recovered from any such reprocessing to the UAE." Available at http://www.whitehouse.gov/the_press_office/Message-from-the-President-on-the-US-UAE-Peaceful-Uses-of-Nuclear-Energy-Agreement/

nuclear cooperation agreements with other states but none with the United States, has balked at renouncing domestic sensitive fuel cycle facilities. The United States is faced with two choices: abandon the more restrictive formulation of its 123 agreements and risk the UAE abandoning its commitments, or only sign nuclear cooperation agreements in the region with such restrictions. This could limit U.S. influence on the development of nuclear energy in the region, or place pressure on the United States to provide similar benefits to those included in the UAE agreement to other Middle Eastern states – namely, fuel supply assurances and programmatic consent for reprocessing.

On programmatic consent for reprocessing, the UAE agreement sets a troubling precedent. Until the India cooperation agreement, the United States did not give programmatic consent for reprocessing U.S.-origin fuel unless a country already had an advanced nuclear program, including reprocessing and enrichment plants; did not pose a proliferation risk; was not located in regions of proliferation concern; and had excellent nonproliferation credentials. Japan and EURATOM countries were the only countries accorded this privilege. One could argue that the proliferation risks were minimal in the case of India because it already had reprocessing and nuclear weapons. In the case of the UAE, the proliferation risk is minimized by the fact that the UAE will not be doing the reprocessing itself because the UAE has committed to relying on the international market for fuel services. However, the disposition of special fissionable material recovered from any reprocessing (in the UK or France) "shall require the further agreement of the Parties."[8] The United States did not require the material to remain in a third country or be returned to the United States, but the agreement reflects its right to do so, if warranted.

Countries need permanent solutions for nuclear waste, which permission for overseas storage and/or reprocessing does not provide. It is important to remember that while the UAE committed to using the international market, it did not commit to pursuing an open fuel cycle – one in which spent fuel would be directly deposited in a geologic repository. The 2003 and 2010 MIT reports on the *Future of Nuclear Power* and the *Future of the Nuclear Fuel Cycle* advocate the pursuit of an open fuel cycle – one that does not include reprocessing – primarily to reduce the risk of proliferation that could result from an expansion of nuclear energy. The U.S.-UAE agreement suggests that a country that may have as few as 10 nuclear power plants in the future could require reprocessing, which does not support U.S. policy to discourage reprocessing.

The UAE is not alone in its desire for autonomy for fuel cycle decisions. The notion of fuel cycle autonomy has long played a part in international nonproliferation discussions. At the 2010 NPT Review Conference in May, the language in the action plan referring to states' fuel cycle decisions called on treaty parties to "[r]espect each country's choices and decisions in the field of peaceful uses of nuclear energy without jeopardizing its policies or international cooperation agreements and arrangements for peaceful uses of nuclear energy and its fuel cycle choices.

[8] Agreed Minute to the Agreement for Cooperation between the Government of the United States of America and the Government of the United Arab Emirates Concerning Peaceful Uses of Nuclear Energy.

The UAE has clearly positioned itself to be a nuclear energy and nonproliferation leader in the Middle East and its negotiations with the United States indicate it understands just how important it is to get a U.S. stamp of nonproliferation approval. There is a parallel here to the U.S.-India deal.

Just four years ago, this committee debated whether or not to exempt India from critical requirements of the Atomic Energy Act. India, which had been cut off from international nuclear trade from NSG members since 1992, sought a U.S. exemption first before going to the NSG.[9] India agreed to many conditions required by the Hyde Act, but the Nuclear Suppliers Group decision to allow nuclear trade with India was open-ended. This means that India's other nuclear partners have few restrictions. While Russia has apparently decided not to engage in sensitive nuclear transfers, France's 2008 cooperation agreement with India contains such provisions.[10] Although a nuclear test by India will halt U.S.-Indian nuclear cooperation, it's not clear what other countries will do. Japan is facing stiff opposition from India on its insistence on no new nuclear tests. Meanwhile, the lack of suitable liability protection is keeping U.S. reactor vendors out of the Indian nuclear power market, but other vendors with government protection are moving ahead.

The UAE, while signing nuclear cooperation agreements with France and the United Kingdom, sought to establish its nonproliferation credentials with the United States, committing itself to reliance on the international fuel market rather than acquiring domestic enrichment and reprocessing capabilities. Yet the UAE will purchase its power reactors from a Korean consortium. Korea, a member of the Nuclear Suppliers Group, does not require the same kinds of restrictions as the United States. However, the inclusion of Westinghouse in the contract for the first four UAE reactors will ensure the UAE remains committed to using the international fuel market for some time.

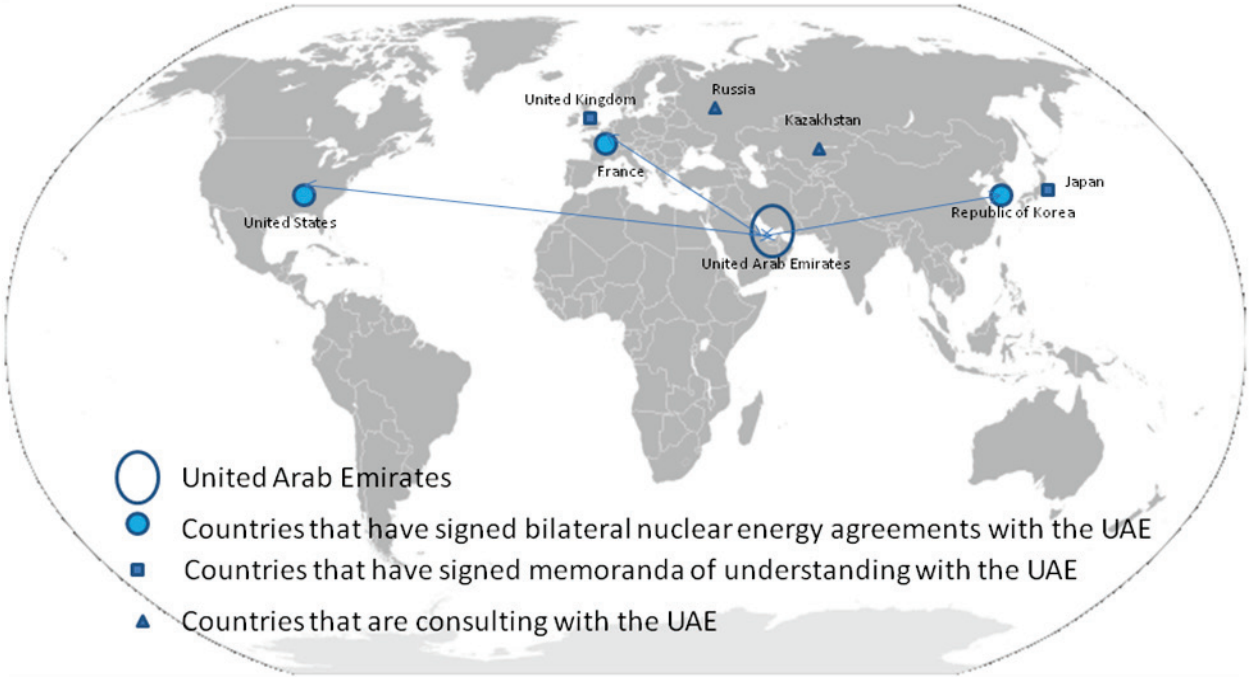
Limits to U.S. Influence

As noted above, the United States government is not the only government pursuing nuclear cooperation around the globe. This past year, the Korean government announced it had plans to export 80 nuclear power reactors by 2030. The French government has avidly promoted nuclear energy, and so have the Russians, Chinese, Japanese, and Indians. With the exception of India, all of these countries are NSG members. However, their legal requirements for nuclear cooperation vary significantly. The two maps below show the UAE's other potential nuclear partners, and Jordan's potential nuclear partners.

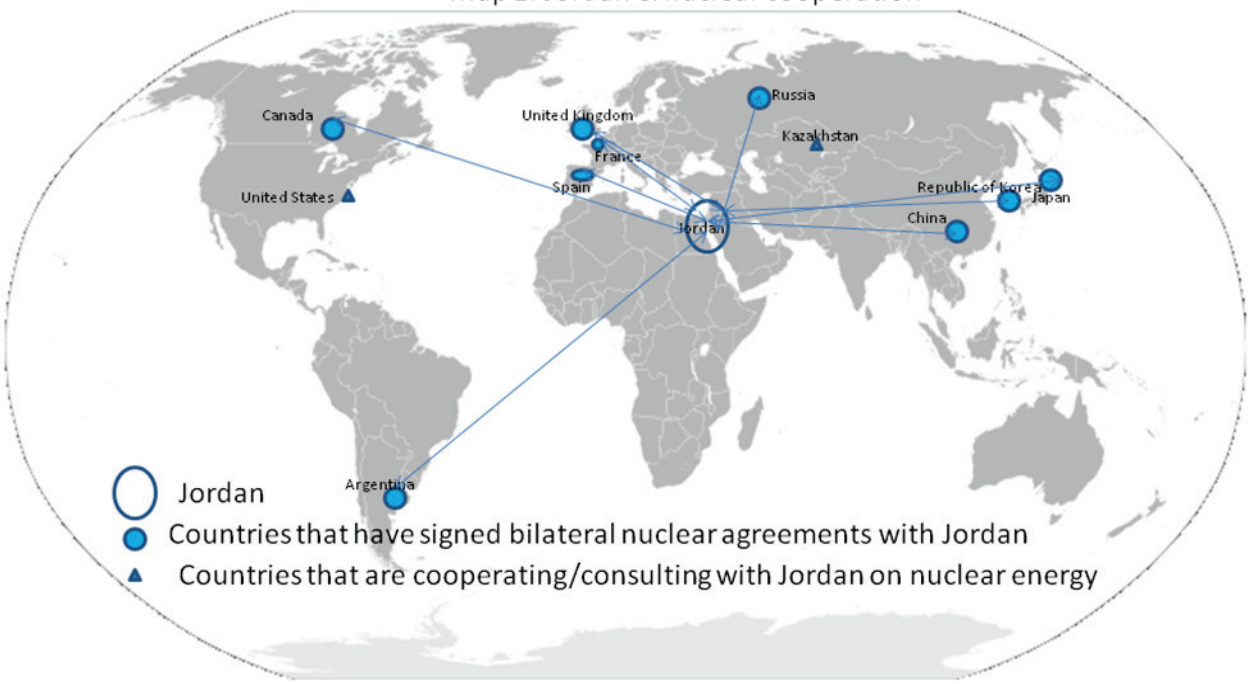
[9] For a more detailed analysis, see Sharon Squassoni, "The US-Indian Deal and Its Impact," *Arms Control Today*, July-August 2010, available at http://www.armscontrol.org/act/2010_07-08/squassoni

[10] For text of the Indo-French deal, see www.dae.gov.in/sectt/indofrench.pdf

Map 1: UAE nuclear cooperation



Map 2: Jordan & nuclear cooperation



It's fairly clear that the UAE chose the KEPCO APR-1400 reactors based on cost and demonstrated manufacturing expertise. The project is likely heavily subsidized by the Korean government. It is not clear that Jordan, which is moving ahead with nuclear cooperation agreements with other states, but not the United States, is basing its decisions similarly. Reportedly, Jordan is considering three reactor designs: the Canadian CANDU-6,

AtomStroyExport's AES-92 model of its VVER-1000; and the Atmea-1 pressurized water reactor (PWR) design proposed by a joint venture between Areva and Mitsubishi Heavy Industries (MHI). None of these manufacturers have the solid, recent experience of the Korean consortium.

This dilemma of U.S. firms losing nuclear business to competitors with less restrictive technology transfer policies is one concern, but is likely outweighed by the ability of foreign firms, many of them owned or subsidized by their governments, to present more affordable contracts. A more disturbing proposition would be for the United States to implement restrictions for some states and not for others. Recent press about U.S. negotiations with Vietnam made it seem as though the United States, because it apparently is having difficulty getting Vietnam to agree to renounce domestic enrichment and reprocessing, would apply a different set of rules in Asia than in the Middle East.[11]

What is essential, however, is to raise the technology transfer threshold for all nuclear suppliers.

A critical question is how high to raise the bar. Nuclear security would be much improved with the elimination of highly enriched uranium and separated plutonium around the world. There is a spectrum of restrictions, ranging from most restrictive to least:

- Elimination of reprocessing by existing states
- Adoption of proliferation-resistant recycling (when it is developed) by existing reprocessing states
- Multinational proliferation-resistant recycling by all states
- Multinational proliferation-resistant recycling by new states
- Proliferation-resistant recycling by new states
- No more reprocessing by existing states of other states' waste (no more clients)
- No limits on reprocessing for any state

Currently, there are no formal limits on reprocessing or enrichment for any state beyond that which is contained in bilateral nuclear cooperation agreements or informally agreed among Nuclear Suppliers Group members. My recommendations, covered in more detail below, chart a middle path among these.

The Russian and Australian Nuclear Cooperation Agreements

The 123 agreements signed with Russia and Australia could enter into force during this Congress or may have to be reintroduced next Congress, if there are not enough legislative days remaining this year. The most promising aspect of the Russian agreement, should it enter into force, would be the ability for U.S. scientists to be able to use Russian fast reactors to test materials and fuel. If implemented fully, the agreement will allow the United States to permit the transfer of U.S.-origin spent fuel to Russia for storage. The U.S.-Russia 123 agreement is

[11] Jay Solomon, "US, Hanoi in Nuclear Talks," *Wall Street Journal*, August 3, 2010, available at http://online.wsj.com/article/SB10001424052748704741904575409261840078780.html

necessary to make any "cradle-to-grave" approach to fuel services work, since Russia is one of the few countries that has passed a law allowing the import of spent nuclear fuel . However, Russia has only applied this policy in a few cases, including Iran, and has not adopted this on a broad basis as part of its nuclear cooperation agreements.

In the case of Australia, the 123 agreement is vital to continued U.S procurement of Australian uranium, which accounts for about 13% of U.S. imports.[12] The transfer of sensitive nuclear technology, from Australia to the United States, was handled in a separate agreement sent to Congress in 1999.

Recommendations

1. Make the Additional Protocol a condition of nuclear supply, in U.S. law as well as in policy.

U.S. policy now requires new recipients of U.S. nuclear cooperation to sign and ratify an Additional Protocol. Japan also requires the Additional Protocol as a condition of supply, but other suppliers like France and Korea will not move forward unless there is universal acceptance. The first step is transitioning from a policy into law. This could be done relatively easily through amending Section 123 (b) of the Atomic Energy Act.

2. ***Abandon existing discussions within the Nuclear Suppliers Group on enrichment and reprocessing restrictions in favor of a solid consensus on requiring the Additional Protocol as a condition of supply*** NSG restrictions on enrichment and reprocessing have gone nowhere because member states are wary of giving up their "rights." The NSG has had a presumption of denial for these kinds of transfers for decades, which, by and large, has worked. Resuming this policy at this point could be more effective in restricting transfers than further watering down criteria.

Reaching consensus on making the Additional Protocol a condition of all nuclear supply will likely be easier than consensus on new enrichment and reprocessing restrictions. Only Argentina and Brazil do not have Additional Protocols in place. Reportedly, Argentina and Brazil want to preserve the importance of their bilateral inspections under ABACC, objecting to a situation in which IAEA inspectors would have more rights and access than ABACC inspectors. However, the solution is not to jettison the Additional Protocol, but to amend ABACC provisions to mirror the additional inspection and information rights accorded to the IAEA under INFCIRC/540.

3. ***Get serious about back-end solutions*** It is not enough to suggest that cradle-to-grave fuel cycle assurances would be a good thing; it is imperative to create opportunities both in this country and abroad. As witnesses before the Blue Ribbon Commission on America's Nuclear Future stated earlier this week, countries with large nuclear programs could absorb the small amount of spent nuclear fuel from other countries. This is far superior to seeing a proliferation of scores of reprocessing plants and geological repositories overseas. More than half a century

[12] CRS report

after the advent of peaceful nuclear power, it is time to come to grips with nuclear waste, approaching the problem beyond national bases.

4. ***Get serious about multinationalizing the fuel cycle*** The United States is building four new enrichment plants, three of which will have significant foreign ownership. Although there are NRC restrictions on licensing plants that have foreign ownership, control or dominance, there are ways to ensure that no single party would be able to dominate operations. The United States should lead the way in demonstrating that its energy security is not compromised by multinational control of enrichment facilities.

The United States should also explore paths to ending national ownership of sensitive nuclear fuel cycle facilities like uranium enrichment and spent fuel reprocessing. A good candidate vehicle for leveling the playing field would be a fissile material production cutoff treaty. If all states agree to ban the production of fissile material for weapons, there is little rationale for national facilities. It is not enough to require new facilities to be multinational, since this would be viewed as discriminatory. Under such an approach, the FMCT could fulfill both its disarmament and nonproliferation missions and go a long way toward easing the tension within the Nuclear Nonproliferation Treaty about perceived rights to fuel cycle capabilities.

5. ***Drop the use of advance consent to reprocess U.S.-origin fuel as a reward for nonproliferation assurances*** Providing new nuclear states with options to send their spent nuclear fuel abroad for reprocessing will increase shipments of plutonium overseas, questions about the final disposition of that plutonium (unclear in the UAE case), and support otherwise unprofitable reprocessing plants. It is possible to provide advance consent for storage, but the United States should continue to discourage reprocessing (using existing PUREX methods) as a technique for spent fuel management.

6. ***Implement current legislation and close some gaps*** Title V of the 1978 Nuclear Nonproliferation Act should be funded, implemented, and monitored by Congress. This requires the United States to conduct non-nuclear energy cooperation and energy assessment assistance with developing states. Nuclear energy is unlikely to be the best choice for all of those 60 countries seeking it. Such countries do, however, need help pursuing low-carbon, renewable options for generating electricity.

There is a provision in the Arms Export Control Act (the so-called Symington Amendment) that would restrict foreign, military, and export assistance to countries that deliver or receive enrichment equipment, materials or technology unless the supplier and recipient have agreed to place all such items under multilateral auspices and management *when available* and unless the recipient has full-scope safeguards. This provision could be tightened by deleting the phrase “when available.”