

THE NONPROLIFERATION IMPLICATIONS OF REGIONAL SPENT FUEL STORAGE

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The idea of establishing regional centers for the temporary storage or permanent disposal of spent fuel arising from the generation of electricity from civil nuclear power stations has been around for decades. It makes me feel old to note that I first wrote about the subject in an edited volume, entitled *Nuclear Nonproliferation: The Spent Fuel Problem*, that was published twenty years ago. Even then, it was commonplace to note that spent fuel management was a problem that was "solvable, but never solved." Regrettably, all these years later, that epigram remains apt. The question I have been asked to address is the implications that multinational or regional spent fuel centers may have for our global efforts to minimize the spread of nuclear weapons.

I. A BRIEF HISTORICAL EXCURSION

The twenty years since my last foray into this subject have witnessed enormous changes in the fields of nuclear energy and nuclear proliferation. In the mid-1970s, many governments were already worried about an impending shortage of at-reactor spent fuel storage capacity. Generally, the future of nuclear energy looked bright; the 1974 Arab oil embargo had produced a surge of interest in building nuclear capacity as a guarantor of a country's energy independence, against the risk of foreign disruption of oil supplies. At that time, however, many governments still entertained plans and projections to close the nuclear fuel cycle through reprocessing spent fuel, and recycling the extracted plutonium either through thermal reactors or breeder reactors. Indeed, the concept of Regional Fuel Cycle Centers -- which would offer reprocessing services multinationally -- was widely discussed, including at the International Atomic Energy Agency. In that era, the threat of nuclear proliferation emanated from more states than today, including countries such as Argentina, Brazil, South Africa, South Korea, and others that have since dropped from the list of nations of proliferation concern.

As we all know, the substantial interest in multinational spent fuel storage did not materialize in facilities being built at that time. In part, this reflected the difficulties in overcoming the obstacles inherent in any large nuclear project, not least of which include securing adequate investment and selecting a politically- and technically-acceptable site for a facility. In part, the lack of realization of a multinational spent fuel center may have reflected the downturn in nuclear power driven by the Three Mile Island and Chernobyl accidents. In the event, reactor operators were able to squeeze more spent fuel elements into their on-site spent fuel storage than they had initially planned.

Today, we find a situation quite different than that which existed twenty years ago. The spent fuel crunch -- especially in the United States, Japan, and the Republic of Korea -- has become increasingly serious. Meanwhile, the prospects for the

future of nuclear power are beginning to brighten in some ways for the first time in a generation, as a consequence of such factors as (1) the substantial improvement in reactor safety and (2) growing concerns about the inability of the international community to meet the targets mandated in the Kyoto Protocol without a substantial nuclear contribution. We also find less interest in either reprocessing plutonium or using it as breeder reactor fuel than we did twenty years ago. While far fewer nations remain of serious proliferation concern than was the case then, far greater nuclear risks have emerged from the breakup of the former Soviet Union. Among those risks is that the considerable stocks of spent fuel languishing in spent fuel facilities are losing their natural radiological barriers to theft and diversion, especially the older elements from the RBMK reactors.

These altered circumstances help explain the renewed interest in multinational spent fuel programs. The critical spent fuel storage shortage afflicting national programs, combined with the continuing impediments to reprocessing, make these programs increasingly attractive. This is particularly true since the absence of an accepted resolution of the back-end fuel cycle issue constitutes a critical stumbling block to hopes for expanded nuclear power use in the years ahead. At the same time, the increased proliferation risks emanating from Russia and its neighbors underlines the need for creative international approaches to this issue.

II. DEFINING A MULTINATIONAL SPENT FUEL STORAGE REGIME

There are certain criteria that any spent-fuel storage regime would have to meet in order to be viable, before one may fairly assess the nonproliferation implications of that approach. Whether any particular proposal for a multilateral spent fuel storage successfully meets these criteria depends upon the specific combination of arrangements proposed. Obviously the most pressing question becomes where such a facility should be sited. Should the facility be owned and operated by private or public sector entities? Should it be a national or international entity? What legal rights and liabilities pertain to the country hosting the facility, the government of the donor entity, and third parties? Should the spent fuel be retrievable, committed immediately to permanent disposal, or subject to some hybrid arrangement?

Turning to the specific criteria for any successful multinational spent fuel program: first, the regime needs to be *technically viable*. At a minimum, this requires a local geology sufficiently isolated, dry, and stable to assure that the containment in casks containing spent-fuel will not permit any leakage of material for 100,000 years or more. Sound engineering is an obvious requirement. The project would also need to satisfy all national and international standards in the environmental, health and safety fields that are applicable, including the Convention on the Physical Protection of Nuclear Material and the Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.

Second, the site selected needs to be *politically viable*. From the perspective of the prospective host government this is a tall order, given the universal not-

in-my-back-yard sentiment generated by the prospect of becoming the future host of a nuclear waste repository. The domestic hurdles to be overcome may include several levels -- local, state or province, national and, if a facility is to be located near an international frontier, diplomatic. From the perspective of the prospective providers of spent fuel, equally important is that the site selected be under the jurisdiction of a stable and reliable government. A necessary (but not sufficient) condition for political viability is *legal viability*, which requires statutory and regulatory definitions of the rights and responsibilities of all participants in these arrangements. This would include defining a regime providing for legal liability in the event of any damages incurred in the establishment or operation of the regime.

Third, the proposal for a regional center must be *commercially viable*. Governments have an undeniable role in nuclear waste management, and governments offer an obvious source of funds to defray the expense of this activity. That said, however, given the historic difficulty governments have encountered in addressing this problem on their own, it is far preferable -- if possible -- to establish a commercially-viable underpinning to these arrangements.

Fourth, the proposal for a regional center *must meet national and international security objectives*. To take an extreme example, this means that a center may not be located in an unstable country of known proliferation concern, requiring transport over long distances through hostile waters in ships that cannot adequately protect their cargo. But in addition to assuring that a regional center "does no harm" from a security perspective, there may be substantial opportunities that it can do a great deal of good in this area, which brings us to the issue of the nonproliferation implications of such a center.

III. NONPROLIFERATION IMPLICATIONS

The balance of this paper will explore the nonproliferation implications of multilateral spent fuel arrangements generally, hopefully in a manner that will remain valid across the gamut of various proposals that have been floated recently.

A number of nonproliferation advantages may accrue from a multilateral spent fuel program. First, since nuclear weapon development decisions are made by individual governments, removing spent fuel from the direct possession of those governments will create a physical impediment to any of them subsequently (or surreptitiously) gaining access to the spent fuel. The security benefit of this removal gradually increases, as the process of radioactive decay reduces the "natural" radiological protection surrounding spent fuel. It should also be noted that creating this physical -- or geographic -- barrier to nuclear weapons development could provide greater nonproliferation benefit than do IAEA safeguards. IAEA safeguards aim to provide timely warning of a diversion of material to impermissible purposes, but do not aim to stop a government committed to breaking out of its nonnuclear status.

Consolidating the spent fuel from several nations at a single site also reduces the number of sites that are vulnerable to theft or diversion, while making it more economical to underwrite the most effective physical security measures possible. The added physical security helps prevent terrorists or other substate actors to gain access to the spent fuel.

To the degree that a single repository takes spent fuel from a number of nations in a single region, this nonproliferation benefit essentially becomes a confidence-building measure among potential rivals. It would do this by providing for transparency among governments as to their disposition of plutonium-laden spent fuel. This is especially important for nations that have not yet amassed large quantities of unsafeguarded nuclear weapons material. For example, an Asian center could substantially reduce regional proliferation pressures by taking spent fuel from Japan, the Republic of Korea and perhaps eventually the Democratic People's Republic of Korea. The situation between nuclear-weapon state China and non-nuclear-weapon state Taiwan illustrates an asymmetric pairing of a demographic giant, nuclear-weapon state against a far smaller yet technologically sophisticated rival. Despite this asymmetry, Taiwan could choose -- either for political or security reasons -- to relieve the anxieties of its neighbors by consenting to dispatch its spent nuclear reactor fuel to a multinational spent fuel center.

A center that took spent fuel from India and Pakistan could also reduce regional proliferation pressures. On one hand, that relief could be largely symbolic, to the degree that Delhi and Islamabad retained their existing stockpiles of weapon-usable materials. On the other hand, a spent fuel repository could provide a vehicle for both India and Pakistan to deliver unsafeguarded spent-fuel stocks to a neutral third party, without the need for making a direct, bilateral concession to one another.

Regional spent fuel centers may not only serve as a confidence-builder among potential rivals, they may also serve as a hedge against future political change. Recent history has highlighted positive political developments, as burgeoning democracies in Argentina, Brazil and South Africa quite consciously drew back from the nuclear brink. A spent fuel center could provide a vehicle to "lock in" the newly-constructive attitudes toward nonproliferation of governments in the midst of dramatic change. If the historical forces reverse and bring an aggressive leader to the fore in a participating country, any effort we will have devoted to remove spent fuel as a potential plutonium source for a nuclear weapon program will prove to have been a wise investment.

Second, regional spent fuel centers could be used to dispose of warhead materials derived from dismantled nuclear warheads. This option has an obvious appeal when it comes to plutonium. Plutonium disposition presents more difficult security and commercial issues than does HEU disposition. First, though HEU, once blended down to low-enriched uranium, does not present a serious proliferation threat, plutonium can be easily separated into weapon-useable material even after it has been fabricated into mixed

oxide fuel. Second, using plutonium in mixed-oxide fuel is far too expensive to be economically viable at current uranium prices.

These difficulties have frustrated repeated efforts to find a viable solution to the growing stocks of plutonium excess to the defense requirements of the United States and Russia. That is why the idea of tethering the weapon-derived plutonium mission to the reactor-based plutonium (i.e. spent fuel) disposition should be seriously explored. It is possible that governments and elements of the private sector, under appropriate circumstances, may be prepared to utilize resources generated in resolving the spent fuel disposition challenge to subsidize the disposition of excess warhead materials, too. In addition, given the substantial stocks of HEU in Russia beyond the 500 tons already subject to the US-Russian HEU deal, there may be opportunities to develop commercial arrangements that would simultaneously address utilities' need for nuclear fuel and national needs to continue to absorb the hangover of weapon-useable materials from shrinking Cold War arsenals.

Are there nonproliferation risks associated with the establishment and operation of regional spent fuel centers? Since any proposal that does not meet the fundamental criteria -- including such elements as proper siting, secure transport and physical protection, and legal protections -- set forth above would by definition be excluded from consideration, we must modify this question to ask whether there are any indirect or long-term adverse proliferation consequences for a center that otherwise appears to present no security threat. Some might argue that the best nuclear nonproliferation policy is one that eliminates the use of nuclear power, thereby eliminating the production and separation of plutonium and the enrichment of uranium, allowing the reduction of weapon-useable materials worldwide.

Nuclear power, however, remains a critical portion of the energy mix even in countries where it is embattled or where no new capacity is expected in the foreseeable future, and -- as noted -- is expected to grow in a number of Asian nations in the decades ahead. So the notion of eliminating the proliferation risk by eliminating nuclear power is not realistic. Moreover, our nonproliferation interests are enhanced in important ways by the continued commercial viability of nuclear power, as this gives the nuclear industry a powerful vested interest in assuring that no security or nonproliferation breach occurs which could undermine the continued political viability of nuclear power.

IV. THE HEU EXPERIENCE

If we conclude, then, that substantial nonproliferation benefits may be available from the establishment and operation of a nuclear spent fuel center, what lessons can we learn from past experience to help bring this about? I will leave to other presenters the opportunity to mix and match parameters -- local geology vs. local politics, political vs. economic, storage vs. permanent disposal -- all of which may be marshaled to define and advocate specific proposals. Instead, I will draw on the only working fissile material disposition program to date -- the US-Russian HEU deal -- to suggest a few principles to be kept in mind. (While the HEU deal has its share of critics, none can deny that 50 tons of HEU have, in fact, been blended down to LEU and shipped to the United

States. This paper is not the appropriate place to wade into the debate over whether or not the deal is on firm ground.)

One critical factor that made the HEU deal viable was the fusion of commercial incentives and security interests. The HEU deal offered something for everyone -- Russia obtained badly-needed hard currency for its HEU, US ratepayers obtained an economical source of electricity from the blended-down commercial reactor fuel, and citizens around the world benefited from the elimination of fissile material vulnerable to theft or diversion. The benefits to Russia gave the government there a palpable commercial incentive to protect the HEU; here was an income-generating asset, not a burdensome Cold War legacy to be guarded forever at great expense out of sense of uncompensated duty to minimize the nuclear danger. Moreover, tying the HEU deal to market prices for enriched uranium assured that the price of the HEU deal stayed within the bounds of the possible. (A principle offered by the Russians and accepted by the Americans at the Vancouver Summit of 1993 was that the deal should proceed on a purely commercial basis: "no charity".) If the price of the HEU were keyed to some other metric -- such as the consequences to the world if some of the HEU were to be converted into terrorist weapons -- it could ascend to levels so high that all the money in the world's treasuries would be insufficient to the task.

A second critical factor in the HEU deal was political leadership. The unilateral nuclear reduction initiated by President Bush in September 1991 fundamentally altered the way the U.S. Government thought about arms control and nonproliferation. The President, National Security Advisor Scowcroft, and their senior national security advisors quickly grasped the implications -- in terms of both risks and opportunities -- arising out of the disintegration of the former Soviet Union. In meetings at Camp David and elsewhere, Americans and Russians quickly shed their Cold War postures -- leading to some extraordinary meetings between individuals who had designed nuclear weapons targeting one another -- and got down to work on a series of initiatives under the rubric of the Safe and Secure Dismantlement ("SSD") of nuclear weapons. U.S. assistance to Russia included railcars, containers, kevlar blankets, as well as initiatives to promote better material controls and accounting (or "MC&A" -- the "p" for protection in "MPC&A" came later) and to address fissile materials disposition.

For a number of reasons, economic and physical, the U.S. Government pushed the HEU deal first, and remanded the plutonium disposition issue for further study to clarify our options. (That decision led to the National Academy of Sciences report on the subject.) By August 1992, the U.S. and Russia had inked a government-to-government agreement committing Russia to sell 500 tons of HEU -- blended down to LEU -- from dismantled nuclear weapons to the United States for use as commercial light-water reactor fuel.

Between the 1992 election and President Clinton's January 1993 inauguration, the National Security Council staff carried out its duties energetically, but also briefed the Clinton transition team to allow the incoming Administration to assess

the situation and decide whether or not to pursue or suspend Bush Administration initiatives. During the transition, the incoming national security team made clear that -- for the rest of the Bush Administration -- the NSC staff should to proceed as rapidly as possible to try to conclude the next phase of the HEU agreement. From that moment forward, the Clinton Administration displayed equal determination in pursuing this deal, which was a critical element not only at the Vancouver Summit but also at the January 1994 Moscow Summit, where the commercial HEU contract was signed.

Of course, political leadership is equally necessary in both capitals and, in this respect, the declining health of President Yeltsin, as well as the deteriorating political and economic situation in Russia over the past year, are sources of real concern. It was never easy, given the extraordinary stresses generated by Russia's heroic effort to evolve into a market-based economy with durable democratic institutions, to reach practical agreements driven by our mutual long-term interest in strategic stability and freedom from nuclear dangers. But now the problem has reached critical proportions.

The final critical element to the success of the HEU deal -- from a domestic U.S. perspective -- was bipartisan recognition of its critical importance to our national security. This bipartisanship appeared not only between successive Presidential Administrations, but also across the aisle in the U.S. Congress. This bipartisanship extended to all areas of nuclear threat reduction, under the outstanding leadership of Senators Nunn and Lugar in the early 1990s. And, I am happy to report, bipartisanship retains its vitality even today, as Senators Domenici and Lugar continue to work with their Democratic colleagues in Congress, as well as with the Clinton Administration, in taking the necessary steps to tackle the challenge of fissile material disposition. This was reflected in the extraordinary last-minute -- and ultimately successful -- effort in the last Congress to add \$200 million for plutonium disposition and \$325 million to support the HEU deal in the Omnibus Appropriations Bill.

V. CONCLUSION

We find ourselves at a rare historic moment. The growing crisis of spent fuel management, which threatens the continued viability of the nuclear energy option at the very moment when it may become critically important in the fight to reduce greenhouse gas emissions, has generated a great deal of creative thinking about proposals to tackle this problem on a multinational basis. At the same time, the great weight attached to our nonproliferation goals in the post-Cold War era and, especially, the deeply worrying situation surrounding the safety and security of fissile materials in the former Soviet Union, demand an energetic and sustained response from the entire international community. The challenge is to weave these converging crises and opportunities into a concrete, well-conceived, well-funded plan of action and to enlist the political leadership to execute it. It is my hope that the discussions at this conference may play a role in that enterprise.

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