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November 2, 2005

International High-Level Radioactive Waste Management  
Conference  
Las Vegas, NV, United States  
April 30, 2006 through May 4, 2006

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## The Back End of the Fuel Cycle Moves Front and Center

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2006 International High-Level Radioactive Waste Management Conference

For many years, the commercial nuclear business has remained relatively stable in many ways. That is unlikely to be the case in the coming years.

While some countries have called for the phase out of nuclear power and others have ordered a small number of new plants, the overall profile of the nuclear power business has changed little. The number of countries with nuclear power plants is not much different than 10 years ago and the total number of operating plants has increased only slightly. Commercial enrichment and reprocessing services have remained the province of a few countries and consortia. Repository programs have moved forward slowly in some cases, backward in others, with a very small number making substantial progress.

We are now witnessing the beginnings of serious change, with significant consequences for the future nuclear regime. Business as usual will not be the business of the future. The way the nuclear and policy community respond will have much to do with energy adequacy, national security, international stability, and environmental consequences including waste management and disposal.

A number of events and trends are becoming increasingly apparent and are cause for both opportunity and caution:

- New nuclear power plant orders are likely to grow and spread, particularly in the developing world, e.g. China and India.
- The growing recognition that the developing world will be a major competitor for limited energy resources is raising awareness in the developed world regarding concerns for future energy security.
- Clearer evidence of the effects of greenhouse gas emissions on global warming, largely from the burning of fossil fuels, is creating more attention on the environmental benefits of nuclear power.
- The last decade has shown unequivocal evidence of countries lying, cheating on their NPT obligation, and covertly carrying out nuclear

weapons-related activities. Some countries have suggested their presumed need for a domestic nuclear fuel cycle as a rationale to pursue enrichment and/or reprocessing capabilities, which would move them to the doorstep of being nuclear weapons capable. The DPRK even took the action to abrogate the NPT to hold on to its nuclear weapons program.

- 9/11 and other evidence have made it undeniable that terrorist groups would like to obtain weapons of mass destruction, particularly nuclear weapons, and would use them if they could.

A number of initiatives have been proposed recently<sup>1</sup> to allow for the growth and spread of nuclear power while limiting the justifications for additional countries to pursue the acquisition of enrichment or reprocessing capabilities. Enrichment or reprocessing are the only ways for countries to gain the indigenous capability to transform natural materials and fuel for and from nuclear power plants to directly weapons-usable materials.

Most of these initiatives have fresh fuel assurance as a central component. The rationale is simple; if a country can have assurance that it will receive all the fresh fuel it needs for the lifetime of its nuclear power plants, there should be no reason for it to pursue the difficult and costly capability to enrich the fuel itself or to reprocess its spent fuel to recover the produced plutonium for recycle as a fuel in its reactors.

While such guarantees face institutional, political, and economic hurdles, they could be overcome. For example, U.S. Secretary of Energy Bodman recently offered 17 tons of high enriched uranium to be blended into fuel grade low enriched uranium as a good faith gesture to create a “fuel reserve” that would be available in the event of supply disruption.

However, such offers are unlikely to be fully persuasive if they are not connected to complementary offers for management of the spent nuclear fuel that is created during power production. Most countries have had issues

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<sup>1</sup> M. Elbaradei, *The Economist*, 16 October 2003.

The US President Bush’s Speech to the National Defense University, 11 February 2004.

INFCIRC/640 – Multi-National Approaches (MNA) to the Nuclear Fuel Cycle, 22 February 2005.

J. S. Choi and T. H. Isaacs, “Toward a New Nuclear Regime,” *Proceedings of ICAPP 2003*, May 2003

V. Reis, et. al., “Nuclear fuel leasing, recycling and proliferation: Model a global view,” *Nuclear Technology*, 150, No. 2, p 121-131, May 2005.

E. Moniz, et. al., “Making the world safe for nuclear energy,” Oct 2004.

associated with spent fuel storage and almost all have faced substantial problems in making progress on ultimate waste disposal, with or without reprocessing. Currently half the countries producing nuclear power (15 of 30) have five or fewer plants making national facilities for storage and permanent disposal politically and economically problematic.

Thus, the idea of spent fuel take-back is gaining visibility as part of a new nuclear regime that could address the front-end and back-end of the fuel cycle simultaneously. If it becomes possible to offer countries both fresh fuel assurances and guarantees of spent fuel take-back (or take-away, since it is not necessary that it be returned to the same country) it may be possible to provide the mechanism for countries that currently do not have nuclear power to take full advantage of the benefits without the complexity, cost, and political consequences associated with having full fuel cycle capability.

This could tie in nicely with the countries that have small numbers of nuclear power plants who no doubt would rather have their spent fuel and nuclear waste disposed of elsewhere, either in shared regional facilities or in the repositories of countries with major nuclear power programs.

Should such a regime be realized, this would have the important mutual benefit of allowing the growth and spread of nuclear power while simultaneously reducing the incentive or rationale for the spread of either enrichment or reprocessing capabilities. Thus the most sensitive elements in the nuclear fuel cycle that could be misused to support a weapons program would be limited. The spread of global spent fuel storage locations would also be minimized, and as a result, the availability of nuclear materials and the corresponding proliferation risks could be reduced. And countries that decide to pursue such capabilities without an obvious energy related reason would provide an early signal to the rest of the world.

Ironically, it is also possible that such a set of initiatives could assist in making national and regional spent fuel or high-level radioactive waste storage and disposal facilities and programs more acceptable (though by no means easy). If a network of such fuel cycle services is offered by those countries currently possessing them, it would add an important national security and international stability dimension to storage and disposal programs.

Repositories, for example, would not be simply dumps for utility spent fuel and wastes; they would be critical elements in a network of fresh fuel assurances and spent fuel take-back that will demonstrably minimize prospects of the misuse of the civilian fuel cycle to abet steps toward a new nuclear weapons program. And as with enrichment and reprocessing, the number and location of these sensitive facilities would be restricted to a small number, located in those countries with ample experience, capabilities, and the stability to secure them. These security benefits, if properly conducted and communicated, could assist in demonstrating their value to a skeptical public and their political representatives.

None of this, of course, should take the place of high priority on securing the existing facilities and materials of greatest concern today. Security of nuclear weapons and the materials that can be used to make them must remain our highest priority wherever they are located. But as we look to the future, the opportunity and, in fact, responsibility exists to shape a new nuclear regime that can simultaneously help meet the energy, security, and waste management challenges better than addressing each aspect separately.

Eisenhower's "Atoms for Peace" speech in 1953, the subsequent creation of the IAEA and the NPT, and continuing export control agreements are among the pillars of the nexus between nuclear power and security. Countries gave up a piece of their sovereignty, for example, and allowed international inspection of their nuclear operations to demonstrate their peaceful intentions. Thus, from the earliest days of nuclear power, the opportunity and the risks were apparent and governmental instruments and international cooperation were seen as essential to augment commercial market mechanisms.

Once again there is a need and an opportunity to augment the market. By investigating cooperative mechanisms, or networks, among leading nuclear nations to serve coming energy needs, the possibility exists to allow for the growth and spread of nuclear power while reducing security and waste management concerns below where they are today.