OVERVIEW OF FRENCH P&T PROGRAMME AND RESULTS FOR WASTE MANAGEMENT

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Abstract

The production of nuclear energy in France has been associated, since its inception, with the optimization of radioactive waste management, including the partitioning and the recycling of recoverable energetic materials.

The public's concern regarding its long-term management made the French Government in 1990 delay the implementation of the geological disposal and to prepare a law, passed on December 30, 1991, requesting in particular the study of solutions and processes for:

- Minimizing the quantity and the hazardousness of waste, via partitioning and transmutation;
- Either reversibly or irreversibly disposing the waste in deep geological formations;
- Waste conditioning and long-term interim storage.

We will present here the French program and an update on the progress made by the research conducted on partitioning and transmutation.

Studies on partitioning and transmutation aim at isolating the most radiotoxic long-lived elements present in the waste then at transmuting them through recycling in nuclear reactors, in order to change them into non-radioactive or shorter-lived elements. The partitioning of minor actinides (americium, curium and neptunium), followed by their transmutation, would reduce to a few hundred years the time necessary for the radiotoxicity of the vitrified waste to become similar to that contained in the natural uranium ore originally used.

The feasibility of partitioning, which did not appear easily accessible at the time the research began since lanthanides and actinides have rather similar chemical properties, was nevertheless demonstrated in 2001 thanks to a series of tests conducted on solutions of dissolved spent fuel, in the CEA's Atalante facility at Marcoule. The 2002-2005 program encompasses technological demonstration of the selected liquid-liquid process, with representative equipment, and economic evaluation of industrial implementation of partitioning.

Studies on transmutation, which were initiated before the 1991 Law, rapidly led to concluding that transmutation of minor actinides (Americium, Curium, and Neptunium) was feasible in particular in fast neutron spectra. Results obtained confirm that the feasibility of transmutation is demonstrated, both in pressurized-water reactors (recycling and transmutation of plutonium, optionally but with more difficulty of americium and neptunium) and in advanced systems of nuclear-energy production (GEN IV fast-spectrum reactors, with recycling and transmutation of all heavy nuclides, uranium, plutonium, the minor actinides) or in dedicated incinerator reactors, either critical or sub critical.

Work on transmutation is now focusing on technical elements necessary for the demonstration of its technological feasibility. Irradiations for fuel transmutation studies will continue in Phénix reactor in a very sustained way until 2008.

Important results are now available concerning the possibility of significantly reducing the quantity and the radiotoxicity of long-lived waste in association with a sustainable development of nuclear energy. Future work will deal with pre industrial demonstrations of partitioning and transmutation