

PANEL SESSION 89 - Innovative Approaches to Shorten the Radiotoxic Period of Wastes Arising From SNF Recycling

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Reporter: Prof. Kun Jai Lee, *KAIST/KUSTAR (ROK,UAE)*

Panelists Included:

- Dominique Warin, *CEA (France)*
- Hamid Ait Abderrahim, *SCK•CEN (Belgium)*
- Il Soon Hwang, *Seoul National University (ROK)*
- Patrick Brady, *Sandia National Laboratory (USA)*
- Myung Jae Song, *Radioisotope Education and Research Institute of KRIA (ROK)*

Some 20 to 30 people were present to hear this session on the innovative approaches on SNF recycling. Following introductions by the Co-Chair, **Kun Jai Lee** opened the proceedings. He gave the reason for the panel. Panelists and audience have expressed their opinion in the panel. Although there was no unanimous agreement, it is now considered possible to reduce the thermal load and total radioactivity such that several innovative options can be possible, based on the presented evidences. The possibility of disposing of the radioactive waste with the reduced thermal load and radioactivity in a geological repository or shallow borehole system was also discussed. The possibility may be tested through a multi-national research project. In the long-run, it is anticipated to be possible to turn all SNF into Low Level Waste for surface disposal. Panelists and Chairpersons agreed to international collaborations to demonstrate these innovative pathways with focus on the verification of technical viability of advanced P&T, the clarification of waste classification, safety assessment methodology as well as its economic feasibility.

Dominique Warin Nuclear systems and fuel cycles are anticipated to significantly evolve in the next decades. He depicted what are the corresponding options for the future and the corresponding supportive French R&D program strategy, with the objective of increasing the sustainability of nuclear energy within the scope of the 1991 and 2006 French Waste Management Acts requesting in particular the study of applicable solutions for still minimizing the quantity and the hazardousness of final nuclear waste. For the future, the long term sustainable nuclear systems will be fast reactors which allow full use of uranium with no enrichment needs, efficient burning of plutonium and potentialities for improving waste management. They will be initially fueled with plutonium coming from spent MOX fuels, the breeding being adjusted according to energy needs. The corresponding fuel cycle main features will be full plutonium/uranium multi-recycle, with advanced recycling concepts (no separated pure plutonium with COEXTM, on-line recycling and co-location of processing and fuel fabrication plants, appropriated international safeguards measures using a systemic approach based on accountancy and monitoring). Regarding waste management, most of the research in France has been conducted in the framework of the 28th June 2006 Waste Management Act which defines a road map and the main objectives to be achieved in a near-future, towards the assessment of industrial potentialities of the diverse P and T options by 2012 and the construction of the sodium cooled ASTRID reactor allowing minor actinide transmutation demonstration after 2020. Minor actinide recycling by P and T could significantly change the

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challenges for the storage of nuclear waste by reducing the heat load, the radiotoxicity and the overall “half-life” of the waste to be buried. In parallel, the retrievable geological repository will be defined in 2015 for already existing wastes, with first operation planned in 2025.

Hamid Ait Abderrahim has spent the last two decades of his research work to progress the knowledge on P&T in Europe and has coordinated various R&D projects in this field co-financed by the European Commission Framework program. He reported on the European vision on how to set up the P&T technology up to industrialization and described what is the progress accomplished in the specific field of dedicated transmutation machines such as Accelerator Driven System where Belgium is playing a world leading role.

Il Soon Hwang compared the environmental impact of final waste from advanced P&T with that of conventional Low and Intermediate Waste in Republic of Korea case. For the entire SNF (26,000 MTHM) of Korea 24 PWR generated over 40 years of lifetime, a conservative site impact assessment showed that the final radioactive waste produced from an advanced P&T (demonstrated partitioning capability with critical or subcritical burner), if disposed of in geological disposal (GD) can be as safe as conventional LILW for surface disposal, warranting an international effort for global standard development, in terms of peak radiation dose and the time of compliance. Reduced heat and long-living radioactivity in the advanced P&T waste will increase the confidence of site safety analysis and decrease the waste volume, providing a significant advantage to gain public acceptance.

Patrick Brady presented about the deep borehole disposal for high level waste as an alternative approach of nuclear waste disposal. Because the deep borehole with 3-5km depth can be drawn very quickly by using an existing gas technology and it requires relatively small resources, it can decrease the large expense of nuclear waste disposal. Therefore, it might be a good solution to the country which does not have a large nuclear waste program and infrastructures. Furthermore, it has good features for safety. First, many of radionuclides could be stabilized because the last 2km of borehole was intended to go into granite which has reducing conditions. Second, it is difficult to imagine an intrusion scenario and migration of radionuclides due to its deep depth and the slow vertical velocity.

Myung Jae Song emphasized the difficulty of securing the site for disposal of radioactive waste. The last twenty years of Korean experience on securing the radwaste disposal site was introduced. The whole process showed us that it would be more difficult, if not impossible, to decide the final disposal site for the spent nuclear fuels or high level radioactive waste in the future. However, there is a little hope since the public has been very much exposed to and has felt the safety of the disposal of low- and intermediate- level radioactive waste. Transforming the high level radioactive waste into the low- and intermediate- level radioactive waste and disposing it as other than high level waste would be much more acceptable by the public. Since significant progress on the development of the relevant technologies has been achieved, it is about time to show the technical feasibility of disposing the high level waste as low- and intermediate - level waste. An international joint research project on this issue was proposed.

Public Comment and/or Questions

Question - Partitioning experience of Korea?

Answer - We are building a pyrochemical process using only uranium fuel as a simulation material and that facility has 10 ton/year capacity.

Comment - International standard is a very fine idea. However, human society may be anxious for a country which is politically unstable to have reprocessing technology.

Answer - The spent nuclear fuel, especially CANDU reactors, contains high purity plutonium which can be weapons grade. If we dispose them directly underground, it can be a plutonium mine. Who is going to guard those plutonium mines for million years? The best way is international cooperation and multi-national approach to take them off. All the final waste can be 1,000 times diluted at the least after that process it will give far better proliferation resistance and safety than direct disposal.

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