General Overview of Worldwide Activities

High-level waste disposal is an element of paramount importance in the discussion of nuclear power generation sustainability. This, and the desire to reduce the quantity of long-lived waste material, have stimulated new interest in the transmutation of actinides and some long-lived fission products, and in emerging system technologies for energy production with reduced actinide generation. One such system is the combination of a particle accelerator with a sub-critical nuclear reactor; another possibility is to reduce the generation of actinides by the introduction of the thorium fuel cycle.

The surmised advantages of accelerator driven systems (ADS) - apart from their intrinsic low production of long-lived radioactive waste, and transmutation capability - are also enhanced safety characteristics and better long-term resources utilization (e.g., in connection with thorium fuels). Important R&D programmes are being undertaken by various institutions in many Member States to substantiate these claims and advance the basic knowledge in this innovative area of nuclear energy development.

In Asia, ADS R&D studies are pursued with both goals in mind: energy production with reduced radioactive waste production and decreased proliferation hazard, on the one hand, and long-lived waste transmutation, on the other. The R&D efforts are concentrated in China, India, Japan and the Republic of Korea. The programmes are presently conducted at national level, with some bilateral or multilateral co-operation agreements. In China, basic R&D activities aimed at the evaluation of various ADS were performed. In Japan, a review report on P&T Technology issued by the Atomic Energy Commission recommended the continuation of system design, scenario studies and basic experimental verification. The report stresses the importance of international cooperation. In the Republic of Korea, the activities are centred on HYPER. The first project phase ended in 2000 with the definition of the basic system concept and key technical issues. Work is continuing in the next phase, focusing on design optimisation and economics.

In Europe, the main driving force behind ADS is long-lived waste transmutation, but the ADS capability to produce energy is also investigated. Driven by the establishment of the “Extended Technical Working Group” and of the “European Industrial Partnership” (EIP) to advance the engineering design studies of a ~100 MW(th) ADS demonstration facility, the national programmes on ADS R&D are converging towards the demonstration of the basic aspects of the ADS concept. These R&D activities are conducted both nationally and as joint efforts within the fifth framework programme of the European Union (EU).

In Russia, there is considerable R&D effort dedicated to the development of the ADS technology. These studies are strongly coupled with advanced fuel cycle studies that aim at waste minimization and at a strong overall simplification of the nuclear fuel cycle (e.g., molten salt). Some Russian R&D activities are mainly conducted in support of western ADS programmes [e.g., within the framework of International Science and Technology Centre (ISTC) projects]. However, a Russian national ADS programme is currently being finalized.

In the U.S., after completion in 1999 of the “Accelerator Transmutation of Waste (ATW) Roadmap Study”, mandated to the DOE by the Congress, DOE is planning to merge all ADS activities into the “Advanced Accelerator Applications (AAA)” program. The main goals of this 10 year program are the proof of practicality for transmutation and the construction of a multi-purpose Accelerator Driven Test (ADT) facility. The need and importance of international collaboration is particularly emphasized.