

EXECUTIVE SUMMARY

More than 160 participants from 15 countries and three international organisations gathered for the sixth time since 1989 to exchange information on the various aspects of partitioning and transmutation (P&T). This 6th OECD/NEA Information Exchange Meeting was generously hosted by CIEMAT and ENRESA and was held in co-operation with the European Commission.

Since 1989, the OECD/NEA has conducted an international Information Exchange Programme on Actinide and Fission Product Partitioning and Transmutation within which the most visible activity has been the biennial Information Exchange Meeting. Previous meetings were held in Mito City (1990), Argonne National Laboratory (1992), Cadarache (1994), Mito City (1996) and Mol (1998). This 6th meeting closed the first ten years of information exchange and opened the discussion on what the next years should bring. Indeed, while the objectives of these meetings have remained unchanged, the focus has changed according to the developments and expectations in the subject field.

This 6th meeting highlighted the developments in P&T according to the themes which were the subject of 5 sessions, i.e.:

- International collaboration and institutional aspects were addressed in the first session “Overview of National and International Programmes on P&T”.
- The role of P&T in advanced nuclear fuel cycles and especially the link with waste management was considered in Session II “The Nuclear Fuel Cycle and P&T”.
- Partitioning was addressed in Session III.
- Session IV addressed basic physics aspects (i.e. nuclear data and experiments), material and fuel developments, as well as an insight into specific reactor physics aspects of transmutation systems.
- Finally, Session V addressed several concepts of transmutation systems and highlighted especially the safety considerations.

An overview of the presentations and discussions during these sessions has been given by the session chairs. This executive summary brings an overview of the discussions held during the technical sessions and reports on the panel discussion during the closing session.

The discussions during the closing session highlighted the current issues and situation of P&T research and development in the individual countries and on an international level. A lively session addressed several aspects:

- The increasing need for interaction between the P&T and the radioactive waste management community.
- The organisation, planning and role of international collaboration in the development of P&T and especially of ADS.
- Multi-purpose or single-purpose development of ADS.

- The need for consensus on figures of merit for P&T, etc.

P&T has made various advances in the past ten years. It has been shown that separation of the minor actinides is a feasible process, exhibiting high separation factors at the laboratory level; figures of merit are needed in the future. Indications are that all separation processes, hydro-reprocessing as well as pyro-reprocessing, are becoming so complex that simplicity and thus cost-reductions should become prime criteria for future development. A large variety of transmutation concepts have been proposed in response to which partitioning has been continuously adapted (increasing recovery yields). As further development in partitioning and in transmutation becomes more expensive, choices on performance and specific objectives (i.e. criteria and indicators) for P&T will be needed. Future reprocessing processes are closely linked to fuel-fabrication aspects (fissile content of fuel, type of fuel). Pyro-processes will most probably be on a batch basis with low throughput because of the limiting transfer capacity between process steps. Continuous pyro-processes may be envisaged in a few decades time. The specific question of whether to include curium in a transmutation scheme influences the partitioning processes to be developed to a pre-industrial stage. The discussions indicated that no common view exists in that respect. Whereas fuel fabricators indicated a receptiveness to separate the curium and to store it in order to decay to plutonium for recycling after about 100 years; others indicated that this (concentrated) storage would involve difficult problems such as criticality, heat removal, doses.

The discussion also covered the question of why P&T might be needed and the objectives involved. P&T may be justified in order to increase the utilisation of the natural uranium resources while minimising the possible impact of the long-lived radionuclides on the biosphere. Different strategies could be envisaged. Multiple recycling has to be considered both in “double strata” strategies and in standard critical reactors to consistently reduce the final potential radiotoxicity of waste (by factors up to 200-300). “Once-through” strategies would only allow lesser reductions (factors 30-40). It was pointed out that, to obtain significant P&T effectiveness in reducing the potential radiotoxicity of waste in a deep geological repository, process losses in the fuel cycle as low as 0.1% for all transuranics are required.

Another option which might improve the disposal strategy would be to adopt partitioning and conditioning (P&C) in which specific conditioning of the minor actinides (MAs) and some of the long-lived fission products (LLFPs) is applied.

Even before deploying P&T in a fuel cycle, questions arise about the role of plutonium in a truly sustainable nuclear option. Sustainable development may depend on a plutonium economy in order to extend the time span over which the natural resources are available to generate electricity. In this context, one should mention that the thorium option also involves specific problems that will require substantial developments in the area of fuel cycle.

One may not forget that the time scales for implementation of P&T and of geological disposal are very different. While P&T could indeed reduce the mass and radioactivity of long-lived waste, for example by a factor of 100, achieving this reduction would take several decades to equilibrium and a few centuries to achieve the potential impact on the final waste disposal. This means an institutional decision to act on P&T early and for several decades in order to reduce potential very long-term impacts. Currently, the time period from decision to implementation of geological disposal is only about 40-50 years.

There has been growing interest and activity in basic science supporting P&T. This is particularly the case in the high power proton accelerator field where a synergy can be envisaged between transmutation and other applications of intense neutron sources using these accelerators. In the nuclear physics field, nuclear data measurements have experienced a revival as deficiencies in data are identified. In the fuel area, laboratories for MA-handling are being built in which, over the next decade, options should be experimentally proven. A difficulty however has been identified, i.e. the

reduced number of fuel irradiation facilities. Other crucial elements in the development of fuel and materials relate to corrosion and irradiation resistance; these are supported in well-structured R&D programmes. New technologies emerging from other fields of science and technology could also play an interesting role in the R&D for P&T (hollow fibres, nano-materials, other uses of Pb-Bi).

The panel discussion indicated that streamlining and prioritisation of R&D is needed in the future as P&T-related R&D starts to demand more resources and, as mentioned above, would benefit of a convergence of ideas and consensus on the selection of desirable fuel cycles schemes. Choices will need to be made in the coming years. Criteria and indicators will therefore need to be identified for future guidance of work. Basic science developments (materials, nuclear data and simulation, chemistry, etc.) will be very important and this will demand an international collaborative effort. The link with waste management was considered as a priority for future work by international programmes. Finally, simplicity in P&T should be sought.

The closing session ended with the statement that “the P&T community will have to make up its mind!” in the near future in order to keep the R&D well supported and well focused on the ultimate objective. This issue will be the focus of the 7th Information Exchange Meeting which is tentatively planned to be held at the end of the year 2002 and will be hosted by the Republic of Korea.