Proposal for a new NSC Expert Group on Integral Experiments for Minor Actinide Management (draft mandate)

Chair:

Members: All NEA Member countries

Observers: Slovenia, Russian Federation

Duration: Two years

Scope:

The establishment of a reliable and economical fuel cycle and a safe management of the radioactive waste are inevitable in pursuing a sustainable utilisation of nuclear fission energy. In this context, minor actinides (MA), such as neptunium, americium and curium in the spent fuel, should be appropriately managed. In particular, the necessity to manage MA becomes more obvious when plutonium is used as MOX fuel on a large scale in power reactors, both light-water reactors and fast reactors, because more americium will be accumulated in the spent fuel. It is, therefore, necessary to prepare carefully for the coming "age of MA management".

One effective way to manage MA is to transmute them in nuclear reactors, such as light-water reactors, fast reactors and accelerator-driven subcritical systems. The transmutation of MA is, however, not easy. From the reactor neutronic viewpoint, the loading of MA generally affects physics parameters, such as the coolant void, the Doppler, and the burn-up reactivities.

In addition, the accuracy of MA nuclear data is not sufficient. Hence, the detailed design of transmutation systems and the precise prediction of the composition of the spent fuel are difficult. This is because there is a lack of experimental measured MA data. It should be remembered that nuclear data of the major actinides, such as U-235, -238 and Pu-239, have been improved for more than 50 years, based on a vast number of differential and integral experiments, using accelerators, critical facilities and experimental reactors.

Integral experiments on MA are much more difficult than those on the major actinides because of restrictions at the facilities, the difficulty of sample preparation, the necessity to improve measurement techniques to reduce the influence of background radiation, and so on. Moreover, facilities for nuclear data measurements and validations are getting old all over the world.

Therefore, it is strongly requested that a critical review of integral experiments for validating MA nuclear data should be undertaken, with appropriate quality assurance for MA transmutation in nuclear reactors such as light-water reactors, fast reactors and accelerator-driven subcritical systems. This activity should be followed by recommendations on

integral experiments needed for validating MA nuclear data and on the establishment of an international framework to facilitate integral experiments for MA management.

The Expert Group is expected to work closely with WPRS (IRPhE), WPFC (the task forces on comparative study on homogeneous and heterogeneous recycle of TRU and on potential benefits of advanced fuel cycles with P&T, etc.) and WPEC (the subgroup on meeting nuclear data needs for advanced reactors (SG31) and the combined use of integral experiments and covariance data (SG33)).

Objectives:

The expert group will prepare a state-of-the-art report on integral experiments for MA recycle. The study will mainly focus on;

- Review of existing integral data (including review of MA sample amount used/required in experiment)
- Specification of missing experimental work to be required for MA management
- Evaluation of target accuracy of nuclear data required for MA management (Reflection of WPEC activities)
- Request and priority list of nuclear reactions, their energy range and their measurement error
- Experiments to meet the requirement
  - Availability of existing experimental facilities with minor modification
  - Development of new experimental facilities
- Identifying and considering possible solutions to the bottlenecks
  - Establishment of route for supplying MA sample
  - Improvement of experimental technique
- Proposal of action program for international cooperation

Time-Schedule and Deliverables:

The expert group will complete and document the activities listed above within 2 years.

Date	Deliverables
June, 2009	Kick-off meeting: initiate expert group activities
June, 2011	Report of expert group activities, including proposal of action program of international cooperation