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**NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY
NUCLEAR SCIENCE COMMITTEE**

**TASK FORCE ON PHYSICS ASPECTS OF DIFFERENT
TRANSMUTATION CONCEPTS (TFDT)**

**Summary Record of the Second Meeting
NEA Headquarters, Issy-les-Moulineaux, France
14 and 15 January 1997**

TASK FORCE ON PHYSICS ASPECTS OF DIFFERENT TRANSMUTATION CONCEPTS (TFDT)

Summary Record of the Second Meeting held on 14th and 15th January 1997
at NEA Headquarters, Issy-les-Moulineaux, France

1. The meeting was opened by the NEA Deputy Director, Ph. Savelli, who addressed the participants and described the NEA programmes on Partitioning and Transmutation studies. Ph. Savelli further stressed the importance of good co-ordination and exchange of information between the NEA Nuclear Science Committee Task Force on Physics Aspects of Different Transmutation Concepts and the NEA Nuclear Science Committee Working Party on the Physics of Plutonium and Uranium Recycling.
2. The introduction of all participants of the meeting followed. The list of participants is given in Annex I.
3. The proposed agenda of the meeting was presented by the Chairman, discussed and approved by the participants.
4. The preliminary results of the TFDT group benchmark were presented as described below.

Preliminary PWR Benchmark Results

5. Two preliminary solutions of the PWR benchmark (by H. Takano, H. Akie, K. Kaneko, PROFIT Team, JAERI, and by B. Kochurov et al., ITEP, Moscow) were submitted to the NEA secretariat. These have been analysed and presented to the meeting by C. Broeders (KZK, Karlsruhe). The third preliminary PWR solution was presented by R. Mills (BNFL, UK). B. Kochurov (ITEP, Moscow) also presented his new PWR results. The following conclusions summarise these three presentations:
 - a) Each participant used different criteria to obtain starting MOX fuel compositions for the three stages of calculations thus solving, in principle, a slightly different problem. This made the comparison of the results quite difficult.
 - b) In order to resolve this difficulty, T. Wakabayashi (PNC, Japan) made the following proposal:
 - prepare the homogenised material number densities for each PWR case;
 - prepare a precise geometrical description of the PWR model;
 - leave to each participant the choice of nuclear data library and computer code system;
 - determine a small number of PWR cases to be analysed by the participants.
 - c) T. Wakabayashi's proposal was accepted by the meeting. C. Broeders offered to prepare four consistent PWR specifications as defined in point b) above. These will include basic cases (0 percent MA and 2.5 percent MA content) for standard (33 MWd/kgHM target burnup) and wide lattice (50 MWd/kgHM target burnup) PWR. These cases will be consistent with the Pu and MA isotopic vectors used in Fast Reactor and Fast Flux Accelerator benchmarks. C. Broeders will

deliver these specifications to the NEA secretariat (R.P. Rulko) at a rate of two cases per two weeks (counting from the date of the meeting).

- d) An attempt should be made to increase participation in the PWR benchmark:
- B. Kochurov will inquire in Russia for additional PWR benchmark solutions;
 - C. Broeders, any potential new participants in Germany?
 - T. Wakabayashi will inquire in Japan for additional PWR benchmark participants.

Preliminary Fast Reactor Benchmark Results

6. The preliminary results of the Fast Reactor Benchmark (five solutions from: H. Oigawa and T. Mukaiyama (JAERI), J. Tommasi (CEA), T. Wakabayashi (PNC), M. Yano (Mitsubishi), and M. Kawashima (Toshiba)) were presented to the meeting by T. Wakabayashi, and the following conclusions were made:

- a) A particularly satisfactory agreement was reported for the calculated Na reactivity worth and Doppler reactivity worth.
- b) The preliminary results are unsatisfactory for such fundamental parameters as k_{eff} and burnup reactivity loss.
- c) Some other calculated quantities show significant discrepancies (in particular the "spectral indices"). These are believed to arise from different definition of these quantities adopted by the participants: a clarification of these definitions is needed.
- d) Not all participants provided the complete Fast Reactor results.

7. The following actions were agreed at the meeting:

- a) Completion of all presently declared Fast Reactor contributions - T. Wakabayashi will co-ordinate completion of the Mitsubishi and Toshiba Fast Reactor solutions;
- b) All participants should review the cross-section data used in their calculations as a potential source of differences between their results and the results from other participants (discrepancies in k_{eff} and burnup reactivity losses - R.P. Rulko will co-ordinate this action);
- c) JAERI will recalculate its solution using JENDL-3.2 data;
- d) Clarification of the definitions of calculated quantities showing significant discrepancies (e.g. spectral indices) is needed - R.P. Rulko will follow up on this point;
- e) More solutions of the Fast Reactor benchmark are needed:
 - B. Kochurov should inquire with Drs. Rabotnov (Obninsk) and Orlov (Institute of Power Engineering, Moscow) to obtain a Russian Fast Reactor contribution;
 - T. Mukaiyama will inquire at ANL (USA) to obtain a US Fast Reactor solution;
 - C. Broeders will inquire at KZK to obtain a German contribution.

Fast Flux Accelerator Benchmark

8. Two contributions to the accelerator benchmark were received (G. Youinou, S. Pelloni, P. Wydler (PSI) and T. Nishida, T. Takizuka, T. Sasa (JAERI)). These were presented to the meeting by G. Youinou (PSI/CEA). The following conclusions were made:

- a) Good agreement was reported for the number of neutrons produced by spallation below (20-15) MeV energy range;
- b) The neutron transport part of the accelerator benchmark results revealed significant discrepancies, in particular, for k_{eff} evolution with burnup and neutron flux energy distribution;
- c) Good agreement was reported for fuel composition evolution in function of burnup;
- d) The group discussed the accelerator results and discovered that the participants might have used different definitions of k_{eff} ;

9. Actions to be taken to improve the accelerator benchmark results:

- a) Reasons for discrepancies in the accelerator results have to be identified (G. Youinou (PSI/CEA) and T. Nishida (JAERI) should jointly discuss their methodologies/assumptions made);
- b) More contributions to this benchmark are needed:
 - C. Broeders should inquire at KZK for a German accelerator contribution;
 - B. Kochurov should inquire about a Russian contribution;
 - T. Mukaiyama should inquire at LANL (USA) for a US contribution and with M. Salvatores (CEA, France) for the CEA and ENEA contributions.

Conclusions of the meeting

10. The next meeting of the TFDT group will take place in Paris on 24th and 25th June 1997. At this meeting, it is hoped that final results of the PWR, Fast Reactor, and Fast Flux Accelerator benchmarks will be reported;

11. To meet the above objective, final solutions of the three benchmarks should be submitted by e-mail (in ASCII format) to the NEA Secretariat by the end of May. The assembly and analysis of the PWR and Fast Flux Accelerator results will be performed by R.P. Rulko; the Fast Reactor results will be analysed by T. Wakabayashi.

12. Proposals from the group members for the follow-up phase of the project are to be presented at the next meeting. An inquiry should be made by the group members about the availability of the experimental data which could be used for verifying calculations (some candidates are: the TCA experiment for PWR MOX at JAERI, German Obrigheim burnup experiment, the Working Party on Burnup Credit - Inventory Burnup Benchmark).

13. Concluding the agenda of the meeting, E. Sartori gave an overview presentation of the completed work of the WPPR to familiarise the participants with the issues already addressed by this Working Group.

Annex IList of Participants

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