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NUCLEAR ENERGY AGENCY
NUCLEAR SCIENCE COMMITTEE

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Working Party on Nuclear Criticality Safety (WPNCS)

SUMMARY RECORD OF THE FIFTH MEETING OF THE WORKING PARTY ON NUCLEAR CRITICALITY SAFETY

6 December 2001
Château de la Muette, Paris

English - Or. English

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Fifth Meeting of the Working Party on Nuclear Criticality Safety

December 6, 2001
OECD, Château de la Muette, Paris (France)

SUMMARY RECORD

1. Introduction

The chairman, Y. Nomura, opened the meeting and welcomed the participants (see Appendix 1 for the list of participants) to the fifth meeting of the NSC Working Party on Nuclear Criticality Safety.

2. Approval of the agenda

The agenda was approved without modification.

3. Review of actions from the previous meeting

The actions from the last meeting were reviewed and considered as satisfactorily completed. One of the actions concerned the results of the poll questionnaire sent by the secretariat to the WPNCS members requesting their opinion on the appropriateness of starting a new activity on Mixed Configurations. Only few responses were collected. Two representatives think that the idea is good in principle but they cannot commit themselves or other people from their organisations. Another said that he is not interested in this activity. Finally, one representative thinks that his organisation might support one participant to this activity.

4. Reports from the Expert Groups and co-ordination of the activities

a. ICSBEP

B. Briggs presented a report on the activities of the ICSBEP Project. A new edition of the ICSBEP CD-ROM was published in September 2001. The Handbook spans over 22000 pages describing 2642 experiments grouped in 307 evaluations. The new edition comprises new and revised evaluations. 12 countries are participating in this effort and the handbook is used in 57 countries.

The distribution of benchmark configurations over the different categories showed a lack of configurations in the Intermediate Enriched Uranium category. However, a large number of such experiments were identified in the UK and they will start to be evaluated this year with the help of Livermore.

A new addition to the handbook this year is a guide for the expression of uncertainties in evaluated experimental data. New and revised evaluations will follow the recommendations of this guide.

Other additions to the handbook are a database and a user's interface which will help users to search with given criteria, and identify experiments.

The effort of compilation and evaluation of critical and subcritical experiments will continue next year. An extension of the format to include Criticality Alarm Shielding type experiments will be proposed.

b. Burnup Credit (M. Brady Raap)

M. Brady-Raap presented the activities of the Expert Group on Burn-up Credit. The results of Phase III-A were published this year and those of Phase III-B will be published in early 2002. An article summarising the findings of the Expert Group was submitted for publication in the RAMTRANS journal. Pre-prints will be distributed by the secretariat, as they become available.

The present activities of the Expert Group concentrate on two main areas. Phase II-C is dealing with axial burn-up profile asymmetry. Two phases are on-going on MOX fuel burnup.

The country reports showed that the interest in burnup credit is still high in most countries. M. Brady-Raap suggests that a core group is formed within the Expert Group to discuss possible directions for future programmes.

c. Minimum Critical Values (W-J. Weber)

W. Weber presented a summary of the Expert Group on Minimum Critical Values. The group has agreed to finalise an intermediate compilation table of minimum critical values (mass, dimensions of different simple volumes and concentration) for usual homogeneous media such as uranium oxide, uranium nitrate, plutonium nitrate and plutonium oxide for different composition vectors and moderation ratios. Up to now, more than 430 values have been entered on a web-based database hosted by NAIS. Conversions to simple tables to be included in a report was also made. It was agreed to define a general layout of the final report for this compilation and to collect information on the conditions under which the data were generated by each participant. Reviewers were assigned for different categories of fissile media.

d. Criticality Excursions Analyses

C. De Oliveira presented a summary of the first meeting of the Expert Group on Criticality Excursions Analyses which was attended by a panel of scientists and regulators. The presentations made at the meeting covered both the modelling and the experimental activities. After the technical presentations, the participants elaborated a proposal of the Scope and Objectives. This proposal was submitted to the Working Party members and was approved.

e. Source Convergence Analysis (R. Blomquist)

The Expert Group on Source Convergence Analyses had defined four benchmarks for code comparisons. The progress in solving the problems was considered as satisfactory since nine institutions have already contributed.

Besides the calculation benchmarks, the Expert Group also discussed the Monte-Carlo algorithms used for eigen value calculations. After finishing the work on benchmark exercises, the following areas will receive more attention:

- Development of criteria to measure convergence reliability
- Investigation and evaluation of methods that can be used to ensure and to detect source convergence.

Proposals will be elaborated and discussed at the forthcoming meeting, which might be held in conjunction with the special session organised at the ANS meeting in Washington in November 2002.

f. Experimental Needs

P. Cousinou presented a summary of the meeting of the Expert Group on Experimental Needs. At this meeting, a web-based form for the expression of needs was discussed. Several presentations were made to discuss the need for experimental programmes with MOX damp powders.

5. Report from the Nuclear Science Committee (C. Nordborg)

After recalling the NEA committee structure, C. Nordbog, the head of the OECD/NEA Nuclear Science section presented the activities of the Nuclear Science Committee (NSC) and the Data Bank. The main working areas of the NSC are in reactor and fuel cycle physics and in chemistry. Besides the WPNCS, the working parties are the WPPR (Physics of Plutonium Recycling), WPPT (Scientific Issues on Partitioning and Transmutation), and WPEC (International Nuclear Data Evaluation). The Data Bank provides services on Computer Codes, Scientific Nuclear Data and Thermodynamical data. Close co-operation exists between the NSC and the Data Bank.

6. OECD/NEA Joint Projects, features and examples (T. Dujardin)

T. Dujardin, Deputy Director of the NEA, presented examples of Joint R&D Projects carried out in the international framework provided by the NEA. Developing such projects is one of the missions of the Agency, and the legal basis is Article 5 of the NEA statute which stipulates that the Agency shall promote joint undertakings if a group of participating countries agrees to perform the work in the framework of the NEA. The general characteristics of these projects are that they have a separate funding, usually contributed by the participating institutions, and that the project is structured with appropriate committees (technical committee, management board…). T. Dujardin presented several examples of such Joint R&D Projects in the area of safety and the Data Bank. The initiation of the process leading to such projects is the expression of interest or need in a particular collaborative programme by one or several member countries. Preparatory meetings are then organised to achieve consensus on the technical programme and to draft the agreement. As a return of experience, it should be noted that the time elapsed between the reaching of a consensus on the technical programme and the formal signature of the corresponding legal agreement is often longer than expected.

The NEA offers flexibility for establishing such projects and offers a wide range of solutions ranging from a pure secretariat role to a more advanced role where other aspects (such as the budget management and the legal advice in establishing the necessary agreements) are also dealt with. Non-OECD member countries can also participate in NEA Joint Projects.

7. A new proposal for the Evaluation of Post-Irradiation Experimental Data and the associated database SFCOMPO.

The participants recognised the need of sharing experimental information on spent fuel composition. It was also acknowledged that the SFCOMPO database constitutes an excellent candidate for the compilation and dissemination of such data. Y. Nomura and the NEA secretariat will work on the possibility to transfer this database on the NEA web server. The participants also discussed the possibility to complete the database with missing information that could be recovered from open literature. The irradiation history of the assembly in the reactor is considered as crucial in this perspective.

A discussion on the quality of the data available in SFCOMPO in terms of uncertainty and evaluation process was also discussed. However, a huge effort is probably needed to improve the data and it was not considered appropriate to start action in this direction in the near future.

8. Nuclear Criticality Safety National Programs.

The country reports started by a presentation made by C. V. Parks on the Nuclear Criticality Safety technical activities and issues in the US. DOE has a Nuclear Criticality Safety program encompassing different areas such as Critical Experiments, Benchmarking, Knowledge Preservation… The benchmarking heading comprises items such as:

Nuclear data measurement and evaluation, including nuclides such as Fluorine, Potassium, U-233…

Integral experiences with iron in LANL.

S/U analysis in SCALE.

An effort aiming at collecting experimental documentation from different laboratories is managed by LANL. This includes the recordings of pioneers.

The NRC activities concentrate mainly on research work connected to BUC implementation, and on clean-up activities associated with decommissioned weapons.

Y. Nomura described the National Program in Japan with emphasis on planned experiments with Plutonium Solutions in the STACY facility. The need for this programme stems from the fact the majority of available experiments with plutonium are those with a low content of Pu-240 while experiments with a plutonium with a higher content of Pu-240 are needed in conjunction with the reprocessing of LWR fuel.

P. Grimm presented the status of the program LWR-PROTEUS Phase II, of which the goal is to extend the code validation database to very high burnups for in-core fuel management and burnup credit. Chemical assay analyses are carried out in PSI. The reactivity worth measurements will consider samples of high burnup PWR fuel, doped samples with individual fission products as well as reference (fresh UO2 at different enrichments) and calibration samples.

P. Cousinou presented the on-going programs in France with emphasis on the following three areas.

Experiments performed in Valduc. This includes the continuation of the Fission Product validation program with different combinations of fission product solutions, high burnup rods, uranium solution and the LWR lattice driver. Extra experiments were also performed with Mo-CH2 and with (CF2)n. A further experimental program presented by Cousinou consists of configurations involving a HEU solution slab reflected by various materials (Cu, Ti, Mo, Ta, C, Pb, organics…) complemented with a water reflector. Finally, the same experiments with “high burnup” rods (containing only actinides) were repeated after 15 years of cooling time to study the effect of the decay of Pu-241 to Am-241.

A new density for solutions was elaborated taking into account experimental data on the density and thermodynamical activity of water. This formula is applicable for uranium and plutonium nitrate solutions. Extensions to UO_2F_2 and to other solutions will be carried out in the future.

The first version of the CRISTAL package developed by CEA, IPSN and industrial partners was released. The next version foreseen at the end of year 2002 will include enhanced capabilities and validation for its application to burnup credit studies.

9. Planning of ICNC'2003.

Y. Nomura presented the status of the ICNC'2003 preparation. Participation to the technical and the advisory committees has been solicited from different criticality experts. The appropriateness of providing an official status of the international advisory committee was also discussed. The Nuclear Science Committee will be consulted on this question.

10. Date and place of the next meeting

The next meeting will take place in Paris on September 12, 2002.

Annex 1

List of participants

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Annex 2

NEA/SEN/NSC/WPNCS(2001)2

ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT

Nuclear Energy Agency
Nuclear Science Committee

Fifth Meeting of the Working Party on Nuclear Criticality Safety

Thursday December 6, 2001, starting at 1:30 p.m.
OECD - Château de la Muette, Paris (France)

PROPOSED AGENDA

1 Introduction (Y. Nomura).

2 Approval of the agenda.

3 Review of actions from the previous meeting (A. Nouri)

4 Reports from the Expert Groups and co-ordination of the activities

g. ICSBEP (B. Briggs)
h. Burnup Credit (M. Brady Raap)
i. Minimum Critical Values (W-J. Weber)
j. Criticality Accidents (C. De Oliveira)
k. Source Convergence Analysis (R. Blomquist)
l. Experimental Needs (P. Cousinou)

5 Report from the Nuclear Science Committee (C. Nordborg)

6 OECD/NEA Joint Projects, features and examples (T. Dujardin)

7 A new proposal for the Evaluation of Post-Irradiation Experimental data and the associated database SFCOMPO.

8 Nuclear Criticality Safety National Programs.

Overview of Nuclear Criticality Safety technical activities and issues in the US, (C. V. Parks)

National Program in Japan; Experimental Project of Plutonium Solution at STACY Facility", Y. Nomura

Status of LWR-PROTEUS Phase II, P. GrimmOverview of the Criticality Safety Program is France

9 Planning of ICNC'2003.

10 Any other business.

11 Date and place of the next meeting