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**Working Party on Nuclear Criticality Safety (WPNCS)**

**SUMMARY RECORD OF THE SIXTH MEETING**

**12 September 2002  
NEA Headquarters, Issy-les-Moulineaux, France**

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## **Sixth Meeting of the Working Party on Nuclear Criticality Safety**

12 September 2002

NEA Headquarters, Issy-les-Moulineaux, France

### **SUMMARY RECORD**

#### **1. Introduction**

The Chairman, Yasushi Nomura, opened the meeting and welcomed the participants to the sixth meeting of the Working Party on Nuclear Criticality Safety (WPNCs). The meeting was attended by 22 participants (see the list of participants in Annex 2).

#### **2. Approval of the agenda**

The agenda (see Annex 1) was approved without changes.

#### **3. Approval of the summary records of the previous meeting**

The summary record of the previous meeting was approved without modifications.

#### **4. Reports from the Expert Groups**

##### **a) ICSBEP (B. Briggs)**

Blair Briggs reported on the activities of the International Criticality Safety Benchmark Evaluation Project (ICSBEP). The 2002 Edition of the ICSBEP handbook will be published in September 2002. This edition includes 330 evaluated experimental programs totalling 2881 experimental configurations available as benchmarks for code validation. The new evaluations included this year are mainly metal and solution systems. In 2003, it is planned to add from 25 to 30 new evaluations and initiate a pilot criticality alarm benchmark evaluation.

Blair Briggs also reported on an on-going pilot project sponsored by the NEA/Nuclear Science Committee aiming at compiling reactor physics experiments (IRPhEP). This project will extend the range of evaluated experimental data beyond the critical parameters and include information such as reaction rates and spectra indices. In cases where the experimental data had already been evaluated by the ICSBEP, the corresponding evaluation for the critical parameters will be reproduced in the IRPhEP and extended to include the evaluation of other measured quantities.

##### **b) Burnup Credit**

Mikey Brady Raap reported on the activities of the Expert Group on Burnup Credit. Progress was made in the analysis of benchmarks involving MOX fuels (Phases IV-A and IV-B). Phase II-C on the sensitivity to axial burnup profile asymmetry is on-going. The group has also expressed an interest in a benchmark exercise studying burnup credit issues with the presence of neutron absorbers.

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

Wolf Weber presented a summary of the meeting on minimum critical values. The Expert Group members discussed an outline of the report which will assemble the minimum critical values collected so far. The document will also describe the methods used for the derivation of these data. The discrepancies between the compiled data will be assessed and an attempt will be made to explain the most important reason(s) for the discrepancies.

d) Criticality Accidents (C. De Oliveira)

Ali Nouri presented a progress report of the Expert Group on Criticality Excursions Analysis on behalf of Cassiano de Oliveira who could not attend this meeting. Proposals for criticality transient benchmarks based on the SILENE experiments in Valduc (France) and TRACY (Japan) were discussed. The final specifications will be made available to the participants in early 2003. JAERI has recently published documentation on the whole series of TRACY transient experiments (Reports JAERI-Data/code 2002-005 to 2002-007). The Expert Group will develop a web-based information system describing experimental programs, criticality accidents and a description of available computer codes.

e) Source Convergence Analysis (R. Blomquist)

Ed Fujita presented a progress report of the Expert Group on Source Convergence on behalf of Roger Blomquist and described the status of the four on-going benchmarks. The ANS winter meeting on November 2002 will include a special session on this subject where several presentations from the Expert Group participants are scheduled. The Expert Group will hold its annual meeting in conjunction with this ANS meeting.

f) Experimental Needs (P. Cousinou)

The meeting of the Expert Group on experimental needs included several country reports on on-going and planned experimental activities, as well as feedback from validation studies. The web-based form designed in order to describe and compile experimental needs was discussed further. Rick Anderson will check whether the experimental needs compiled within the US/DOE could be made available to this committee. Blair Briggs informed the group that the ICSBEP is putting together plans for future evaluation efforts. Most of the US laboratories have a five-year plan. This planning allows some flexibility and the assigned priorities might be reviewed if needed. The information about the planned evaluations is available on the ICSBEP web site at <http://icsbep.inel.gov/icsbep>.

## **5. Discussion of possible new programs of work for the following Expert Groups:**

a) Burnup Credit

The program of work for the Expert Group on Burnup Credit includes several items. The completion of on-going benchmarks is obviously of prime importance. Phases IV-A and IV-B will be completed and published in 2003. Phase II-C will probably be completed by the end of 2003 or early 2004. It is also planned to write a summary report of the EG activities with an emphasis on the relevance of the benchmark exercises and on the lessons learned. In the coming months, Mikey Brady Rapp will circulate an annotated outline to a core group. A draft will be distributed at the next meeting and the final report should be ready in 2004. Finally, the Expert Group members have expressed their interest in continuing the benchmark activities with a study on the effect of absorbers on burnup credit issues. The specification of the benchmark will be circulated one month before the next meeting.

b) Minimum Critical Values

The Expert Group participants will mainly concentrate on the completion of the compilation report for the selected fissile media. A year or two would be needed in order to finalise this effort. After that, new media can be also studied. An example of such media is homogeneous uranium systems with enrichment beyond 5%. Minimum critical values for such systems are needed to analyse the evolution of fuel cycle facilities associated with the projected increase of burnup in light water reactors.

c) Experimental Needs

The Expert Group participants expressed their interest in keeping a framework for the exchange of information on current and planned national experimental programmes. The group had established a mechanism for the expression of experimental needs but this mechanism has never been applied. It was also felt that this EG should limit the scope to the definition and justification of needs and then hand-over this need to higher instances to seek their contribution in establishing the right frameworks for international collaboration. A few cases were selected for the demonstration of this mechanism and Mike Westfall agreed to help collect and formalise the needs for the case of MOX systems and for systems in which the U-238 capture occurs mainly in the intermediate energy range [10-500 keV]. Some concerns were raised about the lack of experimentalists in this Expert Group. The ICNC'2003 conference was considered as a good forum to try to widen the representation within this Expert Group.

d) Other proposals

Blair Briggs informed the participants about on-going activities in the field of sensitivity and uncertainty methods carried out by the Institute of Physics and Power Engineering (IPPE) in Obninsk and ORNL. A comparison of available codes and methods in this area might be of interest to the criticality-safety community. Wolf Weber sees interesting applications of these methods for the assessment of uncertainties of minimum critical values.

## 6. International Conference on Nuclear Criticality Safety (ICNC series)

a) Status of ICNC'2003

Yasushi Nomura circulated an information sheet showing the planning of the ICNC'2003 conference which will be held from 20 to 24 October 2003 at Tokai-Mura, Japan. Updated information on the conference preparation will be posted at the following web site: <http://www.icnc.jp>. The key conference dates are:

Mid-January 2003: Deadline for the submission of abstracts

Mid-July 2003: Deadline for the submission of the full papers

b) Proposals for ICNC'2007

Two proposals for the organisation of the ICNC'2007 conference were discussed. Lida Markova suggested hosting the conference in Prague (Czech Republic). Blair Briggs, on behalf of Anatoli Tsiboulia who could not attend the meeting, presented the second proposal suggesting Saint Petersburg (Russia) as a venue for the conference. After discussion among WPNCS members, Saint Petersburg (Russia) was selected. The proposal will be submitted for approval to the Nuclear Science Committee.

## 7. Nuclear Criticality Safety National Programs.

Mike Westfall presented a summary of the criticality safety programs conducted in FY2002 in the USA. This includes critical experiments with U-235 and graphite in the intermediate energy assembly ZEUS. Other experiments are planned involving gadolinium and steel as interstitial plates. These experiments will be evaluated and included in the ICSBEP handbook. A nuclear data advisory group (NDAG) has been created to better integrate various related aspects (measurements, evaluations, benchmarking and feedback). This group works in co-operation with the Cross Section Evaluation Working Group. Codes and methods development efforts are devoted to the on-going work on source convergence analysis and to the implementation of sensitivity/uncertainty methodology in the SCALE system. Other aspects of the DOE-sponsored criticality safety programs include the preservation of information related to experimental programs and the organisation of training courses using the critical facility in Los Alamos. Carl Withee provided a short description of NRC-sponsored activities. Burn-up credit continues to be a major theme. The increase of uranium fuel enrichment (above 5%) in order to achieve higher burnups is also considered to be a challenging research programme. NRC continues to provide support to the development of the SCALE system.

Patrick Cousinou presented an overview of criticality safety programs in France. This includes the development and the validation of the CRISTAL package. The validation database includes more than 800 experimental configurations and plans for the extension of the database were presented. Experiments performed at Valduc for the validation of six fission products were briefly described. Plans for future experimental programs were presented. Experiments are planned using the same assemblies as those used in the HTC (high burnup) program. The purpose is to validate the "Am-credit", i.e. the decrease of reactivity with cooling time due to the decay of Pu-241 to Am-241. Experiments aiming at investigating temperature feedback effects in low-concentrated plutonium media are planned in 2004. The testing of structural materials (such Fe, Cu, Ti, Mo, Ta, C and Pb) cross-sections is the purpose of another planned experimental programme. Finally, a brief description was given of the planned experiments with low-moderated MOX systems.

Patrick Cousinou mentioned a co-operative programme supported by the European Union research programme aiming at studying critical parameters of actinides. IRSN (France), SERCO (UK) and EMS (Sweden) are involved in this programme.

A. Santamarina described some elements of the burnup credit experimental programme carried out at Cadarache. The programme includes post irradiation examination analysis, oscillations of fission product samples and of irradiated fuel samples in various spectra (PWR, dissolver and BWR). A new programme is planned on high burnup issues which will allow to extend the validation range of UO<sub>2</sub> to 75 GWd/t.

Jim Stewart and Jim Gulliford described the change of structure in the UK. The Nuclear Science Forum is now under government leadership. David Simister is the key contact person for criticality safety issues. NIREX has conducted a criticality safety analysis including criticality excursion calculations in the under-ground repository.

Peter Grimm described the status of the PROTEUS experimental programme at PSI (Switzerland). Further chemical assays are to be carried out after the refurbishment work of the hot cell. The analysis of experiments showed a calculation/experiment discrepancies of about 3%.

Bernhard Gmal gave an overview of criticality safety work in Germany. Analyses are under-way to assess the effect of increasing the uranium to 6% in the enrichment and fabrication plants. Criticality

safety analysis of the final deposit is also a major subject of investigation. A proposed regulation is under study for the licensing of burnup credit in transport and repository.

Yasushi Nomura provides some highlights of the criticality safety programme in Japan. The major issues in the near future (2005-2006) will be the commissioning of the Rokasho reprocessing plant and the licensing of a MOX fabrication plant. A third revision of the Criticality Safety Handbook is expected to be published in the next 2 or 3 years. Planned experimental activities concerns heterogeneous configurations for the simulation of the dissolver configurations and plutonium experiments. The experimental data of plutonium will be used for the criticality safety review of the MOX fuel fabrication plant. Yasushi Nomura also mentioned that a process has started to unify JAERI and JNC. This process will be achieved in 2005.

Klaus Schneider announced the organisation of an IAEA workshop on the storage of spent fuel from commercial reactors. This workshop will be held in Vienna from 2 to 6 June 2003. Information on the workshop will be sent to the working party members.

#### **8. Date and place of the next meeting**

The next meeting will be held in Japan in conjunction with the ICNC'2003 conference. The local hosts and the NEA secretariat will study several options for the venue. The week 13-17 October 2003 has been tentatively selected.

#### **9. Election of chairman**

Yasushi Nomura announced his intention to retire from JAERI in the coming year. Consequently, he informed the participants that he will step-down from his position as WPNCS Chairman. After consultation with the Working Party members, Blair Briggs was proposed as the new chairman. This proposal will be submitted for approval to the Nuclear Science Committee.

**Annex 1**

Nuclear Science Committee  
Sixth Meeting of the Working Party on Nuclear Criticality Safety

Thursday, September 12 2002, starting at 9:00 a.m.  
NEA headquarters  
Issy-les-Moulineaux, 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
  - a. ICSBEP (B. Briggs)
  - b. Burnup Credit (M. Brady Raap)
  - c. Minimum Critical Values (W-J. Weber)
  - d. Criticality Accidents (C. De Oliveira)
  - e. Source Convergence Analysis (R. Blomquist)
  - f. Experimental Needs (P. Cousinou)
5. Discussion of possible new programs of work for the following Expert Groups:
  - a. Burnup Credit
  - b. Minimum Critical Values
  - c. Experimental Needs
  - d. Other proposals
6. International Conference on Nuclear Criticality Safety (ICNC series)
  - a. Status of ICNC'2003 (Y. Nomura)
  - b. Proposals for ICNC'2007
7. Nuclear Criticality Safety National Programs.
8. Date and place of the next meeting

**Appendix 2**

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