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**NUCLEAR ENERGY AGENCY
NUCLEAR SCIENCE COMMITTEE**

**NEA/SEN/NSC/WPNCS(2007)2
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Working Party on Nuclear Criticality Safety (WPNCS)

SUMMARY RECORD OF THE ELEVENTH MEETING

**31 August 2007
NEA Headquarters, Issy-les-Moulineaux, France**

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**Summary Record of the Eleventh Meeting of the
NEA Nuclear Science Committee
Working Party on Nuclear Criticality Safety (WPNCS)**

31 August, 2007
NEA Headquarters, Issy-les-Moulineaux, France

SUMMARY RECORD

1. Introduction

The WPNCS chair, Gulliford, opened the meeting and welcomed the delegates. Twenty-two delegates attended the meeting (see the list of participants in Annex 1).

2. Review of actions from the previous meeting

BUC/Phase II-C report has been reviewed by Gulliford and a final version that includes reviewers' comments is under preparation. The Chair thanked all participants for their contribution to the review process of ICNC2007 papers and acknowledged the success of the conference. He informed the delegates that the members of the Nuclear Science Committee had noted that the conference was well-organised.

3. Approval of the summary record

The Summary Record of the previous meeting (NEA/SEN/NCS/WPNCS(2006)1) was approved without modification.

4. Feedback from the Nuclear Science Committee (NSC) meeting

During the last NSC meeting (14 to 15 June 2007), Gulliford presented the progress of the Working Party and its Expert Groups. Publication of the ICSBEP 2007 Handbook and reports from the different Expert Groups were announced for the end of 2007. The outcome of the ICNC2007 conference was also reported.

5. ISO standards

Mennerdahl gave a brief overview of the progress which on-going projects are making and noticed that in some, participation is too limited. He encouraged WPNCS members to contribute more.

6. Nuclear Criticality Safety National Programmes (Belgium, Czech Republic, Finland, France, Germany, Japan, Korea, Slovakia, Sweden, Switzerland, UK, USA) and International Organisations

Belgium

Baeten provided a brief report on criticality safety activities in Belgium. He announced the completion of the REBUS project's experimental data. In 2006, SCK-CEN decided to change the VENUS reactor into a zero-power, fast, lead reactor coupled to a 14 MeV accelerator. This is known as the GUINEVERE-project. The GUINEVERE-project is part of the FP6 IP-EUROTRANS project for the study of ADS systems for P&T. The objective of the GUINEVERE-project is to validate the methodology for sub-criticality monitoring in ADS.

Czech Republic

Markova informed the Working Party that the Czech Republic closed tender for two new NPP units at the Temelin site. Two important projects have recently been launched regarding the construction and commissioning of New Generation NPPs and on the research of methods and technologies in spent fuel management. With regard to the preparation of post-irradiation experiments, in collaboration with other OECD member countries, more information would be given under item 10 of the agenda.

Finland

Ranta-Aho reported on criticality safety related activities in Finland. At present, intermediate storage at Loviisa and Olkiluoto is not expected to be implanted because of their current plans to extend capacity. However, the first analyses for the final disposal facility in Olkiluoto prompted recommendations for the use of BUC. The MCNPLINK code system has been developed to perform criticality safety analysis and the MCNP and ORIGEN 2 codes (ABURN) have been coupled to perform burn-up calculations. A new continuous Monte Carlo code, PSG, has been developed in Finland and its coupling with ORIGEN2 could speed up calculations.

Ranta-Aho added that Finland participates in the VVER-PIE consortium and, as such, obtains new experimental VVER-440 spent fuel data to promote burn-up code validation.

France

Cousinou from IRSN and Santamarina from CEA presented the French national program. The fuel cycle industry progress report was summarised, stressing that the La Hague plant, a spent fuel reprocessing facility, will apply BUC and that the uranium enrichment facility Georges Besse II is under construction.

Cousinou provided some details about the last campaign of measurement at the criticality CEA/Valduc&IRSN facility related to temperature effect in low concentrated Pu solutions and future critical experiments related to the study of non-fissile materials (concrete, iron, copper,...). The activities on criticality code development and validation were briefly summarised and comprised the continued development of the CRISTAL code and the improvement of the validation data base.

Germany

Neuber informed participants about the nuclear energy programme in Germany. The standard DIN ("Deutsches Institut für Normung") 25712 for BUC applications to transport and dry storage was published in July 2007 and, on the same date, the draft of the revised version of the BUC DIN Standard 25471 was presented to the public. For the last standard, changes made to the 2000 version included rearranging the text and the chapters to reach compliance with the newly developed standard DIN 25712. The German criticality safety working group has prepared a preliminary study on the application of BUC to the pre-closure and post-closure phase of a final disposal. The safety requirements for the pre-closure phase are standard. They are based on the design basis event (DBE) methodology and the application of the double-contingency principle. The draft for the post-closure phase includes the application of risk-informed approaches. Neuber added that a first actinide-only BUC application to a dry storage cask (CASTOR cask) has recently been approved.

Kilger summarised the main activities of GRS in the criticality safety area. The GRS team performed significant improvements to and proceeded with the relevant validation of codes for burn-up credit applications. Actions have been taken regarding the criticality analyses for the post-closure phase of a repository for spent fuel.

Japan

Miyoshi reported on the current activities of Nuclear Criticality Safety in JAEA. The activities of the department responsible for criticality safety were presented by Miyoshi. Emphasis was given to the Rokkasho reprocessing plant (RRP) currently in the forth stage of hot testing using spent fuels in order to be commercially operable in 2008 and the safety review of the MOX fabrication plant JMOX is on-going. Concerning criticality safety experiments using STACY, detailed evaluation (to be included in ICSBEP) has been performed for critical experiments on the reactivity effects of fission products in the heterogeneous core composed of low enriched UO₂ fuel rods and uranyl nitrate solution.

Miyoshi added that Japan is planning to accumulate systematic data on transient criticality experiments by TRACY into the database for validating the kinetic codes. This database will include not only kinetic data, but also the spatial distribution data of neutron and gamma rays for validating the dose evaluation codes. Another project recently initiated involved criticality analyses concerning the long-term storage or direct disposal of spent fuels.

Miyoshi concluded his presentation affirming the development of advanced technology for the nuclear fuel cycle. Japanese experts on criticality safety promote the study on increasing the initial enrichment of U235 beyond 5wt% to enhance the fuel burn-up.

Korea

Park informed the participants of the plans to use Burn-up credit for the design of the cask storage in Korea.

Slovakia

Chrapciak presented the status of the Slovakian nuclear Criticality Safety Program and the completion of the safety report for transport of spent fuel with a short cooling time (<2 years). The methodology developed by VUJE company and the Nuclear Regulatory Authority in Slovakia has been completed along with the validation of SCALE 5.0 for criticality and inventory calculations. The application of the developed methodology on wet and dry storage is in progress as is the validation of the latest version of the SCALE code, SCALE 5.1. Slovakian participation in the PIE measurements for VVER reactor will be reported under item 9 of the agenda.

Sweden

Mennerdahl reported on the main developments in Sweden. The compilation of references made in 2005 to support the licensing review of burn-up credit and burnable absorber credit applications have been provided to the BUC EG. Mennerdahl added that Sweden is contributing actively to the new EG on Assay Data for Spent Nuclear Fuel.

Switzerland

Vasiliev presented the new methods developed at PSI for criticality safety. These new methods will use Monte Carlo transport codes (MCNP) and are planned to replace the previous deterministic approach. The assessment has been performed for benchmarks similar to designs of LWR spent fuel storages and transport casks (dry and wet), including configurations with MOX fuel rods. The benchmark suite comprised as much as 149 cases. The analysis includes calculations of K_{eff} and spectrum-related parameters defined in the ICSBEP Handbook. The applicability of the new methodology and its validation basis for BWR fuel will be investigated further (Gd-credit).

UK

Gulliford informed participants that in the UK, the national (and international) activities are co-ordinated through the UK Working Party on Criticality (WPC). A new sub-group on Burn-up Credit and the reviewing and compilation of critical experimental data have been proposed as future activities for the WPC.

Recent developments in computer codes (MONK, WIMS...etc.) were briefly detailed as well as the activities related to knowledge preservation in the UK. In addition, Gulliford highlighted their contribution to the following international organisations: ISO, NEA (NSC/WPNCS), IAEA and ANS standards groups.

USA

Briggs presented the Nuclear Criticality Safety Program (DOE/NCSP) in the USA. Blair described the status of the experimental facilities in USA, pointing out the development of a new experimental facility in Nevada by the Los Alamos and Livermore National Laboratories and the recent interest in restoring the ZPPR at Idaho NL. He also stressed that significant progress has been made on covariance files for the actinide evaluations and Oak Ridge NL has completed a comprehensive low-fidelity covariance library for testing sensitivity/uncertainty methodology.

Briggs informed participants about projected criticality safety data needs for the Global Nuclear Energy Partnership (GNEP) Advanced Fuel Cycles. Increased efficiency and more precise safety margins are needed. When considering the Actinide Burner Reactor Fuel Reprocessing, including fabrication, handling, storage and transportation, more precise thermal and resonance data are needed for the fissile and high-energy fissionable minor actinides. Thermal and intermediate energy range data are needed for those elements involved in reprocessing working fluids and for structural and shielding materials.

Barto added that 3 groups of projects of interest for criticality safety practitioners are on-going at NRC: Spent Nuclear Fuel Storage and Transportation (it includes BUC for actinides and the application to fission products is under study); fuel cycle facilities (the MOX facility license is under review and actions to support DOE efforts regarding initiation to GNEP) and on High Level Waste (Yucca Mountain repository license and use of BUC for post-closure criticality safety analyses)

IAEA

Waernecke informed participants of the activities on criticality safety at the IAEA. Three departments are involved in the work on criticality safety: Nuclear Science and Applications (NA), Nuclear Energy (NE) and Nuclear Safety and Security (NS). Specific assistance can be provided upon request, including assistance through technical co-operation projects. The IAEA assists Eastern European countries by holding workshops on criticality safety/burn-up credit. Waernecke concluded that the IAEA plans to organise a BUC Technical Meeting in 2008 or 2009 and the location and final dates will be communicated shortly.

7. Reports from the WPNCS Expert Groups

- *Burnup Credit (Brady Raap)***

Brady Raap reported on the outcome of the last meeting of the BUC Expert Group. The Expert Group met on 29 August 2007.

The Phase II-D report was published and distributed at the end of 2006.

The publication of the summary report on the activities of the Expert Group was delayed; the participants decided on a new deadline: the end of January 2008. The draft versions of three of the five

main chapters are already available for review. However, the chapters from the activities related to PWRs and BWRs have not yet been drafted.

The progress of the Phase II-E report, which looks at the effect of the partial insertion of control rods during irradiation, was presented by Neuber. A new extension of the deadline to receive more contributions has been fixed: the end of November 2007.

Preliminary results from the new benchmark to study the results of the data available from the ISTC2670 project were presented during the last BUC meeting.

Brady Raap informed participants that the BUC Expert Group launched a new exercise to study the performance of the depletion calculation codes for long-term geological disposal applications. She added that this proposal received a lot of interest from participants and good progress is expected.

- ***Source Convergence (Blomquist)***

Blomquist outlined the main progress achieved by the Expert Group on Source Convergence. The report of Phase I was completed and distributed in October 2006.

The outline of a guideline report on Nuclear Criticality Safety and Source Convergence was completed by the main contributors.

Experts from IRSN had proposed an updated version of the exercise presented at the 2006 meeting to test the statistical methods used by the different codes to estimate source convergence.

- ***Criticality Excursion (Miyoshi)***

Miyoshi informed the Working Party that the final draft for the Phase I report has been distributed for review among WP members. The publication schedule was determined as follows: first, working party members will provide comments to the current version before the end of September 2007; by the end of October 2007 a reviewed version including comments from the WP members would be distributed for a second review and a final version would be sent for formatting to the NEA before the end of 2007.

Miyoshi summarised the outcomes from the last meeting. Results from the benchmark Phase II were presented by Yamane and several participants showed interested in joining this activity. The specifications for the exercise proposed by the French delegates to study the effect of the approximations made by code users on the description of the geometry were introduced and the list of participants established.

- ***Assay Data for Spent Nuclear Fuel (Rugama)***

Rugama reported on the outcome of the kick-off meeting and on the first meeting of the Assay Data for Spent Nuclear Fuel EG. The group is composed of experts from experimental hot cell facilities, radioactive waste management and reactor physics; as well as criticality safety practitioners.

This expert group will focus on issues concerning the isotopic composition data from spent nuclear fuels, especially for light water reactors such as PWR, BWR and VVER. The main activities of the expert group will be the publication of the state-of-the art report for the assay data of nuclear spent fuel and the updating of the SFCOMPO structure and data. Rugama added that participants have compiled data from recent projects on Assay Data from MOX spent fuel (ARIANE) and a new and more comprehensive format for the SFCOMPO DB has been established.

8. Status of the ICSBEP (Briggs)

Briggs described the activities of the International Criticality Safety Benchmark Evaluation Project (ICSBEP). The September 2007 issue of the handbook contains evaluations of 464 experimental series, containing 4092 critical and sub-critical experiments. Three Criticality-Alarm/Shielding Benchmarks, covering 21 configurations, with each configuration containing numerous dose points, and three Fundamental Physics Benchmarks with numerous fission rates measurements are included in the 2007 edition.

9. Experimental needs

- PIE data needs – Status Report (Markova, Chrapciak)

Chrapciak informed members that the funding problems for the VVER PIE measurements project have been resolved and the proposal for the experimental phase is under preparation. He added the data will be available via SFCOMPO once a comprehensive analysis of the data is performed.

10. ICNC conferences (Technical Program)

Gulliford and Rugama thanked the WPNCS members for their contribution to the successful organisation of the ICNC 2007. Gulliford added that the UK has established a working group to prepare the venue for the ICNC 2011.

11. Perspectives and future activities

- Workshop on Needs of Research on Nuclear Criticality Safety for future nuclear systems. The proposal to organise a workshop in 2008 on Nuclear Criticality Safety for future nuclear systems: advanced reactors, advanced fuel cycles, etc. was discussed. The participants agreed that before taking any decision they would like to discuss the interest, content and the possibility of contributing as local organisers within their organisations. Rugama will distribute complementary information and collect comments and proposals on the content of the workshop and has offered to organise the workshop.
- Proposal for setting up an Expert Group on Uncertainty Analysis for Criticality Safety Assessment in OECD/NEA/NSC/WPNCS

Ivanova presented the proposal for setting up an Expert Group on Uncertainty Analysis for Criticality Safety Assessment. The draft proposal was extensively discussed during the meeting and the objectives were defined. The group was very enthusiastic about the proposal and a preliminary list of participants was prepared. It was decided that the kick-off meeting would take place before the end of the year; the mandate will be drafted at the meeting. Ivanova and Rugama will coordinate the organisation of the kick off meeting.

12. Date and place of the next meeting

The chair suggested that the next meeting of the Working Party be organised together with the workshop discussed under item 10 of the agenda. Decisions regarding date and place will be made based on the organisation of the workshop. However, Rugama will investigate the possibility of reserving a meeting room at the NEA facilities on 29 August 2008.

Annex 1**WPNCs-07 (WPNCs meeting 2007)**

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Annex 2
LIST OF ACTIONS

Action number	Action holders	Description of the action	Due dates
Wpncs-2007.1	All	Send proposals for the organisation of a workshop on criticality safety 2007	End of 2007
Wpncs-2007.2	All participants	Participate in the review and send comments on the Phase I report on criticality excursions analyses	End September 2007
Wpncs-2007.3	Miyoshi	Add comments to the first draft of the Phase I report on criticality excursions and distribute the second draft of the Phase I report	End October 2007
Wpncs-2007-4	Ivanova and Rugama	Organise kick off meeting for the new EG on Uncertainty analyses for criticality safety assessment	Before end 2007

Annexe 3

ORGANISATION FOR ECONOMIC COOPERATION AND DEVELOPMENT

Nuclear Energy Agency / Nuclear Science Committee Eleventh Meeting of the Working Party on Nuclear Criticality Safety

Friday, August 31 2007, starting at 9:30 a.m.

NEA Headquarters, Issy-les-Moulineaux, France

PROPOSED AGENDA

- 1) Welcome and Administrative Items
- 2) Review of actions from the previous meetings (Y. Rugama)
- 3) Approval of the summary records of the previous meeting
- 4) Feedback from the Nuclear Science Committee meeting (J. Gulliford)
- 5) ISO standards
- 6) Nuclear Criticality Safety National Programmes (Belgium, Czech Republic, France, Germany, Hungary, Japan, Korea, Slovakia, Sweden, Switzerland ,UK, USA,..) and IAEA activities
- 7) Reports from the WPNCS Expert Groups
 - Burnup Credit (M. Brady Rapp)
 - Source Convergence (R. Blomquist)
 - Criticality Excursions (Y. Miyoshi)
 - Assay Data for Spent Nuclear Fuel (Y. Rugama)
- 8) Status of the ICSBEP (B. Briggs)
- 9) Experimental needs
 - PIE data needs
 - Other needs
- 10) ICNC conferences
 - ICNC 2007 Feedbacks and comments
- 11) Perspectives and future activities
 - Workshop on Needs of Research on Nuclear Criticality Safety for future nuclear systems
 - Proposal for setting up an Expert Group on Uncertainty Analysis for Criticality Safety Assessment in OECD/NEA/NSC/WPNCS
- 12) Date and place of the next meeting