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Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 02-Oct-1997
Dist. : 03-Oct-1997

Or. Eng.

NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY

NEA/SEN/NSC/WPNCS(97)3
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Working Party on Nuclear Criticality Safety (WPNCS)

SUMMARY OF THE FIRST MEETING OF THE WORKING PARTY ON NUCLEAR CRITICALITY SAFETY

11 July 1997
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SUMMARY OF THE FIRST WPNCS MEETING

1. Introduction, announcements, participants

The meeting was opened by Yasushi Nomura, Japan, who had been designated by the NSC Bureau as the first chairman of the Working Party.

The list of participants is provided as Annex 1. Apologies were received from some delegates for not being able to attend this time.

2. Review and approval of the agenda

The agenda was approved with the only change consisting of presenting the National Programmes and priorities in criticality safety before the reports of the groups and in connection with the discussion of scope and objectives.

3. Review of scope and objectives

The scope and objectives were reviewed. A few amendments were proposed such as extension not only to experiments on subcritical but also supercritical systems; another topic concerns the technical basis for standards. The Scope and Objectives including these two extensions are enclosed as Annex 2.

4. Summary of NSC discussion on Nuclear Criticality Safety Programme

The Secretariat informed the WP of the discussions concerning criticality safety held at the last NSC meeting (9-11 June 1997), in particular on the status of the work carried out on burn-up credit and the International Criticality Safety Benchmark Experiments Project (ICSBEP).

The NSC took note of the progress achieved and approved the continuation of the programme in these two areas.

It noted that in recent years an increased interest in criticality safety issues had emerged covering a scope difficult to be dealt with completely at a technical level by a single experts' group. It had therefore endorsed that a Working Party on Nuclear Criticality Safety (WPNCS) be established. The WPNCS should provide guidance to NSC and co-ordinate these activities. When necessary, the WPNCS should delegate more specific technical work to Task groups.

It then asked that the newly formed Working Party on Nuclear Criticality Safety set as first objectives:

- To define the working method.
- To propose to the NSC a work programme for 1998-2000.
- To define priorities based on criticality safety issues that are of common interest and importance to Member countries.

The Working Party should provide experts' view on sound technical approaches to criticality safety, to facilitate harmonisation of such approaches and to provide recommendations as to where action is most needed that would benefit from international co-operation.

A paper summarising all activities carried out within the NSC scope was distributed; this paper shows that criticality safety holds an eminent place among those activities (see *List of Papers*, W.04).

5. National programmes, priorities in criticality safety

Under this item, country representative have expressed the specific interest in the different criticality topics, presented the work being carried out including the experimental programme. Several have provided a summary paper (listed in an annex).

Germany (B. Gmal)

- No criticality experiments are carried out in Germany as there are no such facilities.
- There is interest in burn-up credit for storage and transportation of spent fuel; effort concentrates in convincing the organisations concerned of its economical interest.
- Concerning standards and minimal critical masses they have a specific group in Germany addressing these issues. The role of WPNCS is seen one of assessing safety margins, to establish a common base of minimum critical masses, to validate the codes. In particular there is interest in criticality of fuels with enrichments ranging from 5-8%.
- There is also interest in issues concerned with criticality accidents and incidents in the fuel cycle.

Belgium (T. Maldague)

Present work concentrates on:

- Water pool spent fuel storage with borated steel.
- Long term storage as a function of time, in particular dry storage and underground storage.
- Critical masses and k_{eff} calculations for MOX fuels.
- Validation of code systems are based on open literature experiments and benchmarks as well as experiments carried out in the VENUS facility and within the REBUS international programme (both including MOX).

Future effort will be devoted in addition to:

- Critical masses of actinides (Pu, Np, Am, Cm); in particular the issue of fast system reactivity such as void effects in MOX lattices(dry and wet, Pu content up to 14%).
- Degradation of structural materials (ageing and temperature effects on concrete and hydrogen carrying materials).

Czech Republic (L. Marková)

The criticality issues of major interest are the following:

- Validation of relevant codes and data libraries for VVER environment. This includes extension of non-VVER specific codes to include their specific requirements, burn-up credit benchmarking for an interim storage container, burn-up credit experiments (REBUS) in the LR-0 reactor, VVER-440 fuel assay with well defined irradiation history (good records are rare).

- Evaluation of safety margins for spent VVER-440 fuel systems including re-assessment of the Dukovany storage in connection with advanced (higher enrichment, radial enrichment profiles) VVER fuels, and geological repositories of spent fuel.

- Criticality safety studies in support of ADT (Accelerator Driven Transmuter) systems.

France (P. Cousinou and A. Santamarina)

The French criticality programme is carried out in support of the fuel cycle industry, transportation and waste management and safety assessment and regulation. The main activities are as follows:

- Development of a new code system “CRISTAL”, which will undergo extended validation using an on-line database and will include a user friendly interface providing standard procedures (a separate paper describes the details). Main efforts go into benchmarking for PWRs and MOX, but also on BWR fuels for reprocessing purposes. Validation for intermediate energy spectra, benchmarking for minor actinides in particular Am-242 and Cm-244 and Cm-245 are planned.

- Extended implementation of burn-up for spent fuels, improvement of burn-up measurements in the facilities.

- Critical experiments (Valduc and Cadarache) using fission products, dissolution media and structural materials. It is envisaged to carry out experiments on low moderated, damp MOX. Future experiments will be devoted to validation of burn-up credit, oscillation measurements of reactivity worth for MOX and BWR spent fuel and later actinides reactivity worth.

- Revision of “standards” and minimum critical values emphasis will be given to various reflectors, the review of the density formula for nitride solutions and on MOX.

- Study of accidents in heterogeneous media: pellets, rods, fuel assemblies.

- Training (handbooks and knowledge database).

Japan (Y. Nomura, Y. Naito)

In Japan there is a limited intermediate storage space for spent fuel, and reprocessing at the Rokkasho plant will not be available before 2003/4, therefore there is a particular interest in burn-up credit. Other topics of great interest are:

- Subcritical experiments.

- Minimum critical masses.

- Criticality accidents and supercritical experiments, in particular the TRACY facility (transient analysis) provides experimental data to establish analytical methods for analysing critical accidents which can be made available.

- Criticality of major and minor actinides (including Np) for safeguards and waste management issues.

- Critical experiments in the STACY facility using 10% enriched uranyl nitrate solutions, measurements of temperature effects, reflector effects of structural materials. Programmes in the future will concentrate on neutron interaction effects and simulation of a dissolver process. Experiments with plutonium solutions are also planned, in particular with high Pu-240 content.

Spain (A. Alvarez – presented during the burn-up credit meeting)

Among the issues of great interest are:

- Burn-up credit mostly for storage pools; interest is growing on applying it to shipping casks.

- Minimal critical values are of importance for licensing purposes.

- There is some interest in MOX issues but is not a priority for Spain now.

Sweden (D. Mennerdahl)

The interest mainly regards:

- Basic “criticality safety physics”, including aspects of optimal distributions of fissile material in a single unit and of optimal configurations of different units with fissile material (mixed arrays).

- Better methods for criticality safety assessment (a calculation code system is only one of the ingredients). In particular influences of moderation, reflection and of neutron-scattering influcences of non-fissile nuclides mixed with fissile nuclides. Approximations in general methods often need better justifications.

- Issues related to the final disposal of irradiated fuel assemblies, including burn-up credit.

- Future needs may involve fuel with enrichments from 5-8% and MOX fuel. International exchange within the OECD/NEA, ANS and the European Union. Computer codes and data. Further development and support is important. More than one code system may be needed by a single reviewer for independent checks. More automatic parameter searches requested (including material compositions, densities and concentrations). Validation of complicated cases (including loosely-coupled systems).

- Experiments; no specific needs are expressed. Critical and subcritical experiments are valuable in many ways. Further, reactivity experiments and in some cases neutron shielding experiments are useful for testing certain capabilities of a code system for criticality safety analysis.

- A compilation of “commonly made mistakes” is envisaged.

UK (R. Bowden, N.T. Gulliford, J. Stewart)

The work programme and issues of importance are discussed within the UK Working Party on Criticality (UK WPC). The issues identified are as follows:

- Safe limits for LEU (0.71 - 1% enrichment).
- Criticality in intermediate spectra (e.g. wet/damp powders).
- Burn-up credit (axial effects, BWR & MOX fuels) and burn-up verification measurements.
- Criticality data handbook (extension of scope, new calculations/experiments).
- Plant accumulations (control and monitoring techniques, subcritical measurements/monitoring).
- Monte Carlo methods (settling, sampling, sensitivity, case categorisation).
- Decommissioning (general criticality principles, fissile assay techniques, subcritcal measurement and monitoring)
- Waste repository issues (worst case scenarios, probabilistic methods).
- Subcritical monitoring.
- Criticality safety criteria (suitable k_{eff}, use of physical parameters to express safe margins rather than k_{eff}).
- Treatment of calculation bias (credit for overprediction).
- MOX fabrication (dry and humid powders), MOX recycling (isotopic compositions for criticality assessment).
- Training and accreditation for criticality assessors.
- Probabilistic criticality assessment (suitability, criteria, combination of probabilistic with deterministic approach).
- Emergency planning – criticality and operational safety, medical treatment after irradiation, alarm systems, risk, likely consequences and frequency.
- Experiments database (experimental needs).

There is a lack of experimental critical facilities in the UK. There is still one but it is used exclusively by one company, although it could be used more widely if required. Therefore work is carried out in co-operation with other countries such as in the CERES and ARIANE programmes. Experiments will be carried out at BNFL when dissolving MOX in THORP (chemical analysis has been added), but these will have commercial restriction first; a more open collaboration is envisaged because this has shown clear benefits, e.g. ICSBEP has been very useful for validation of MONK and JEF based data libraries and there is support for it by nuclear industry.

USA (M. Brady, J.B. Briggs, E. Fujita, M. Westfall, C. Withee)

The interest in the USA can be divided into two broad areas:

- Nuclear criticality predictability.
  - Experimental needs – efforts to fill the needs.
  - Codes and methods (capability maintenance, improvements, range of applicability, training).
  - Basic nuclear data (generation and validation: criticality safety specific needs).
  - Integral experiments (ability to predict criticality), benchmark evaluation.
- Applications and facility safety.
  - Burn-up credit.
  - Fuel cycle criticality safety.
  - Technical basis for standards.
  - Accidents (analysis/characterisation, dosimetry, alarms).
  - Training.

Concern was expressed on the decrease of the number of critical facilities; the ones existing should be maintained; there are specific experimental needs for fuel in the enrichment range 5-10% and criticality in an environment with epithermal spectrum is of particular concern.

There is a limited application of burn-up credit in spent fuel storage pools at some PWR plants. Burn-up credit has been allowed for the analysis of a hypothetical accident when the boron poisoning in the pool disappears by precipitation, dilution or some other means. In dry storage casks at one or two reactors, burn-up credit is needed to show criticality safety if the cask is accidentally flooded with pure water when the case is prepared for unloading. Special operational controls are required to guard against this type of accident. A range of applicability study is trying to develop analytical tools to determine the criticality code bias if calculations are extrapolated beyond the current experimental benchmark base. One specific problem is industry's desire to use the codes for the uranium enrichment range of 5-10% where little experimental benchmark data exists. There is a project to modify AMPX to process basic neutron cross-section data as an alternative check on NJOY which is the only computer code now that can handle ENDF/B-VI data.

For the civilian radioactive waste programme the criticality issues of relevance are:

- Criticality safety for repository – probabilistic approaches are used.
- Parameters of interest concern the consequence of source term – environment interaction in particular coupling with chemistry. MCNP with a special purpose data library for waste management based on ENDF/B-VI has been constructed.

- Appropriateness of data – extrapolability.
- Reactor restart critical data can be used as benchmark data; validation is a key issue.

EC (J.P. Lehmann)

In view of the deregulation in the EU of energy systems at large efforts go towards keeping the nuclear sector competitive; effort is thus devoted to increased enrichment and higher burn-up for UOX and MOX. Issues of concern are reduction of the stockpiles of separated plutonium, decommissioning of NPP, spent fuel and waste management. All this requires enhanced safety in particular establishing criticality safety margins for fabrication, transportation, storage, processing and disposal of spent fuel. It is expected that different directorates of the EC will show interest in the work of the group.

IAEA (H.P. Dyck)

The Section on Nuclear Fuel Cycle Materials of the IAEA is interested in spent fuel storage and management and in burn-up credit issues related to storage. They plan to prepare a technical document on the evaluation and review of the implementation of burn-up credit in spent fuel management systems. It was clearly stated that any duplication of the OECD/NEA will be avoided.

6. Report from groups

a) Burn-up Credit Benchmarks

M.C. Brady, Chairman, summarised the results of the meeting held on this topic over the previous two days. The summary of that meeting is the subject of a separate document, which can be found under NEA/SEN/NSC/WPNCS(97)4.

b) ICSBEP

J.B. Briggs reported on the status and future programme of the ICSBE Project. Seven countries participate at present in the project (France, Hungary, Japan, Republic of Korea, Russian Federation, United Kingdom and the United States (9 laboratories).

Two issues (1995 and 1996 editions) of the “Handbook” have been released both in hard copy and on CD-ROM. Future issues will be available on CD-ROM only, but paper versions or updates can be printed directly from the CD-ROM. The next issue is planned for September 1997 with a total of 178 evaluations. The largest contributions come from the USA (83) and the Russian Federation (76). In all the present work concerns 1532 configurations of which 1336 have been approved.

These are subdivided as follows:

Category	Configurations
Total Plutonium Systems	285/433
Total Highly Enriched Uranium Systems	471/515
Total Intermediate or Mixed Enrichment Uranium S.	44/45
Total Low Enriched Uranium Systems	410/410
Total U-233 Systems	16/16
Total Mixed Uranium-Plutonium Systems	107/110
Total Special Metal Systems	3/3
Total	1336/1532

Future work will concentrate on the enrichment range 5-10% and several evaluations in that range will be available from Russia. Submissions from STACY are forthcoming as are some data from MOX lattices. The next meeting will be held in Albuquerque, NM this fall.

At the last meeting possible extensions for the future were discussed:

- Subcritical experiments:
  - ICSBEP provides publication media but a slight format adaptation is required. It will be published as a separate volume.
  - The evaluation will not be carried out by the present group because it requires a different expertise; a separate task should be formed but some manpower could be offered.
- Physics benchmarks:
  - Also for these a separate volume is planned. It includes experiments relevant for criticality but does not necessarily concern a criticality experiments. One example is the NBS water sphere in which a californium source is placed. It concerns slowing down of neutrons and at present a discrepancy of 7% is found in the calculation of the capture rate.
  - It will include reactor experiments useful for criticality programmes.
- Replacement measurements will be stored in the volume of special isotopes.

7. Programme of work and priorities for 1998-2000

The discussions after these presentations concentrated on what issues are most important to member countries, how many of these can be handled at a technical level at any one time and how the Working Party should work.

- Minimal Critical Masses

  It was noted that besides the great interest in BUC and ICSBEP there is a great interest in Minimal Critical Masses. Several efforts are in progress in different countries. The work by D. Clayton, N. Pruvost and C. Rombough from the USA on "Criticality and Fissionability Properties of Selected Actinide Nuclides" has been noted particularly; it will be released this fall. A common technical basis for national and international programmes should be formed in support of establishing a standard.

  B. Gmal, agreed to be the co-ordinator of this activity. He will contact within four months the interested members and try to define scope and objectives of a specific task group, and establish a work programme for the next few years. Should this meet a large interest, a first meeting of the task would be held in conjunction with the WP meeting. Should the interest be only moderate the matter will then be discussed at the Working Party meetings.

- Experimental Needs

  Experimental needs as seen by the different nuclear programmes have been expressed by the different members. It was felt that a specific action would be required to co-ordinate work in this area as expressed also at the Specialists' Meeting on "Experimental Needs in Criticality Safety"

held at Albuquerque in 1995. A charter for a specific activity should be developed over the next five months as well as a format for describing needs. The format used for such an objective in the USA may form the basis. P. Cousinou agreed to co-ordinate this activity, assisted by M. Westfall for liaison with the US laboratories. In particular R. Anderson and D. Rutherford from LANL were identified as candidates to play an important role in this. Other countries interested in this are Belgium, Japan and the UK. Input on this subject should be provided to P. Cousinou by the end of 1997.

– Subcritical/Supercritical Experiments

The need for experimental data from subcritical experiments is another topic that has attracted great interest. Preliminary discussions on this have been taken place between Japan (Y. Naito), UK (N.T. Gulliford) and USA (J.B. Briggs). Data from Japan and the UK would be released and would need to be evaluated and placed into an agreed format. This work can be carried out best in connection with the ICSBE Project and the evaluations would be integrated as a separate volume of the "Handbook". Scope and Objectives should be defined by Japan in consultation with members from the UK and USA. A work programme should be established with identification of the effort required. A first proposal should be prepared by mid-November for discussion at the NSC Bureau meeting in December.

– Databases

The access to international databases was discussed. It was agreed that such databases should not be subject to restrictions, except as required by UN sanctions to specific countries or other strong reasons that may be imposed. The easy access should contribute to their wide use and overall usefulness. However, a trace will be kept of those accessing the database with the sole purpose of monitoring their use, to obtain feedback and to make it possible to inform users of detected shortcomings. For the first access a password will be provided. Transfer of the information to a third party will not be allowed for the reasons specified above.

8. Report and recommendations to NSC

This summary will be distributed together with the one of the burn-up credit meeting to the NSC.

Figure 1 enclosed describes a summary of a working scheme and relationships.

It was agreed that there should be limited numbers of working groups active at any one period of time so that the technical activities remain focused. Proposed groups to be formed should be identified and their scope and objectives defined in advance. By mid-October a more clear picture should emerge concerning the real interest and priorities in the countries. A summary of such interest should be prepared for the NSC Bureau to be held next December. In order to facilitate the preparation of the summary, members should provide a list of priority items similarly to the one provided by the UK.

The figure shows also a special link to the WP on International Evaluation Co-operation to ensure that the needs in criticality safety for basic nuclear data are properly taken into account. This will allow also to provide feedback from the use of data to evaluators. N.T. Gulliford was recommended to act as liason with the JEF and WPIEC.

9. Conferences and meetings of relevance to the WPNCS

9.1 PATRAM'98

The presentation of the paper "OECD/NEA Working Party on Nuclear Criticality Safety: Challenge of New Realities" has been accepted for presentation in a lecture session. The Chairman has suggested that the paper be presented by M.C. Brady, who accepted.

9.2 Preparation of ICNC'99

P. Cousinou reported on the progress in organising the next International Conference on Nuclear Criticality. It will be held in Versailles, France from 20-23 September 1999 just before the ANS Topical on Mathematics, Computation and Reactor Physics to be held in Madrid, Spain. The 24 September will be reserved to visits to French fuel cycle facilities.

Members of the WP will be asked to be members of the international organising committee and help in shaping the technical programme.

9.3 Other meetings

The list of meetings of interest to the WP has been distributed and is included as Annex 3.

The call for papers and announcement of the ANS Topical on "Criticality Safety Challenges in the Next Decade", 7-11 September 1997 in Chelan, WA was distributed.

10. Date and place of next meeting

It was agreed to hold the next meeting after the International Conference on Packaging and Transportation of Radioactive Materials, PATRAM'98, namely on 20 May 1997. During 18-19 May the working groups on burn-up credit and minimal critical masses should meet. CEA Cadarache offered to host it. The Working Party recommends to extend an invitation to the Russian Federation to participate in the net meeting. It is expected that specialists could provide a substantial contribution to the work of the WP.

ANNEX 1

List of Participants of the First Meeting of the WPNCS
11 July 1997, Paris

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July 1997

ANNEX 2

OECD/NEA Nuclear Science Committee (NSC)

Working Party on Nuclear Criticality Safety (WPNCS)

SCOPE and OBJECTIVES

Scope

The Working Party will deal with technical away from reactor criticality safety issues relevant to fabrication, transportation, storage and other operations related to the fuel cycle of nuclear materials.

Areas and items of activity include:

- Experiments – critical, subcritical and *supercritical*;
- Experiments databases: critical, subcritical, spent fuel isotopic composition;
- Code and data validation and benchmarking;
- Basic criticality condition data;
- Criticality safety handbooks and *standards*;
- Burn-up credit;
- Criticality accidents;
- Criticality safety of fuel cycle installations;

Objectives

a) Guide, promote and co-ordinate high priority activities of common interest to the international criticality safety community, establish co-operations.

b) Propose to NSC the setting up of specific task forces when needed.

c) Maintain priority list of needs.

d) Promote establishing international databases relevant to nuclear criticality safety.

e) Monitor progress and report to NSC.

f) Publish progress reports.

g) Assist the Steering Committee of the International Conference on Nuclear Criticality Safety (ICNC) series.

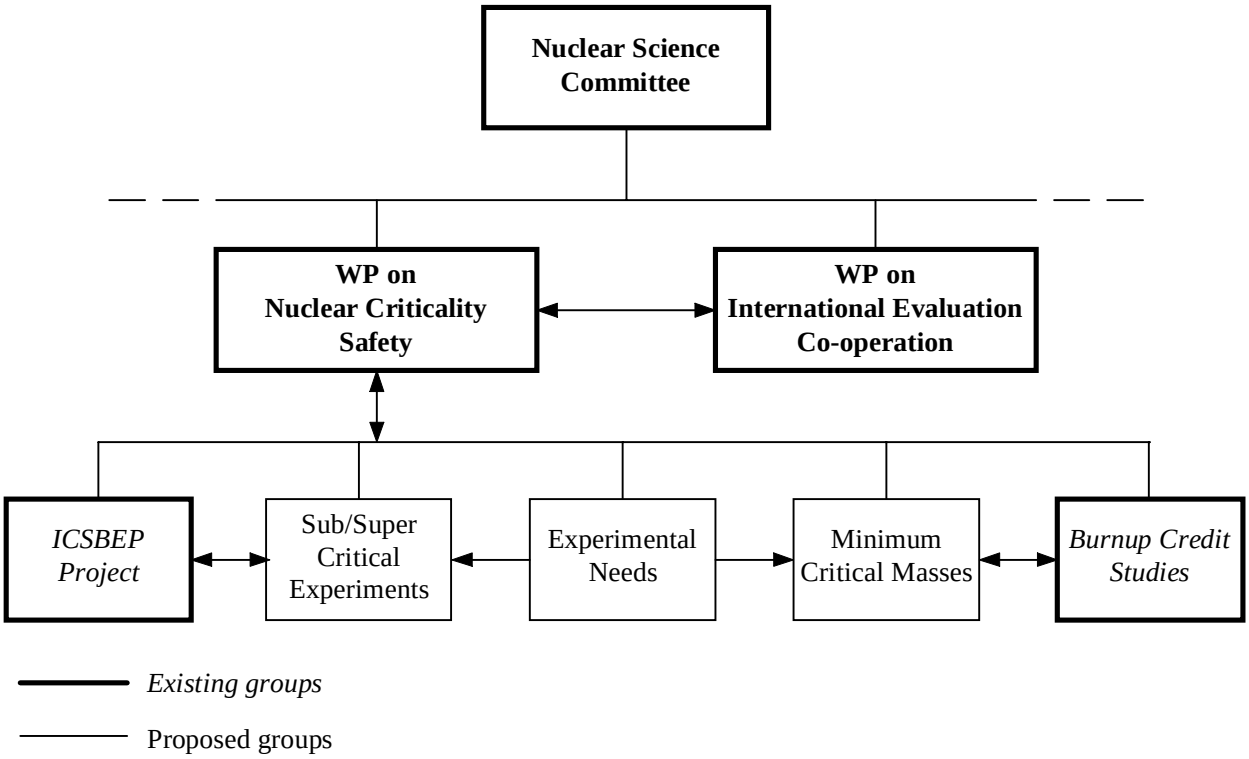
h) Hold an annual meeting.

i) Co-ordinate work with other organisations (e.g. IAEA) and other working groups within NEA, to avoid overlap of activities.

Duration

Three years, with possible extension after revision of scope and objectives.

Figure 1. Existing and proposed working groups and relationships with WPs



Working/Task Groups report to the Working Party, who discusses in addition other topics of relevance to criticality safety such as:

- Criticality accidents(analysis, alarms, dosimetry).
- Databases (needs, developments, monitoring).
- Training and accreditation (exchange of national experience and approaches).
- Technical basis for standards.
- Nuclear data (liaison with WP on International Evaluation Co-operation).
- Codes and methods (Monte Carlo, probabilistic assessments).
- Decommissioning (criticality principles – techniques, monitoring).
- Waste repository issues.

ANNEX 3

Meetings of Interest to the WPNCS

1997

- ANS Topical on Criticality Safety Challenges in the Next Decade, 7-11 September 1997, Chelan WA.
- International Conference "Future Nuclear Systems," GLOBAL'97, Yokohama, Japan, 5-10 Oct. 1997.
- Joint International Conference on "Mathematical Methods and Supercomputing in Nuclear Applications," Saratoga Springs, NY, 6-10 October 1997.
- Training Course on Computing Criticality, Source Term and Shielding of VVER Spent Fuel Transportation Packages, Rez-Prague, Czech Rep., 13-17 October 1997.
- CSNI Topical Meeting on Safety in Intermediate Storage Facilities, Lakeside Hotel, Newby Bridge, Cumbria, UK, 28-30 October 1997.
- ANS Winter Meeting, San Francisco, CA, 16-21 November 1997.

1998

- 12th International Conference on Packaging and Transportation of Radioactive Materials: PATRAM'98, 10-15 May 1998, Paris.
- Topical Conference of the ANS Radiation Protection and Shielding Division, "Technologies for the New Century," Nashville, TN, 19-23 April 1998.
- ANS Summer Meeting, Nashville, TN, 7-12 June 1998.
- ANS Winter Meeting, Washington, DC, 15-20 November 1998.

1999

- ANS Summer Meeting, Boston, MT, 6-11 June 1999.
- International Conference on "Nuclear Criticality Safety" (ICNC'99), Versailles, France, 20-23 September 1999.
- ANS Topical on Mathematical Methods, Computation and Reactor Physics, Madrid, Spain, 27-30 September 1999.
- 9th International Conference on Radiation Shielding (ICRS9), Tsukuba, Japan, 14-19 October 1999.

- ANS Winter Meeting, 14-18 November 1999.

List of Papers

Distributed at the First WPNCS Meeting

11 July 1997

W.01. Agenda

W.02. List of participants (subset of participants in 6th BUC meeting).

W.03. Working Party on Nuclear Criticality Safety - Scope and Objectives (December 1996).

W.04. Status of the NEA NSC Projects and Their Evolution, NEA/SEN/NSC(97)2.

W.05. M.C. Brady, J.B. Briggs, E. Sartori: Nuclear Criticality Safety: A Subject of Growing International Importance, OECD/NEA Newsletter, Spring 1997, Draft.

W.06. J.B. Briggs: The International Criticality Safety Benchmark Evaluation Project.

W.07. BN Criticality Safety Activities.

W.08. French Programs in Criticality (1996-2000).

W.09a. A. Santamarina, N. Thiollay: The French Experimental Programme and Burn-up Credit

W.09b. P. Cousinou: IPSN Valduc Critical Experiments (1997-2001).

W.10. "CRISTAL": New French Codes System for Criticality Studies (1996-2000).

W.11. Recommendation 97-2 to the Secretary of Energy on Criticality Safety, 19 May 1997.

W.12. M. Westfall: US Nuclear Criticality Predictability Program (NCPP) Modelling Codes Element – Objectives/Benefits (viewgraphs).

W.13. D.E. Cabrilla, R.E. Westfall: Meeting the Challenge: Assuring Adequate Criticality Predictability, Pre-print of paper submitted to ANS Topical, Chelan, WA, 7-12 Sept. 1997.

W.14. Contribution of Plutonium Experiments with STACY to Activities for Criticality Safety in OECD/NEA/NSC

W.15. A Brief Summary of Criticality Issues Identified by Members of UK Working Party on Criticality for Discussion at the First Meeting of the OECD/NEA WPNCS.

W.16. L. Marková: Upcoming and Future issues in Criticality Safety in Czech Republic.

W.17. Y. Nomura, M.C. Brady, J.B. Briggs, E. Sartori: OECD/NEA Working Party on Nuclear Criticality Safety; Challenge of New Realities, Abstract submitted to PATRAM'98.

W.18. ANS Topical: Criticality Safety Challenges in the Next Decade, Preliminary Program, Chelan, WA, 7-11 September 1997.

W.19. List of Meetings of Interest.