

SUMMARY OF ICNC '95

The Fifth International Conference on Nuclear Criticality Safety
Albuquerque, New Mexico USA
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C. V. Parks and G. E. Whitesides
Oak Ridge National Laboratory*
Oak Ridge, Tennessee USA

Introduction

We have now closed what, by almost any measure, is the most successful meeting in the ICNC series. The technical attendees numbered almost 300, there were 145 technical papers presented, and a record number of countries were represented at the conference. The authors agreed to prepare a summary of the conference that would provide a record of the highlights and impressions that may not be conveyed in the conference proceedings. To aid in this process, several attendees were asked to provide comments that summarized their impressions of the conference. Those who provided input were the following:

Japan	Yasushi Nomura, JAERI Yoshihiro Yamane, Nagoya University
France	Patrick Cousinou, IPSN Francis Barbry, IPSN
Spain	Jose M. Conde, CSN
OECD-NEA	Enrico Sartori
Germany	Hans Schweer, BfS Wolf Weber, GRS
Russia	Nikolai Kukharkin, Kurchatov Institute Boris Ryazanov, IPPE-Obninsk Vladimir Yuferev, VNIIEF-Arzamas-16 Albert Vasilyev, VNIITF-Chelyabinsk
United Kingdom	Stephen Walls, BNFL-Sellafield Peter Thorne, BNFL-Risley

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The following information is taken from the authors' notes and the reports submitted by those listed above. The authors are grateful for the input that was received. While the summary provided here does not provide a day-by-day summary of the meeting, it does provide input about the things that made ICNC'95 successful, comments and suggestions for possible improvements in future meetings, and activities that were initiated to ensure the continuation of the ICNC series of meetings.

Technical Overview

The theme of the conference, "A Half Century of Criticality Safety," was intended to provide a retrospective look at the field of criticality safety as well as an outlook on the future. It was with this in mind that the conference was opened on Sunday evening, September 17, with a "Pioneer Session." Pioneers in the nuclear safety field from France (P. LeCorche), Japan (R. Kiyose), the United States (D. Callihan), and the United Kingdom (G. Chatburn) were invited to present a summary of the early history of criticality safety in their respective countries. This session was chaired by Elizabeth B. Johnson, the ICNC'95 Honorary Chair.

The technical presentations were initiated on Monday morning, September 18, with a plenary session that consisted of reports on the history and technical contributions of four major nuclear installations in Russia. This was the first significant participation of the Russian criticality safety scientists in the ICNC series. As anticipated, their presentations of information not previously available to the rest of the world provided an excellent opening for the conference and was a topic of informal discussions throughout the week. Of particular interest was the information on the Russian experience with criticality accidents. This new information will make it possible to expand the data base of criticality accidents in order to improve our knowledge of both the consequences from accidents and the measures that must be developed to further decrease the probability of accidents.

Information from the accident scenarios and consequences will surely help researchers working to develop more accurate models of accidental criticality excursions.

The Pioneer Session and the Plenary Session of Russian speakers were only two of the many sessions of ICNC'95 that had an international flavor and/or international impact. Several countries made presentations on criticality safety issues related to burnup credit and mixed-oxide (MOX) fuel. Experimental and calculational work on the burnup credit issue was reported by presenters from Japan, France, the United Kingdom, and the United States. This wide range of papers demonstrated the increasing international interest in using burnup credit in criticality safety assessments for transportation, storage, and reprocessing of spent nuclear fuel. There was a general spirit of cooperation among the various countries and organizations investigating (and in some cases, using) burnup credit. This willingness to exchange information and data will prove helpful for each country as they seek to ensure and demonstrate safety in the use of burnup credit.

Like burnup credit, criticality safety related to MOX fuel is an issue that is rapidly gaining interest in several countries as the nuclear industry looks to make use of plutonium provided from reprocessing and excess weapons-grade fissile material. Technical efforts directed towards reprocessing of MOX fuels and use of MOX fuels in light-water reactors will surely provide subjects for numerous presentations at future ICNC conferences.

As at previous ICNC conferences, the importance of calculational tools used in criticality safety assessments has again been stressed. These codes and data are vital in enhancing safety assurance and improving the related technology for the existing nuclear fuel facilities. Judging from the contents of related presentations, it appears that the technology has reached a high level of maturity, but nonetheless needs to be improved to promote further safety assurance of nuclear facilities. Extensive information was presented for both code and data validation and benchmarking. Improvements deemed necessary on the cross-section libraries were identified. The lack of experimental data to allow for a complete code validation under several circumstances was extensively discussed and identified as an outstanding issue.

Even though there were a large number of papers on critical experiment results and future programs, there was general agreement that the number of ongoing and planned experimental programs were diminishing. Budget reductions and loss of staff with vast experience in performing critical experiments were recognized as major concerns for the criticality safety community. The loss of critical experiment facilities and experienced staff has made the community keenly aware of the importance of documenting and retaining the existing experimental data. Partly for this reason, there is enthusiastic interest in the international effort to prepare a handbook of critical experiment data that have been reviewed and evaluated as suitable for validation purposes. There also continues to be interest in subcritical measurement techniques to apply in transportation, storage, and reprocessing operations; however, the techniques still need further research and qualification prior to their general use in fissile material operations and storage.

Some presentations from Japan discussed the contribution of their criticality safety handbook in providing data and material useful for the review and licensing of facilities and packages. With anticipation that the handbook will prove valuable to specialists in other countries, the Japanese made copies of the English version of this handbook available for the first time at ICNC'95.

Several papers on criticality safety assessments and general practice were presented at the conference. The effort to formalize safety assessment methods and to produce standards and guides for use by practitioners was generally accepted as benefiting both safety analysis and training activities. The use of probabilistic risk assessment (PRA) methods in the safety assessment process was a subject of several papers at the conference, but it is evident that more experience is needed before these methods will be generally accepted. Another difficult area for criticality safety assessments involves the safety analysis of liquid and solid waste containing large amounts of fissile material. The difficulty comes primarily from the complex physical and chemical forms of these wastes as well as the lack of applicable experimental data.

Organization

The large number of technical presentations submitted to ICNC'95 provided the organizers with a difficult challenge that was solved by orchestrating an efficient program of both oral and poster presentations. The attendees were very receptive to the poster sessions. These sessions were excellent for those papers containing detailed data. Notably, the majority of papers in the Tuesday poster session were much better suited to posters than verbal presentations. This was the first ICNC conference that used parallel sessions and, while their use was almost a necessity, they were

favorably accepted. However, care should be taken in future meeting organizations to ensure that the parallel sessions do not overlap closely related areas.

The number of papers submitted to the conference also resulted in little time being available for discussion following the formal presentation. However, the ICNC'95 attendees were provided with breakfast and lunch (and at least two dinners) in an informal atmosphere that enabled participants to become acquainted, renew old friendships, and discuss papers or exchange information. These meals and experiences shared during the conference were appreciated by all.

Participation

The ICNC series of meetings has always had participation from most countries with a strong investment in the use of fissile material. With ICNC'95, the participation of the Russian delegation added a tremendous benefit to the conference. A resounding opinion from those who contributed comments was that there needs to be additional efforts to facilitate wider participation in the conference to all the countries involved in nuclear energy. Many of these countries have limited experience in the area of criticality safety and could benefit from the data and information exchange that comes from participation at ICNC. A particular thought was that the International Atomic Energy Agency (IAEA) could help identify (and fund) countries and participants. Coordination with the IAEA will surely help future conference organizers in their efforts to increase international participation. The presentation of the work being performed in European countries traditionally active (Belgium, Sweden, Italy, Spain, etc.) in nuclear issues was also missed at this ICNC.

ICNC'95 had few papers from individuals involved in the licensing review of criticality safety assessments, although many individuals working in this area were present. This is not unusual at technical conferences; however, the field of criticality safety can surely benefit from an open exchange of ideas and information on licensing. The practice of criticality safety is to prevent critical accidents and the goal of the regulator and licensee should be the same. Thus interaction in a collegial environment that can help facilitate understanding of different perspectives on safety issues should benefit everyone.

Topics for Future ICNC Meetings

The criticality safety community continues to be challenged by new and modified fuel cycle applications involving ever-increasing amounts of fissile material. The release of fissile material from weapons programs to the civilian nuclear fuel cycle, as well as the fuel cycle approach that is employed by each country, should have a significant influence on the focus of criticality safety issues over the next several years. Based on their experience in the field and their perception of issues or trends identified at ICNC'95, the contributors to this summary provided the following list (in random order) of topics that should be considered for inclusion at future ICNC meetings.

- A survey of the principles, approaches, and criteria used in various countries to ensure criticality safety.

- Analysis of production processes and selection of rational safety factors in production (methods, approaches, evaluations, recommendations, etc.).
- Methods of selecting and conducting experiments in order to receive benchmark data for resolving safety problems and calibrating calculational methodologies.
- Problems of ensuring safety during handling (storage, recovery, processing) of weapons-grade nuclear materials after the disassembly of nuclear weapons.
- Control measurements or methods and devices for determining parameters that must be restricted in order to assure criticality safety.
- Research to verify and, possibly, correct the existing nuclear data and calculation methodologies for use in new applications.
- Criticality safety issues related to the different fuel cycle options such as once-through, recycle and actinide partitioning, burning, and transmutation.
- The introduction of PRA in criticality safety as a useful tool to complement the traditional bounding approach.
- A “state of nuclear industry” review for each country or from industry representatives, stating their current/future activities.

Future Sponsorship and Organization

In the past, key leaders in the criticality safety community have worked informally to ensure that a sponsoring country for the next ICNC meeting was identified and announced at the ICNC conference. Typically, this location and responsible country for each succeeding ICNC conference has been determined only in the final days of the current meeting. This ad hoc process has always caused doubts regarding the survival of the ICNC series. In order to help remedy this problem, the International Liaison for ICNC'95 (G. E. Whitesides) proposed that a permanent planning committee be established to initiate planning activities and provide guidance and direction relative to future ICNC meetings. During two working lunch meetings at ICNC'95, a temporary planning committee met to discuss the formation of a permanent planning committee. The temporary planning committee consisted of the authors, the ICNC'95 General Chair (Norman L. Pruvost), and the individuals identified in the Introduction of this paper. It was determined that the membership of the committee should be made up of representatives from countries that have a continued interest in the ICNC meeting. Representatives would be selected by whatever procedure the country felt was proper. It was recommended that members be leading, active members of the criticality community in their country and have experience with organization and planning of major technical conferences. Once formed, the committee will serve to

- ensure timely selection of sponsoring countries for subsequent ICNC meetings;

- provide advice on organization of the conference as requested by the sponsoring country;
- provide a point of contact for the technical community of each major country; and
- assist in formation of an international technical program committee that would work to solicit and review the papers.

Patrick Cousinou of France was asked to be responsible for compiling the membership of the planning committee as nominated by each country and initiate the activities of the planning committee. Dr. Cousinou was also the spokesperson for the French proposal to host the next ICNC conference in 1999. The French proposal was accepted by the temporary planning committee, and the ICNC'99 host country was announced at the conference banquet. The permanent planning committee will serve, along with technical staff of the host country, as the technical paper review and selection panel for ICNC'99. They will also hear proposals from countries willing to host ICNC meetings and make a choice about the location of the following meeting during the paper review session. This action ensures that proper planning for future meetings will occur in a timely fashion.

Sponsorship of ICNC by international organizations was discussed by the temporary planning committee. In particular, the benefits of having the involvement and sponsorship of the IAEA and the OECD-NEA were discussed. The benefits include availability of a permanent secretariat to help coordinate the planning committee activities. These organizations also could provide a means to expand the planning committee functions to one that helps coordinate information exchanges that may help resolve or address criticality safety issues of international concern.

Summary and Conclusions

The influence of nuclear energy in everyday life has become an established fact, and in the future the role of nuclear energy will grow. As a whole, ICNC'95 had enormous significance for the enhancement of nuclear criticality safety in existing and proposed nuclear facilities and processes, as well as in work with fissile material being done in tandem with them. The ICNC conference has been very significant in promoting the acceptance of the work of the criticality safety community and must continue this role into the future.

Perhaps the distinguishing feature of ICNC'95 is the broad representation of specialists on criticality safety from various countries. In particular, for the first time, specialists on nuclear criticality from the nuclear industry in Russia attended and presented their observations. Increased openness in the exchange of information in criticality safety has thus emerged across the nuclear energy community, casting new light on the early developments and the differences in approach. New contacts and a better common understanding of the issues will hopefully be established. This test will certainly bear fruit in the coming years and will contribute to increased mutual trust. The information about the Russian criticality safety facilities, their extensive experimental program, and the data produced are likely to be integrated into criticality safety data bases and shared among specialists worldwide.

In connection with the decrease in research related to the development of nuclear weapons and the conversion of weapons research installations in Russia and the United States, there is a significant

window of opportunity to ensure that the criticality safety research experience accumulated in these installations, as well as the staff and experimental facilities of these installations, is effectively used for the benefit of nuclear safety issues. It is vital to support the developing cooperation among all of the countries that have had nearly "A Half Century of Criticality Safety." A diversity of national policies on cooperation is expected to persist in the short term. For the longer term, and to ensure the nuclear option remains open for future generations, there is a need to share criticality information beyond national policies.

For those countries where the use of nuclear energy is emerging, the assurance of nuclear criticality safety in all phases of the fuel cycle becomes vitally significant to the world community. Therefore, an exchange of experience, information, and ideas accumulated and acquired in various countries of the world in this field is extremely important, and it is anticipated that the ICNC series of meetings will ensure that this exchange continues for the foreseeable future.