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NUCLEAR ENERGY AGENCY
COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS

SUMMARY AND CONCLUSIONS OF THE INTERNATIONAL SEMINAR ON THE SAFETY RESEARCH NEEDS FOR RUSSIAN-DESIGNED REACTORS

Held in Tokyo, Japan, 8th and 9th July, 1997

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SUMMARY AND CONCLUSIONS
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INTERNATIONAL SEMINAR
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KOUKU KAIKAN, TOKYO, JAPAN
8 - 9 July 1997

The International Seminar on The Safety Research Needs for Russian-Designed Reactors was held in Tokyo, Japan, July 8th and 9th, 1997. This seminar on international, national and bi-lateral co-operation programmes on the safety research needs for Russian-designed reactors was hosted by the OECD Nuclear Energy Agency and the Science and Technology Agency (STA) of Japan at the Kouku Kaikan Conference Centre in the center of Tokyo. More than 70 participants attended the seminar. Represented were experts from Japan, OECD/NEA member countries, the Russian Federation, the International Atomic Energy Agency (IAEA), the International Science and Technology Center (ISTC), the International Nuclear Safety Center (INSC) and the Russian International Nuclear Safety Center (RINSC). Eighteen papers were presented in five sessions.

The purpose of the International Seminar was to bring together experts involved in this work, to provide a hearing for progress in programmes sponsored by governments and OECD/NEA, and to review significant new technical information coming from these programmes.

The International Seminar was structured around four main areas of co-operation: co-operative programmes of the OECD/NEA, programmes of international organisations, bi-lateral programmes, and national programmes of OECD/NEA Member countries having reactors of the VVER type. Each of these areas corresponded to a separate session. The general conclusions, followed by the specific technical conclusions, from the International Seminar are included in the following points.

GENERAL CONCLUSIONS

1. By wide acclaim of the participants, the International Seminar on the Safety Research Needs for Russian-designed Reactors was very interesting, informative, timely, and useful. There were 5 Sessions for papers. Sessions I and II: Programmes of the Nuclear Energy Agency; Session III: Programmes of International Organisations; Session IV: Bilateral Programmes; and Session V: National Programmes. The emphasis of the presentations was on the research needs and not on specific safety issues that are design related. The papers presented at the seminar show the large breadth and depth of safety research underway applying to Russian-designed reactors. The seminar was apparently the first to include the entire range of work in this field.

2. The goal of nuclear safety assistance programs in the CEEC and NIS should be to transfer relevant safety knowledge and technology, and to develop indigenous capabilities in ways that will be self-sustaining when assistance eventually comes to an end.

3. One of the important lessons of Chernobyl, and of Three Mile Island before it, was the necessity of understanding severe accidents in order to prevent or mitigate them. Severe accident research is difficult and expensive, but international co-operation has proved to be very beneficial through pooling of resources and bringing the best minds and facilities to work on problems, and through dissemination of research results. Work in the field has greatly expanded the common language of reactor safety. Specific NEA initiatives, such as the TMI Vessel Investigation Programme and RASPLAV gathered together teams of skilled people and achieved important results. NEA initiatives with the CEEC and NIS are assisting national programmes by disseminating current knowledge and helping to generate new knowledge in these countries.

4. The Overview of NEA Co-operation Programme, and reports of co-operative research between NEA country research centers and Russian research centers clearly indicated that work is progressing well, and is achieving NEA goals of building know-how and capability in safety technology. In particular, CSNI initiatives of RASPLAV and Safety Research Needs for Russian-designed Reactors are good models for future research and technical co-operation. Reports from the Czech Republic and Hungary were also very positive, and indicate keen interest in co-operative programmes from the CEEC point of view.

5. Information exchange between NEA and other international organisations interested in CEEC and NIS nuclear power plant safety is very beneficial, and is contributing to better understanding of safety technology and issues in these countries. Information exchanges show each organisation working in the field what other organisations are doing. Some co-ordination of activities would be useful for disseminating information to these organisations, and for eliminating unnecessary duplication. These are roles that NEA could perform well.

6. With regard to the Safety Research Needs of Russian-designed Reactors, development of a strategic plan for this research has top priority. The key players, i.e., design engineers, plant operators, regulators, and safety researchers in the CEEC and NIS must be involved in developing the plan.

7. It is clear that assistance programmes will eventually come to an end. Meanwhile the best thing to do is to replace assistance with integrated, co-operative safety research programmes. Technical co-operation programmes should lead to self-sustaining nuclear safety improvements and sustainable improvements in the safety culture. CSNI with its long experience can contribute to this development.

8. Regarding co-operation with Russia, we understand that Russian research centers are able to obtain funds from their government for international co-operation on specific projects. Ministerial approval is required, and there are two conditions: a) proposed research must have technical merit, and show reasonable promise for success and practical application in Russia; b) the funds that partners offer to provide, and thereby risk sharing, make the project more attractive than it would be with purely Russian funding.

9. The International Science and Technology Center (ISTC) is dedicated to non-proliferation purposes, but nevertheless, because of special capabilities of the scientific community that it serves, has the potential of contributing to nuclear power plant safety. The ISTC structure exists,

and funding is available to support projects approved by sponsoring governments. The way to approach ISTC is to provide clear definition of nuclear safety research needs. If successful, the only cost to nuclear safety projects would be the cost of co-ordinating ISTC work with the project.

10. Although the Russian Regulatory Authority is responsible for certification of codes used in Russian nuclear power plants, the Authority does not have means of independently verifying codes, because it does not have a research budget. It depends on the Ministry of Atomic Energy for this purpose. This dependence is at variance with OECD/NEA Member country practice. Further, there is the potential for conflict, as thermal-hydraulic code validation reaches completion. Conflict would be apparent if different decisions on code certification were made for similar applications in Russia and CEEC countries.

11. The NEA methodology of co-operation and collaboration on nuclear safety issues could serve as a model to be extended to other parts of the world.

12. Transfer of western codes is a very effective basis for technology transfer by providing up-to-date technology and by training on how to use the technology. The recipients of the codes can contribute further by developing new models to be included in the codes.

TECHNICAL CONCLUSIONS

1. The report of Status and Plans for the VVER-440/213 Bubble Condenser Containment revealed thorough technical evaluation and planning since inception five years ago. However, experiments and data are urgently needed to demonstrate the effectiveness of the bubbler condenser containment in accident conditions. Unfortunately, contracting and procurement problems are delaying the start of experiments. In view of the safety implications of the bubbler condenser to VVER confinement, strong support should be given to getting the experiments underway and completed.

2. Human performance continues to be very important to plant operational safety. There are three specific research needs: (a) a common methodology for performance evaluation; (b) a human error data base for PSA; and (c) expert systems to help prevent accidents caused by human error.

3. The VVER Thermal-Hydraulic Code Validation Matrix work began in 1992, and is progressing well. Additional tests are needed to complete the work. The absence of fully-validated codes is now slowing the implementation of symptom-based EOIs. The first draft of the report on the VVER thermal-hydraulic code validation matrix is expected early in 1998, and completion in two years.

4. The VVER-1000 Large Scale Test Facility (PSB) would be very useful for obtaining data for the VVER Validation Matrix, and the case for completion and operation of the thermal-hydraulic facility is very convincing. Completion of the PSB test facility would provide a full height, approximately 1/300 volumetric scale, for test of the VVER-1000 design. About $2M is needed

to complete construction, and about $1M annually for three years is needed to operate the facility, for a total expenditure of about $5M.

5. The SCORPIO - VVER Project is going well. Its purpose is to adapt the SCORPIO core surveillance and prediction systems, which has been used at six OECD plants, beginning with Ringhals-2 in 1987, to VVER units. Dukovany is the current target plant. The SCORPIO core surveillance and prediction systems are to be extended to other VVER nuclear power plants in co-ordination with upgrades to the instrumentation and control (I &C) systems.

6. With regard to Integrity of Equipment and Structures for RBMK, the integrity of the fuel channel is the top priority. A major effort is needed on this issue, including NDE development, materials properties determination, ageing, seismic and dynamic loading, and full-scale testing facilities. The question of the possibility of multiple concurrent ruptures of fuel channels should also be addressed.

7. Important points of view emerged from CEEC and NIS countries:
- the bubble condenser greatly improves VVER confinement systems, and therefore research to prove performance is very important and urgently needed;
- most, if not all, thermal-hydraulic codes used in the CEEC come from other countries, and the ability to understand and use them properly is necessary;
- the nuclear safety research strategic plan should definitely be developed;
- the end of assistance is anticipated, and intentions are to develop their own expertise;
- nuclear safety information and research co-operation is very important and useful.

8. Representatives from the CEEC and NIS countries also pointed out that there are also many positives aspects of the VVERs. For example, credit is due to VVER conservative design, because of the large water inventory, which slows the evolution of accidents.

RECOMMENDATIONS TO CSNI

Based on the presentations and discussions at the “International Seminar on the Safety Research Needs for Russian-designed Reactors” held in Tokyo, the participants made several follow-on recommendations to CSNI.

1. Following the success of CSNI initiatives, clearly evident at the Seminar, CSNI should seek to expand safety research co-operation between NEA Member countries and the NIS and CEE countries to assist them in their national nuclear safety programmes.

2. Based on the recommendations contained in the CSNI-sponsored report “The Safety Research Needs for Russian-designed Reactors”, the Russians are starting to develop their own strategic plan for nuclear safety research. When requested, the CSNI should offer assistance, in terms of a

review, to the Russians in connection with the development of their strategic plans for VVER and RBMK safety research.

Similarly, the CSNI, if requested by the host country, could offer to review the strategic plans for VVER and RBMK safety research for other NIS and CEE countries.

3. CSNI strongly endorses the importance of the VVER Bubbler Condenser Containment Research, and urge authorities in the EU PHARE/TACIS Programme to resolve procurement problems so that work can get underway in the foreseeable future and reach completion.

4. With regard to funding of PSB, it is clear that this large-scale thermal-hydraulic facility is important to the safety of many VVER plants in the NIS. Furthermore, research that would be performed at PSB appears to satisfy the financial criteria for Russian government as well as international support. It would, therefore, be appropriate for CSNI to support completion of the facility as an OECD VVER-PSB International Joint Project.

5. As a complement to the published OECD/CSNI reports on separate and integral effects thermal-hydraulic test matrices, the CSNI should encourage the early completion of the VVER Thermal-Hydraulic Code Validation Matrix. This VVER code validation matrix can then be used to validate computer codes used to simulate the thermal-hydraulic behaviour of VVER-type reactors, and the performance of VVER safety systems following postulated accidents.

6. The Tokyo Seminar was extremely useful in bringing together organisations and experts that support NIS and CEE countries in their national nuclear safety programmes. We recommend that CSNI take the initiative and organise a similar international seminar in two years time. The objective of this meeting would be to expand international participation, calling on all related programmes, including NEA and IAEA programmes, EU PHARE and TACIS programmes, other international programmes, and bilateral programmes that relate to and promote development and dissemination of nuclear safety technology.