

Feedback from the Regional Meetings on the Application of the Code of Conduct and Updating of the IAEA Programme on Research Reactor Safety

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Abstract. Research reactors are not only a cornerstone of many national nuclear science and technology programmes, they are an important part of a national safety infrastructure. The IAEA seeks to assist Member States in maintaining and improving the safety of their research reactors. Recently, major emphasis has been placed on application of the Code of Conduct on the Safety of Research Reactors, including three regional meetings at which self-assessments of the status of application of the Code and areas in which additional assistance is needed were identified. The results of these meetings, together with insights gained from reports of Integrated Safety Assessment of Research Reactor (INSARR) and other safety missions, reports of incidents collected through the Incident Reporting System for Research Reactors (IRSRR) were evaluated. The conclusions of this evaluation, which were used to identify issues that are of concern and warrant continued or increased attention, enabled the Agency to make some near-term modifications to the research reactor safety programme to address these issues.

1. Introduction

Research reactors have been from the very beginning an important part of the development of nuclear technology, its application, and the education and training of nuclear scientists and engineers. The benefits of research reactors have extended to applications of nuclear technology in many other fields. Research reactors have compiled an excellent record of safe operation through over six decades of operation. Continued safe operation of research reactors is essential to their future and the future of the whole nuclear community.

Throughout its 50-year history, the IAEA has supported Member States (MSs) by providing guidance and support for safe design and operation of research reactors. According to the IAEA research reactor database (RRDB), there are currently 250 operational research reactors; 248 reactors are shutdown, and 170 reactors have been decommissioned. Of the research reactors that are no longer operating, some of them have plans to resume operation in the future, some are undergoing decommissioning or waiting for it, but some reactors are in an extended shutdown state with no clear plans for their future. Maintaining safety of reactors in extended shutdown was one of the concerns that led to development of the Code of Conduct on the Safety of Research Reactors [1].

In the late 1990s, concerns over some aspects of safety of research reactors were raised by the International Nuclear Safety Advisory Group (INSAG). The IAEA considered various measures that might be instituted to address the concerns. In September, 2001, the 45th IAEA General Conference endorsed a decision of the Board of Governors to request the IAEA Secretariat to develop and implement, in conjunction with MSs, an international Research Reactor Safety Enhancement Plan. A

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principal component of this plan was the preparation of a Code of Conduct on the Safety of Research Reactors with a view to establishing the desirable attributes for management of research reactor safety. The Code of Conduct was endorsed by the IAEA Board of Governors in March 2004. It provides guidance for the development and harmonization of national practices, laws, and regulations, and sets forth the desired attributes for the management of research reactor safety.

2. Regional Meetings on the Application of the Code of Conduct on the Safety of Research Reactors

As a first step towards the implementation of the Code of Conduct, and in response to the resolution of the Contracting Parties to the Convention of Nuclear Safety (CNS), an Open-ended Meeting on Effective Application of the Code of Conduct on the Safety of Research Reactors was convened at IAEA Headquarters, from 14 to 16 December 2005. Fifty-one representatives of 31 MSs participated. The principal recommendation of the Open-ended Meeting was that the IAEA Secretariat should organize triennial meetings to exchange experience and lessons learned, identify good practices and discuss plans, difficulties and assistance needed in applying the Code of Conduct. To assist in preparation for the first of these triennial meetings, three regional meetings on application of the Code of Conduct have been organized, and another is planned before the first triennial meeting, now envisaged to take place in mid-2008. These regional meetings have included respectively MSs from Africa, Eastern Europe, Asia and the Pacific. A fourth regional meeting for Latin America is planned for December 2007.

The three regional meetings on application of the Code of Conduct held so far have followed a consistent format. The first part was a tutorial on the history and content of the Code and its role in the spectrum of international legal documents, the recommendations of the 2005 Open-ended Meeting, and the benefits of the Code to the MSs. The programme continued with presentations by the participants of an informal self-assessment of application of the Code of Conduct in their countries. In preparation for the meeting, each participant was asked to perform a self-assessment to identify areas of satisfactory application of the Code and areas in which improvement is needed. A questionnaire, based on the Code, was developed by the IAEA and provided to each participating MS to guide the self-assessment. The results were discussed and compiled in participants' working groups, and then summarized and presented to the whole meeting. This information provided a useful picture of the opinions of the participants about the situation in their own countries, as well as a comparison of the situation in countries within the region.

3. Safety Issues and Concerns for Research Reactors

The IAEA has used many sources of information on the safety status of research reactors in MSs to identify issues that are of concern and need continued or increased attention. These sources include the regional meetings on application of the Code of Conduct discussed above, the results of INSARR and other safety missions, and the reports of incidents collected through the Incident Reporting System for Research Reactors (IRSRR).

3.1 Feedback from the Regional Meetings on Application of the Code of Conduct

The results of the self-assessments made by the MSs that participated in the regional meetings on application of the Code of Conduct and the associated discussions showed that, in many MSs, there is common need to:

- Establish effective and independent regulatory bodies having the authority and ability to carry out regulatory functions;
- Improve the capabilities of regulatory bodies in the review and assessment of safety submittals;
- Increase the attention to commissioning of modifications and experiments. In particular, safety aspects of core conversion need to be taken into account in a more effective manner;

- Perform site re-evaluation for existing research reactors as a part of maintaining their safety assessment up to date;
- Develop comprehensive emergency plans and establish preparedness and response capabilities at the national level;
- Improve the safety culture in operating organizations and address human factors issues in all phases of research reactors lifetime;
- Improve the capability to prepare the safety documentation for decommissioning, and establish criteria for research reactors in extended shutdown and for release from regulatory control of decommissioned research reactors.

In the regional meetings, many participating MSs expressed the need for the IAEA assistance in enhancing safety assessment of research reactors, including help for operating organizations in updating safety analysis reports (SARs), and help for regulatory bodies in developing regulations and evaluating SARs. The IAEA assistance in training of new personnel entering the regulatory bodies and operating organizations was also requested. Other MSs requested the IAEA assistance in performing periodic safety reviews of their research reactors using a graded approach.

3.2. Feedback from Results of Safety Review Missions

The analyses of the results of the IAEA safety review missions, including INSARR missions, and missions to research reactors under Project and Supply Agreement with the IAEA, were useful in identifying common safety issues and trends, although the observations made and the issues raised by these missions are specific to the problems of each individual reactor. The results of the recent missions indicated that out-of-date safety documentation (safety analysis report, operational limits and conditions, emergency plans, etc.) is a common problem. The safety documentation often needs to be updated to conform to the actual status of the facility. These missions showed also the need to:

- Enhance the role and responsibilities of the safety committees in many operating organizations;
- Improve the safety analysis of experiments and modifications with safety significance;
- Establish integrated management systems and quality assurance programmes in many operating organizations;
- Develop and implement systematic aging management programmes;
- Develop and implement a clear strategy for the management of radioactive waste generated from research reactors operations;
- Elaborate decommissioning plans for many research reactors, especially for those in extended shutdown.

3.3. Feedback from IRSRR Reports

The IRSRR now has 50 participating MSs. The analysis of incidents reported to the IRSRR showed that ageing of components is one of the most important root causes of the incidents, representing more than 50 %. Two-thirds of the operating research reactors are over 30 years old. Although many of these old reactors have been refurbished to comply with today's safety requirements, ageing of systems and components, including obsolescence of the instrumentation and control systems, is considered to be an important safety issue. Human factors are another important root cause of incidents reported to the IRSRR.

3.4. Future Challenges

In addition to the above mentioned safety issues, future challenges include the continuing need to take into account the safety aspects associated with core conversion from high-enriched uranium to low-enriched uranium, to develop self-assessment capabilities for safety review in all MSs, and to

coordinate with other international organizations, having activities regarding the safety of research reactors.

4. Updating of the IAEA Research Reactor Safety Programme

The safety issues and the future challenges described above are considered in the detailed activities of the IAEA programme on research reactor safety. Some near-term actions were planned based on the feedback from the regional meetings on the application of the Code of Conduct and the IAEA programme was modified to consider the identified needs and concerns, as described below.

4.1. Near-term Actions

The feedback and the needs for assistance above mentioned were considered in defining and implementing near-term actions to improve the situation from safety point of view. In this regard:

- The programmes of the safety review missions conducted by the IAEA at research reactors were modified to include application of the Code of Conduct as one of the review areas;
- The IAEA Safety Guide No. 35-G2 [2] is being revised to include practical guidance on safety of modifications and experiments;
- A technical meeting is planned for December 2007 on safety management and verification for the benefit of the chairpersons and senior members of research reactors safety committees to promote the application of relevant IAEA safety standards and international good practices. The meeting will also provide a forum for the participants to discuss their national practice with a focus on the role and operating procedures of the safety committees and to exchange information on the safety status of research reactors worldwide;
- A series of regional meetings is being prepared to improve the capabilities of regulatory bodies in performing review and assessment of safety documents;
- Workshops and training activities on development of ageing management programmes and promotion of safety culture in research reactor operating organizations are also planned.

The specific needs for assisting in refurbishment of instrumentation and control systems, and in updating SARs are also considered.

4.2. IAEA Programme on the Safety of Research Reactors

The programme for improving research reactor safety is based on three specific elements:

- (a) Establishing IAEA safety standards as the foundation for a global safety regime for research reactors;
- (b) Assisting MSs in the effective application of the safety standards with particular emphasis on the Code of Conduct;
- (c) Fostering regional and global cooperation in research reactor safety.

The programme includes four projects, which are presented hereafter.

4.2.1. Enhancing the Safety of Research Reactors

This project is focussing mainly on providing assistance on the effective application of the Code of Conduct and the IAEA safety standards, enhancing the regulatory supervision of research reactors, implementing safety review missions and assisting in resolving safety issues. The main activities under this project are:

- Developing safety standards that support the application of the Code of Conduct, the Safety requirements for research reactors (NS-R-4) was published in 2005 [3]. A comprehensive set of safety guides which support the safety requirements are currently in various stages of preparation. In addition to the existing two safety guides on the preparation of the safety analysis report and safety in the utilization and modifications [4, 2], another two safety guides were published in 2006 [5, 6] and one was approved and will be published at the end of 2007 [7]. Another three safety guides will complete the review process in 2007 [8, 9, 10] and are expected to be published in 2008. In addition to those already published, further supporting documents (safety reports and TECDOCs), will be prepared as necessary.
- Conducting safety review missions, regional and international meetings, as well as national and regional training activities and meetings on application of the Code of Conduct;
- Assessing needs in regulatory matters and assistance for improving the regulatory supervision of research reactors;
- Providing assistance and support for improvement of ageing management, development of decommissioning plans, core fuel management and conversion, increasing awareness of safety of experiments, and establishing and enhancing safety management systems.

In addition, the IAEA will develop guidance for periodic safety review and provide assistance to MSs for enhancing self-assessment capabilities and for implementation of the recommendations resulting from safety review missions.

4.2.2. Monitoring and Safety Enhancement of Research Reactors Under Project and Supply Agreement

There are 36 research reactors in 28 MSs under Project and Supply Agreement with the IAEA. These agreements generally require that a MS receiving assistance to acquire or to operate a research reactor applies the IAEA safety standards and measures as specified in the agreement. In accordance with this project, regularly scheduled safety review missions are conducted at these reactors to ensure their compliance with the requirements of the IAEA safety standards. The IAEA will continue to ensure the implementation of the follow-up system for monitoring the safety of these research reactors, which is based on collection and analysis of data on safety performance indicators and ensure the dissemination of operating experience.

4.2.3. Fostering International Exchange of Information on Research Reactor Safety

The objective of this project is to facilitate the improvement of operating practices and the exchange of information on events with lessons learned. The main activities under this project include:

- Operation of the IRSRR and organization of meetings for exchange of operating experience feedback, as well as conduct of reviews of incidents and results of safety review missions to identify the significant issues and trends;
- Promotion of the use of research results in safety assessment and harmonization of the approaches and data used in the safety analyses through the development and conduct of coordinated research projects;
- Cooperation with other international organizations on research reactors safety matters.

Within this project, a web-based forum will be established as a tool for continuous exchange of information on safety aspects. This information will be available to all the research reactor community: operators, regulators, designers and constructors, users and suppliers. This tool will help reducing the isolation of small organizations with limited resources.

4.2.4. Assisting on Safety Aspects Related to Protection Against Sabotage for Research Reactors

This project aims at improving protection of research reactors against sabotage and enhancing the awareness and understanding of the synergy between safety and security and, including development of the regulatory authority's capabilities on methodologies for assessment and improvement of the synergy between safety and security. The activities under this project include the devolvement of guidance to identify, assess and manage vulnerabilities, and mitigate radiological consequences of sabotage for research reactors.

5. Conclusions

Analysis of the data and information derived from various IAEA activities has resulted in identification of important safety issues common to the research reactors worldwide. These issues are primarily related to ageing of facilities, inadequate regulatory supervision, out-of-date or incomplete safety documentation, and lack of preservation plans and decommissioning plans. Other areas that need more attention include establishment of effective management systems and quality assurance programmes, safety culture, human factors, waste management programmes, and emergency preparedness and response. Needs for assistance identified at the regional meetings on application of the Code of Conduct are concentrated in the same areas and complete the insights gained from other sources, including the safety review missions.

The IAEA safety programme on research reactor safety takes into account these issues. It is currently focussing on providing assistance on the effective application of the Code of Conduct on the Safety of Research Reactors and completing the corpus of comprehensive safety standards that support this task. The programme gives priority to the improvement of the regulatory supervision of research reactors, self-assessment capabilities, and dissemination of the operating experience, and considers future challenges like improving the synergy between safety and security and coordinating with other international organizations on safety matters relating to research reactors. The programme will also address specific requests for assistance to the extent possible within the availability of resources.

6. References

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