

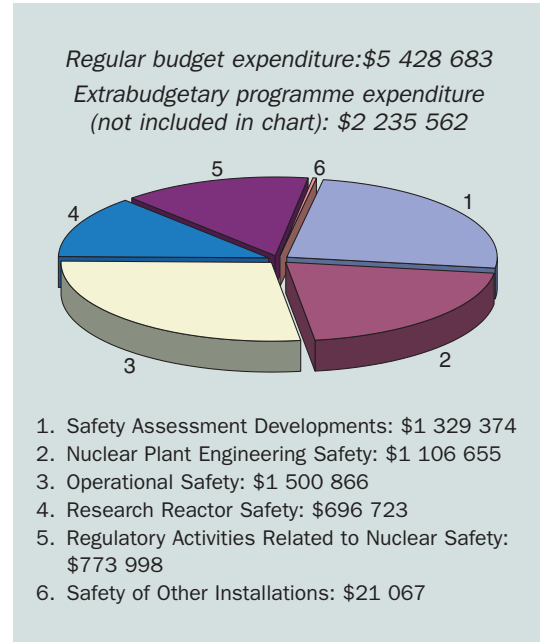


The Agency's Programme in 2001: Safety

NUCLEAR SAFETY

PROGRAMME OBJECTIVE

To achieve and maintain a high level of safety of nuclear installations under design, construction or operating worldwide by: establishing standards of safety for the protection of health including standards for research reactors, nuclear power plants and other non-reactor nuclear installations; and providing for the application of these standards through support for the Agency's technical co-operation programme, the rendering of services, the promotion of education and training, the fostering of information exchange and the co-ordination of research and development.



KEY ISSUES AND HIGHLIGHTS

- Three Safety Guides were published, with six more approved and in the process of being published.
- There was continuing, and in many cases increasing, demand for Agency safety review services. The results of these safety reviews demonstrate a general improvement in the safety of nuclear power plants and implementation of corrective safety measures, and progress in enhancing the effectiveness and technical capabilities of regulatory bodies.
- An international action plan was developed to improve the safety of research reactors.
- Following up on earlier meetings in 1991 and 1998, an international conference on topical issues in nuclear safety was held in September (Box 1).

SAFETY ASSESSMENT DEVELOPMENTS

The Secretariat began development of safety standards addressing the safety of non-reactor nuclear fuel cycle facilities. Safety Requirements for fuel cycle and isotope production facilities and two Safety Guides covering mixed oxide and uranium fuel production facilities were drafted. Publications covering other types of facility are planned for the coming years. The standards for fuel cycle facilities build upon the established standards for nuclear

power plants, with the addition of international consensus requirements and guidance on specific issues relevant to the different types of facility.

In light of the increasing use of probabilistic safety assessment (PSA) by operators and regulators to support safety related decisions, the Agency's activities in this area focused on promoting improvements in the quality and consistency of PSAs as a prerequisite for their use in decision making. Regulatory review guides on level 1, 2 and 3 PSAs were developed

BOX 1. BUILDING AN INTERNATIONAL CONSENSUS ON KEY ISSUES IN NUCLEAR SAFETY

In 1991, the Agency organized an international conference on the safety of nuclear power, with a particular focus on developing a strategy for the future. As a follow-up, another conference was held in 1998 to discuss various topical issues in nuclear, radiation and radioactive waste safety. Substantial progress has since been made by Member States in enhancing the safety of their nuclear power plants. However, there are still areas of concern, for example research reactor safety and the safety of other facilities in the nuclear fuel cycle.

In response, the Agency convened a conference in September 2001 to study the following "topical issues":

- Risk informed decision making,
- Influence of external factors on safety,
- Safety of fuel cycle facilities,
- Safety of research reactors,
- Safety performance indicators.

There was broad agreement at the conference that, where the capability exists, risk informed decision making can be a significant enhancement to nuclear safety and safety focus. With regard to external factors, it was noted that in cases where the achievement of strong business performance was recognized to be a natural result of strong safety performance, market liberalization could enhance safety. For fuel cycle facilities, the conference felt that development of the appropriate safety standards was a prerequisite to the provision of safety services to Member States. Turning to research reactor safety, there was agreement that the organizations responsible for these reactors should develop strategic plans on their future utilization to help in making decisions on whether or not to terminate operations or decommission reactors in extended shutdown. The Agency was requested to place greater emphasis on helping countries to build their national infrastructure for education and training programmes. There was recognition that while research reactors are currently under-utilized, they could become valuable resources for training and practical experience, especially if they were used to support regional centres for education and training. Finally, a three tier approach was considered for the development of a possible framework for safety performance indicators, focusing first on the needs of the nuclear facility, then on the regulatory bodies and later on the public. There was consensus that the Agency should continue its work to ensure that definitions of safety indicators allow their effective use for nuclear power plants, research reactors and other nuclear fuel cycle facilities. ■

in co-operation with the OECD NEA, advice and training were provided on achieving quality and consistency of PSAs, and PSA intercomparison exercises were conducted for WWER-1000 and PHWR reactors. Substantial progress was also made on a technical document on methods, requirements and applications of PSA for risk informed decision making, which will be published in 2002.

To support Member States in their development and use of PSA, the Agency conducted workshops and training activities, including risk monitors (a plant specific real-time analysis tool) and a level 2 PSA. Six International Probabilistic Safety Assessment Review Team (IPSART) missions were conducted to review PSAs and to provide guidance on the use of the results. Although the results of these reviews are dependent on the individual studies, in general the weak areas relate to the estimation of initiating event frequencies, identification and modelling of human errors and common cause failures, and the completeness of information and the screening process for fire analysis. Common weaknesses were also identified in technical quality assurance processes for PSAs and in the preparation of supporting documentation.

The new Review of Accident Management Programmes (RAMP) service aims to assist Member States in the development and implementation of effective plant specific accident management programmes consistent with the Agency's safety standards. A pilot mission visited the Krško nuclear power plant in Slovenia in November 2001. The objective was to review the comprehensiveness, consistency and quality of the accident management programme for the plant, including material and human resources, interrelation with other plant activities and emergency arrangements, and the qualifications and training of plant personnel. The mission found that the programme had been successfully developed and largely implemented in accordance with Agency guidance and good international practice. The mission team identified a number of positive features, and also made recommendations on areas in which improvements could be made. The lessons learned during the pilot mission will be used in further improving the review methodology and guidelines for this service.

An extrabudgetary programme on the safety of nuclear installations continued to provide assistance to China, Indonesia, Malaysia, Philippines, Thailand and Viet Nam, with contributions from France, Germany, Japan, the Republic of Korea, Spain and the USA. The objective is to strengthen safety infrastructure and the safety of nuclear power plants and research reactors in the region, and in particular to develop human resources and enhance the technical capabilities of regulatory authorities and supporting organizations. In China expert missions visited the newly constructed Tianwan Nuclear Power Plant (a WWER-1000 design), reviewing the design with regard to severe accident mitigation, the reactor protection system and the control room, and validation and verification of the safety software. The reviews, intended to serve as training for the Chinese organizations, involved experts from Russian and German companies that are designing the instrumentation and control and other systems for the nuclear power plant. Safety Analysis Reports for research reactors in Malaysia, Thailand and Viet Nam were reviewed with the aim of improving their scope and technical quality. And a pre-International Regulatory Review Team mission visited Thailand to review the practices of the regulatory body and make recommendations to strengthen and enhance its effectiveness.

NUCLEAR PLANT ENGINEERING SAFETY

A Safety Guide, *Safety Assessment and Verification for Nuclear Power Plants*, was published in 2001, the second in a series of Guides supporting the new Safety Requirements for design published in 2000. Another Safety Guide, *Instrumentation and Control Systems Important to Safety in Nuclear Power Plants*, is in the process of being published; nine other Safety Guides on design safety are being prepared.

Design safety review services have gained momentum recently in relation to both new designs and existing nuclear power plants. A number of projects are under way within which such reviews have been conducted. Under a technical co-operation project, the Preliminary Safety Analysis Report (PSAR) for the Bushehr

Nuclear Power Plant in the Islamic Republic of Iran is being reviewed. The design of this plant is unique: the civil engineering structures from a partially built PWR are being used to house a WWER-1000 reactor. The structures have also been repaired after suffering war damage. In addition to this support to the operator, another technical co-operation project is supporting the regulator: six meetings were held with the regulatory body in 2001 — in Tehran, Moscow and Vienna — providing advice on atomic law, reviewing various parts of the PSAR and the environmental impact assessment report, and reviewing the regulatory body's training programme. In addition, an Iranian delegate participated as an observer in an Operational Safety Review Team (OSART) mission, and a workshop on accident analysis was conducted.

A design safety review of the LWR project for the Democratic People's Republic of Korea was conducted by the Agency in June 2001 at the request of the Korean Peninsula Energy Development Organization (KEDO). The review covered all aspects of the siting and design of the plant, and was aimed at verifying the compliance of the design with the Agency's safety standards and international practices. Comments and recommendations for improving the safety of the plant and its documentation were also made. Two teams in parallel reviewed the PSAR and the assessment of the site, including the radiological environmental impact and the external hazards. The design is based on the proven technology and performance of the reference design (Ulchin 3 and 4 in the Republic of Korea), and includes the most recent design improvements made for Ulchin 5 and 6. The Kumho site was found to have no characteristics that would make it unacceptable from a nuclear or radiological safety point of view. However, some recommendations were made in a number of areas, including further investigation of the seismic situation.

The final design safety review mission of 2001 was to the Temelin nuclear power plant in the Czech Republic, in November 2001, to review the resolution of safety issues identified when the Agency conducted a similar review in 1996. The expert mission addressed both the Agency issues and those raised in recent years by other parties. Because of the recent OSART mission to

Temelin, the review did not include the issues related to operational safety. The experts concluded that most of the design safety issues identified as being relevant to reactors of the generic Temelin design had been addressed and resolved, and that work is nearing completion on the few remaining issues. The judgement of these experts was that these issues would not preclude the safe operation of Temelin.

A technical document (IAEA-TECDOC-1235) published in 2001 addresses the safety and licensing aspects of nuclear plants coupled with seawater desalination plants and the basis for the safety assessment of such plants. It also proposes a general approach for the preparation of safety requirements for reactors with special safety features or of a smaller size as compared with nuclear power plants. This approach is aimed at generating the safety design requirements for any kind of nuclear reactor starting from those for nuclear power plants.

Seismic safety review services continue to address both the application of the seismic re-evaluation of existing nuclear power plants and more general siting projects, including facilities other than power plants. A mission to the Armenia Nuclear Power Plant in May gave advice on the second phase of a seismic reevaluation programme for the plant, including the possible role of PSA in the programme.

A series of reports on the assessment and management of ageing of major nuclear power plant components important to safety was completed when a technical document (IAEA-TECDOC-1197) covering CANDU reactor assemblies was published. The series documents current practices for the assessment of safety margins (fitness for service) and the inspection, monitoring and mitigation of ageing degradation of selected components of CANDU reactors, BWRs, PWRs (including Soviet designed WWERs). These practices are intended to ensure the safe operation of nuclear power plants and also provide a common technical basis for dialogue between plant operators and regulators when dealing with age related licensing issues.

Intergranular stress corrosion cracking in stainless steel pipes is a safety issue for BWRs. An extrabudgetary programme on the mitigation of

such cracking in the austenitic stainless steel piping of RBMK reactors assists countries operating such reactors in establishing effective mitigation programmes through technology transfer, training and guidance. The programme is entering its final phase. The main achievements in 2001 included: adaptation of sizing procedures for ultrasonic testing to RBMKs; training of RBMK operators on advanced ultrasonic testing; development of an ultrasonic testing qualification procedure for a pilot study; development of a risk based inspection system for the Ignalina nuclear power plant in Lithuania; transfer of technology and training on repair techniques; and formulation of guidance on improving water chemistry monitoring and control.

OPERATIONAL SAFETY

Two Safety Guides were published in 2001 supporting the Safety Requirements for the operation of nuclear power plants, published in 2000. The new Guides discuss modifications to nuclear power plants and the operating organization. Three other Safety Guides in the operational safety area will be published in 2002, and four others are being prepared.

The Agency's operational safety review services are being improved to better meet current and future challenges identified by the Member States using these services. More requests have been received from utilities and regulatory organizations to provide methodologies for the self-assessment of management processes and safety culture, and there has been greater demand for assistance in areas identified by assessments as needing improvement.

The general impression gathered from OSART missions is that managers are committed to improving the operational safety and reliability of their plants. The missions identified several examples of good practices, and also made recommendations and suggestions to improve operational safety. The results of each mission are made available to the nuclear industry and their regulatory authorities through a database called OSMIR. Follow-up missions in recent years confirm that operational safety services such as OSART are helping Member States

achieve and maintain a high level of safety performance. On average, the rate of resolution of and compliance with the Agency's recommendations has improved over the last five years from 80% to over 90%.

Recently, the Agency, in consultation with Member States, developed the Peer Review of Operational Safety Performance Experience Review processes, known as PROSPER. Guidelines for the PROSPER service were finalized during the year. Another service, the Safety Culture Enhancement Programme (SCEP), supports Member States in their efforts to develop a sound safety culture in their organizations. The SCEP services can be tailored to the needs of a particular organization, where they may want support only in certain steps of the process. The ongoing SCEP support to Electronuclear, in Brazil, has served as a basis for the continued development of these services. Based on the experience gained, guidance is being developed on how to implement such a programme. Full scope SCEP support has also been initiated for the Laguna Verde Nuclear Power Plant in Mexico, and for the fuel cycle facilities in Industrias Nucleares do Brazil.

RESEARCH REACTOR SAFETY

In response to a resolution from the 2000 General Conference, the Secretariat's proposal for an international research reactor safety enhancement plan aimed at strengthening the safety, monitoring of safety and regulatory supervision of research reactors worldwide was endorsed by the Board of Governors. This plan calls on the Agency to:

- Conduct a survey of research reactor safety in Member States;
- Prepare a code of conduct on the safety of research reactors with a view to establishing the desirable attributes for management of safety;
- Explore possible means to strengthen the system for monitoring the safety of research reactors, taking account of the experience of organizations working in other fields.

The number of requests to conduct Integrated Safety Assessment of Research Reactors

(INSARR) missions is increasing. During 2001, a mission to Greece reviewed operational safety aspects of the GRR-1 (“Demokritos”) research reactor and concluded that: the reactor is generally in good condition and is being operated safely; and the operating organization has the human and financial resources to keep the facility running well. A number of good practices were identified, and recommendations were made to address several weaknesses and opportunities for improvement. A mission to Australia in May–June 2001 reviewed the PSAR for the Replacement Research Reactor to be built at Lucas Heights (to replace the existing HIFAR research reactor at the same site). This was a follow-up to a 1998 review by the Agency of the environmental impact statement for the reactor. It was noted that all of the recommendations made then had been addressed in the PSAR. Recommendations for further improvement were made, but the review generally concluded that the PSAR reflected the design accurately and effectively, had been prepared using Agency safety standards, reflected current good international practices and provided an adequate basis for licensing purposes.

The Agency has a particular responsibility for the safety of research reactors under Project and Supply Agreements with Member States. General Conference Resolution GC(44)/RES/14 requested the Secretariat to continue to closely monitor research reactors subject to such agreements. Accordingly, seven safety review missions visited research reactors during the year.

The Incident Reporting System for Research Reactors (IRSRR) has 31 participating countries, representing a large majority of the

research reactors in the world. In November, the second meeting of IRSRR national co-ordinators was held in Lisbon. A pilot version of incident reporting software for the system was demonstrated, and the participants presented reports of incidents for inclusion in the database. A workshop on human performance was also part of the meeting.

REGULATORY ACTIVITIES RELATED TO NUCLEAR SAFETY

The Agency’s International Regulatory Review Team (IRRT) service studies the effectiveness of regulatory bodies and exchanges information and experience. Many of the recommendations for improvement made during IRRT missions are specific to the particular national circumstances. However, some issues of more general interest are also raised. A review of the recommendations and suggestions from seven full scope IRRT mission reports identified areas where more effort to improve regulatory effectiveness was recommended (Fig. 1).

The Incident Reporting System (IRS), operated jointly with the OECD NEA, exchanges information on unusual events at nuclear power plants, and seeks to increase the awareness of actual and potential safety problems. As Fig. 2 shows, participating countries submitted 76 reports in 2001. This number is, for the second consecutive year, at the lower end of the expected range. A questionnaire to IRS co-ordinators will try to identify possible problems in reporting, following which the Secretariat will prepare recommendation for the participating countries.

Two IRS topical studies — on incidents caused by loss of corporate knowledge and memory, and on events indicating non-compliance with operational limits and conditions (OLCs) — were completed. The first study provided findings in particular subject areas. More generally, the procedure for analysing events helped to generate ideas for improvement in the areas of: identifying and using event information to avoid loss of knowledge; using event information to ensure better learning from other events; and reducing recurring events, especially by enabling

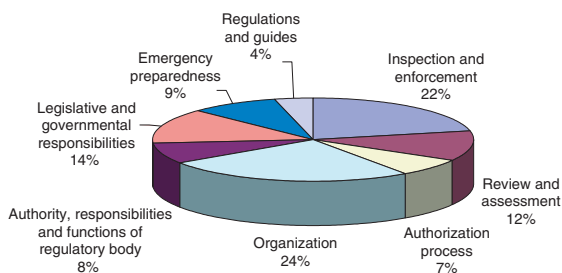


FIG. 1. Distribution of recommendations from seven full scope IRRT missions.

comparison between different events. The second study found that the majority of events were related to human factors deficiencies and procedural inadequacies rather than to deficiencies in the OLCs themselves. Other findings highlighted the importance of functional testing after maintenance to ensure that equipment is restored to an operable status, of explicitly high-

lighting OLC values in procedures and providing visual indications of OLCs on monitoring instrumentation, and of operators taking adherence to OLCs seriously. It was recognized, however, that competitive pressures may encourage operators to perform closer to limits, which may result in an increased number of events of this type in the future.

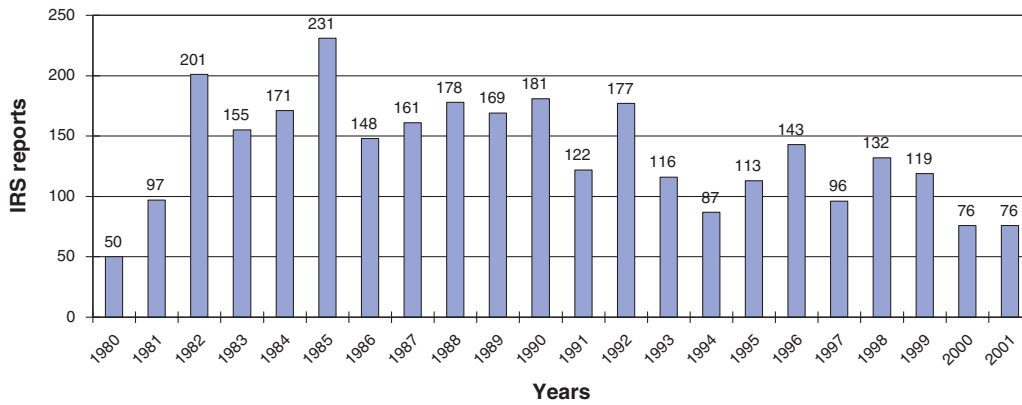


FIG. 2. Number of events reported to the IRS, 1980–2001.