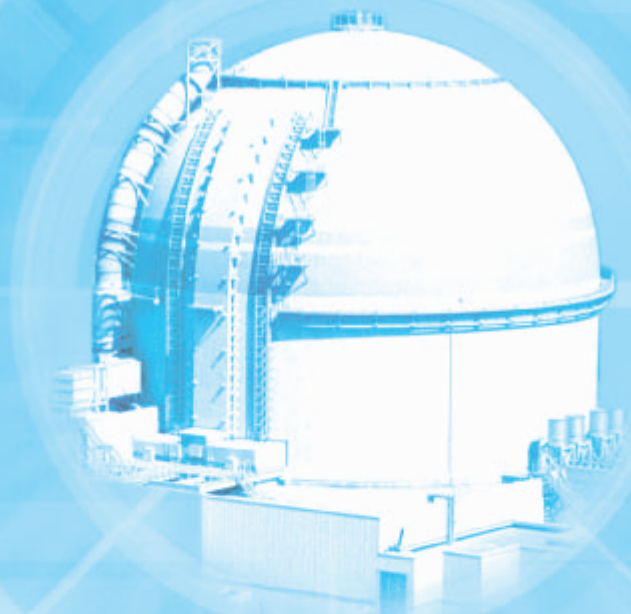


# Safety



# Safety of Nuclear Installations

## Objective

To increase the capability of Member States to achieve and maintain a high level of safety in nuclear installations under design, construction or operating.

## Key Issues and Highlights

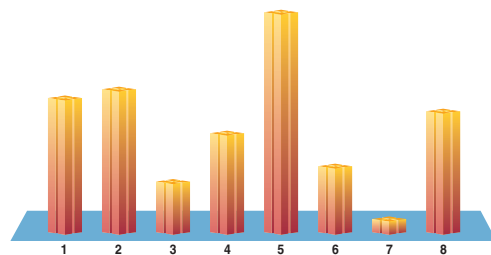
- Seven Safety Guides were published, with eight more approved and in the process of being published.
- There was continuing demand for Agency safety review services. They showed a general improvement in the safety of nuclear power plants and implementation of corrective safety measures, and progress in enhancing the effectiveness and technical capabilities of regulatory bodies.
- Progress was made towards the establishment of an international Code of Conduct on the safety of research reactors.
- An international conference on safety culture in nuclear installations was held in Rio de Janeiro, Brazil.

## Regulatory Infrastructure for Nuclear Safety

Four Safety Guides were published covering various aspects of legal and governmental infrastructure for the safety of nuclear facilities (see Table A20 in the Annex for a list of all Safety Standards issued in 2002). These support the Safety Requirements on legal and governmental infrastructure for safety published in 2000.

The Agency's International Regulatory Review Team (IRRT) service studies the effectiveness of regulatory bodies and exchanges information and experience. Recent follow-up IRRT missions indicate that these bodies have been making significant progress in resolving issues raised during previous missions. In 2002, revised guidelines for the IRRT service were

Regular budget expenditure: \$6 852 874  
 Extrabudgetary programme expenditure  
 (not included in chart): \$3 067 684



1. Regulatory Infrastructure for Nuclear Safety: \$1 091 423
2. Development of Safety Assessment Methods and Tools: \$1 160 064
3. Engineering Safety of Small and Medium Sized Reactors and New Nuclear Power Plants under Construction: \$404 804
4. Engineering Safety of Existing Nuclear Installations: \$807 928
5. Operational Safety: \$1 789 308
6. Research Reactor safety: \$525 794
7. Safety of Fuel Cycle Installations: \$99 222
8. Fostering Harmonization in Nuclear Safety: \$974 331

published that included lessons from several years of experience gained in conducting IRRT missions.

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 in 2000 and 2001, the number of reports submitted continued to decrease in 2002. Analysis of the answers to a questionnaire sent to the national IRS co-ordinators shows that fewer resources are being dedicated to the preparation of these reports by Member States.

## Development of Safety Assessment Methods and Tools

Peer reviews of a probabilistic safety assessment (PSA), as carried out in International Probabilistic Safety Assessment Review Team (IPSART) missions, can enhance the quality of the PSA, thus strengthening its credibility for supporting safety related decisions. In

a mission conducted to the HFR research reactor at Petten in the Netherlands, the “Risk Scoping Study” developed for this installation made use of simplified PSA techniques adjusted to the particular design and operational features of a research reactor.

As part of the extrabudgetary programme ‘Accident Analysis and its Associated Training Programme for the RBMK-1000 Kursk-1 NPP’, a study was published to evaluate, define and establish a sustainable accident analysis infrastructure at the plant. A second phase is continuing with the development of an Integrated Training and Accident Analysis System (ITAAS) to provide a safety analysis capability and associated training to plant personnel and to the Russian regulatory body.

A CRP to develop the Agency’s framework for the implementation of safety performance indicator systems for nuclear power plants was completed. The CRP has helped the participating plants to adapt and fine-tune the Agency framework to their particular needs. In turn, they have provided feedback to the Agency on the use of the framework and proposed improvements.

### **Engineering Safety of Small and Medium Sized Reactors and New Nuclear Power Plants under Construction**

A Safety Guide, *Instrumentation and Control Systems Important to Safety in Nuclear Power Plants*, was published in 2002, the third in a series supporting the new Safety Requirements for design published in 2000. Three other Safety Guides on design safety have been approved and will be published in 2003, and a further six are at an advanced stage of preparation.

Missions on the safety of new nuclear power plants were conducted in China. Two missions were related to fire hazard analysis and core design and fuel management at the Tianwan nuclear power plant project, while three focused on reviewing draft utility safety requirements for evolutionary nuclear power plant designs.

Building upon assistance provided to South Africa, the Agency is working on the development of a general approach for assessing the safety of the design of advanced and innovative reactors, and more broadly for all reactors (including research reactors) with characteristics that differ from those of LWRs. In this regard, a new method was developed for the safety

assessment of innovative reactors based on the defence in depth principle.

### **Engineering Safety of Existing Nuclear Installations**

A safety review mission to Kozloduy, in Bulgaria, reviewed the results of more than a decade of safety upgrades and assessments at units 3 and 4, including a series of actions recommended by various Agency review teams. The team concluded that the operational and design safety at Kozloduy now corresponds to the level of improvements seen at plants of similar vintage elsewhere. Many of the safety measures adopted for these plants in the design, operation and seismic areas exceeded those that were foreseen.

The Agency has a long-standing project to provide assistance to the Islamic Republic of Iran with respect to the construction of the Bushehr nuclear power plant, and particularly to the preparation and review of the preliminary safety analysis report (PSAR). Seven missions in the design safety area were conducted during 2002, some to the reactor site and some to the Russian Federation, where the plant’s designers are based. A large mission in September reviewed answers provided by the contractor to recommendations from the Agency. The Agency team suggested a final review of the PSAR in 2003.

Agency missions visited the Armenia nuclear power plant during 2002: two in relation to a seismic re-evaluation of the plant and one to review the plant’s ageing management programme. The support to the seismic re-evaluation programme was concentrated on a review of the geotechnical investigations, on a review of the evaluation of the structural capacity and on the development of a probabilistic seismic hazard assessment. The support given to the ageing management programme included a review by Agency experts of the regulatory requirements and plant procedures developed by the Armenian organizations.

A CD-ROM was issued in 2002 entitled *IAEA Guidance on Ageing Management for Nuclear Power Plants*. This collects all of the safety standards and other Agency documents that provide guidance on the effective management of the physical ageing of systems, structures and components important to safety for nuclear power plants.

Intergranular stress corrosion cracking of austenitic stainless steel piping in BWRs has been a major safety concern since the early 1970s. Similar degradation was

found in RBMK reactor piping in 1997. An extrabudgetary programme initiated in 2000 to assist countries operating RBMK reactors in addressing this issue was completed in 2002 (see [www.iaea.org/ns/nusafe/ebpigscc.htm](http://www.iaea.org/ns/nusafe/ebpigscc.htm)). The programme's results included: improvements in the quality and reliability of in-service inspection; comparison of flaw assessment methods leading to a set of recommendations on inspection requirements; development of improved methods for the repair and mitigation of cracks; and recommendations for other mitigation strategies based on water chemistry.

## Operational Safety

Four Safety Guides published in 2002 supported the Safety Requirements document for the operation of nuclear power plants. The new Guides discuss the operating organization, core management and fuel handling, maintenance, surveillance and in-service inspection, and the recruitment, qualification and training of personnel. The suite of safety standards on operational safety is now close to completion, and these standards will form the basis for the Agency's operational safety review services.

The Agency's review services often trigger requests from the Member States visited for further activities linked to topics identified by the reviews. During 2002, workshops were conducted on managing the early termination of nuclear power plants and on configuration management. Seminars were held on operational safety during commissioning and for inspectors from the corporate office of the operating organization on the Operational Safety Review Team (OSART) methodology.

In 2002, three OSART missions, five OSART follow-up visits and five preparatory meetings were carried out. On average, the rate of resolution of and compliance with the Agency's recommendations in follow-up missions has continued to improve over the last five years and in 2002 reached 97%. Improvements were observed in safety management, industrial safety, plant material conditions, reporting criteria and analysis of low level events, standards for quality management systems, and expanded use of safety performance indicators.

The Agency held an international conference on 'Safety Culture in Nuclear Installations' in Rio de Janeiro in December 2002. The conference demonstrated that safety culture is now recognized

throughout the world as a mature concept and a crucial element of nuclear safety. The most important conclusions from the conference related to the need for further development and use of assessment models that can serve as indicators of safety culture, more effective means for enhancing safety culture and better definition of the appropriate role of the regulator in relation to an operating organization's safety culture.

## Research Reactor Safety

In 2001, the General Conference endorsed a decision of the Board to request the Secretariat to develop and implement, in conjunction with Member States, an international research reactor safety enhancement plan. Two of the tasks in this plan were to prepare a Code of Conduct on the safety of research reactors and to conduct a survey of research reactor safety in Member States.

A meeting of experts in December 2002 agreed on the draft text of a Code of Conduct. The objective of the Code is to achieve and maintain a high level of nuclear safety in research reactors worldwide through the enhancement of national measures and international co-operation. The draft Code specifies the respective roles of the State, the regulatory body, the operating organization and the Agency's Secretariat in pursuing this objective.

With regard to the survey, 55 of the 67 Member States that have or plan to construct research reactors had responded at the end of 2002, although only about half of the States responding have as yet provided information on all of their research reactors. Of the 55 States that responded, 41 stated that they observed standards that were identical or similar to the Agency's safety standards. One of the main findings from these responses was that most, but not all, of the reactors reported to be in a state of extended shutdown were in Member States with good regulatory supervision programmes.

Three Integrated Safety Assessment of Research Reactors (INSARR) missions were carried out in 2002, and a pre-INSARR mission visited Viet Nam. The Agency also conducted expert missions on research reactor safety where it has a specific responsibility to monitor the safety of research reactors provided under its project and supply agreements. During 2002, expert missions visited research reactors in three States and two follow-ups to earlier missions were also conducted.

## Safety of Fuel Cycle Installations

At the request of the Commission on Safety Standards, the Secretariat is developing a set of standards to address 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 are being prepared.

To complement these publications, a technical document was issued on procedures for conducting PSAs for non-reactor nuclear facilities. The aim is to promote a standardized framework, terminology and form of documentation for these PSAs. The report indicates that the depth of analysis should be commensurate with the risk posed by the facility.

## Fostering Harmonization in Nuclear Safety

The International Nuclear Event Scale (INES) is used by 60 countries for facilitating rapid communication to the media and the public regarding the safety significance of events at all installations associated with the civil nuclear industry, as well as events involving the use of radiation sources and the transport of radioactive material. A total of 27 events were reported in 2002, of which 7 were at level 1, the lowest level of safety significance, 13 were at level 2 and 3 were at level 3 (Fig. 1).

The Nuclear Events Web-based System (NEWS), managed jointly by the Agency, OECD/NEA and

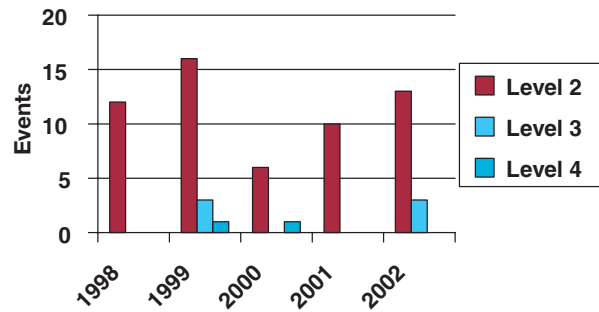


FIG. 1. Reporting of events to INES, 1998–2002.

WANO, is designed to provide authoritative information rapidly on the occurrence of nuclear events. Following a period of trial use, NEWS began to be used for the exchange of reports and related information provided by Member States under the INES system. Over the course of 2002, the number of users who registered for NEWS increased by a factor of two and the number of visits to the site per month by a factor of three. The system can be accessed at [www-news.iaea.org/news/](http://www-news.iaea.org/news/).

More than 80 training events of various types were conducted on nuclear safety in 2002 to enhance knowledge, understanding and use of the Agency's nuclear safety standards by Member States. As one element of its strategic plan for education and training in nuclear safety, the Agency began a review and advisory service for national education and training programmes. The first four such missions were conducted during 2002 under the extrabudgetary programme on the safety of nuclear installations in the South East Asian, Pacific and Far Eastern regions.