

THE 2002 IAEA SCIENTIFIC FORUM

NUCLEAR LIFE CYCLES, KNOWLEDGE AND SECURITY



In September 2002, leading experts from around the world participated in the IAEA's Scientific Forum, held in conjunction with the Agency's General Conference. A concluding report to the Conference was presented by Mr. Mohammad Ridwan, head of the Nuclear Control Board in Indonesia. It highlighted major points of discussion during three Forum sessions: nuclear power life cycle management; the management of nuclear knowledge; and nuclear security. The full report follows:

The Fifth Scientific Forum, organized during the 46th Regular Session of the IAEA General Conference, took place in the Austria Center, Vienna, on 17-18 September 2002, and focused on three topical issues: Nuclear Power – Life Cycle Management; Managing Nuclear Knowledge; and Nuclear Security. Each of the three sessions consisted of presentations by leading experts in the field, followed by panelists' comments and then discussions with participants. Also each session was moderated by a

leading expert in the respective field.

Nuclear Power & Life Cycle Management. The discussion was devoted to two sub-topics, namely Life Extension of Nuclear Power Plants and Decommissioning. The nuclear industry is, at present, at a crucial juncture, where it has to decide about the future of the first generation of nuclear plants, which are approaching the end of their licensed service life. At the same time, long term experience and new advances have established that it is possible to extend the life of nuclear plants beyond their initially licensed life by another 20-30 years. While some utilities and regulatory bodies have already gone ahead with license renewal or extension, many others are still exploring various possibilities concerning these processes.

The session addressed key issues, concerns and trends in the life cycle management of nuclear power plants – from construction to operation and then to decommissioning. Measures to cope with ageing plants, li-

cense renewal, expected growth in electricity demands and the need to find sustainable long term solutions for closed or ageing nuclear facilities were presented, including examples of experience from FORATOM (European Atomic Energy Forum), Japan, the United Kingdom, the United States, the Russian Federation and Hungary.

Life extension is considered to bridge the gap between ageing and new plants and between energy demand and supply. It is technically feasible, economically attractive and able to be regulated successfully. Nuclear power plants are capital intensive and therefore extension of their operating life will provide a very significant financial advantage besides avoiding new generation capacities. The cost of nuclear power plant life extension, according to Russian experience, is around US \$160–200/kW installed capacity, while in the US the process costs 10 to 15 million US\$ per unit, excluding any cost of additional hardware since plant upgrade is not part of the license renewal process.

Information from the European Commission's *Green Paper* on the Security of Energy Supply and current policy development indicates that the

Distinguished experts participated in the Forum. Session moderators were Dr. V. K. Chaturvedi, India; Mr. Dave Torgerson, Canada; and Dr. Richard Meserve, USA.

potential growth of the European Union together with the reduction of nuclear energy as plants reach the end of their life would lead to an increase in carbon dioxide emissions by 31% and a dependency for the enlarged Union on imported energy of 60%. In the United States, ten licenses have been renewed to permit a 60 year operational life; nearly half of the existing plants have submitted license renewal applications and many more were expected to do so.

For decommissioning, it is not efficient or reasonable for each country to develop its own technologies and approaches. The costs of decommissioning are high and may place a heavy burden on national budgets. The most cost effective approach includes the use of proven practices rather than each organization developing new techniques. Decommissioning should be a key consideration in the design of new facilities, which would save much time and effort and reduce the risks of exposure during decommissioning.

It is essential to recruit and maintain a strong and highly skilled workforce to ensure secure, safe and economic future license renewal and plant decommissioning operations. The motivation of this workforce should be a major concern of the facility management. This should ensure that the operational culture of the plant is maintained at a high level as the plant is seen to be reaching the end of its economic life, and plant activities involve restoring the environment rather than creating energy.

The IAEA could act as a catalyst to enable the dissemination of experience in license renewal

and decommissioning activities to all Member States. In addition, the IAEA should identify proven practices in license renewal and procedures that have been demonstrated, to achieve efficient review of applications. The IAEA should produce guidance on the scope of safety and environmental reports in support of license renewal and on standards and proven practice required to achieve safe and economic operations during decommissioning.

The issues arising from this session require further consideration. It is proposed that these issues are presented to SAGNE (Standing Advisory Group on Nuclear Energy), TWG (Technical Working Group) on Plant Life Management and the proposed TGDE (Technical Group on Decommissioning) so that advice can be sought and given on future actions to be taken.

Nuclear Knowledge. The second session of the Forum focused on Managing Nuclear Knowledge and served to re-enforce the view that nuclear knowledge is a timely subject of strategic importance. It is an issue that concerns all Member States that use nuclear technologies for either power or non-power applications. It needs to be addressed to ensure the continued safe use of these technologies.

Throughout the discussions, participants, keynote speakers and panelists strongly endorsed the key findings from the meeting of senior officials on Managing Nuclear Knowledge held in June 2002, in particular with regard to: the urgency of the problem, the clear understanding that all nuclear technology and its innovation relies

on nuclear knowledge, and the importance of addressing succession planning and preserving knowledge.

It was the consensus view that preserving and enhancing nuclear knowledge is a topic on which the Agency is well suited to take a leading role, particularly in terms of promoting Member States' increased awareness of the issues involved, and in facilitating international and regional collaboration. A proposal was made for the Agency to establish, as soon as possible, a working group to address these issues, including giving practical advice on both the programme and its implementation. Also, participants emphasized that this new activity needs to be equipped with sufficient resources and funding, and that extrabudgetary contributions by Member States as well as resources from the Regular Budget would be needed.

The moderator of the session noted that a resolution on "Knowledge Management" would be submitted to the General Conference. The very large number of Member States co-sponsoring this resolution in the Committee of the Whole clearly shows the great importance Member States assign to that topic.

Problems were identified and possible innovative solutions proposed, including long distance education, clusters and networks and a knowledge management portal. Now, it is time to take action and to give increased attention to knowledge management activities in the Agency, notably in terms of funding and resource allocation.

Nuclear Security. In the session on Nuclear Security, the

keynote speakers spoke on issues related to risk assessment, the control of radioactive sources and new approaches to protecting nuclear material and facilities. It was noted that security was not a new concern for the nuclear industry, which had long considered the threat of theft of [special] nuclear material and sabotage. Extensive measures had already been taken in the field of physical protection. Furthermore, nuclear power plants have the strongest defensive capabilities to be found in the commercial world: the result of inherent defensive capabilities arising from designs to withstand extreme events. Nonetheless, further measures are needed to improve security measures, to identify and mitigate vulnerabilities, and to refine the assessment of potential threats.

Identifying and evaluating potential threats and the consequent assessment of risks have an added impetus since the events of last September. Preventative measures result from an assessment of the threat and risk. To these could be added precautionary measures, which address the consequences of an event without being able to fully assess the risk that it will occur. Security assessment is not like establishing a safety case, which could rely on redundancy and sound scientific knowledge, separation and diversification, and identification of common mode failures.

It was noted that there was a distinction to be made between threats which should be addressed by the State; (e.g. aircraft hijacking, or attacks), and those which are facility related; (e.g. a direct assault on a nuclear plant by a small group), which would be the subject of the Design Basis Threat and are the responsibility

of the operator. The boundary between the two is not clear and must be clarified.

The session also considered the competing interests of maintaining public access to information with the need to protect information. But confidentiality must also be maintained to avoid providing assistance to an attacker.

On the issue of radiological sources and their potential to be used in radiological dispersion devices (RDDs or "dirty bombs") the session considered the risks and consequences. The difficulties in Kazakhstan of identifying and controlling radioactive sources provided a case study in the problems of other States, which found themselves in a similar position. The issues are lack of effective controls, lack of detection equipment, imperfect application of established procedures, and lack of appropriate intergovernmental agreements. The solutions included enhanced accountancy and legislative framework for radiation sources, increased physical protection of sources, improved international co-operation on combating illicit trafficking and better response measures. The session recognized a need to establish "cradle-to-grave" control of radiological sources and that the issue of orphan sources could be solved by ensuring that there was an appropriate "grave" for sources which had outlived their usefulness.

Ideas for enhancing physical protection measures on both a regional and a global scale were proposed. The former included establishing regional networks to exchange information and experience among States. The latter included establishing a list of priorities, which would include revising INFCIRC/225 and devel-

oping new security recommendations, along the same lines, for the protection of radiological sources. Such sources are covered by safety guidance but not security guidance covering physical protection.

The session recognized the threat of terrorist use of RDDs and the priority of establishing security measures applicable to the radiological sources which offered the greatest threat. The session also noted a proposal for an International Conference to discuss the threat posed by the potential misuse of radiological materials (since scheduled for March 2003 in Vienna, Austria). Facilities in need of enhanced protection might also be prioritised; assistance may be available under the G8 initiative. Other ideas included creating a multi-lateral security cooperation system, which intended to facilitate the exchange of information, measures to improve co-operation among nuclear regulators, security forces and intelligence agencies, tagging and tracking the movement of radioactive sources and financial incentives for operators to improve physical protection measures at nuclear facilities.

The Fifth Scientific Forum addressed three key issues for the nuclear community. In order to ensure the security of nuclear materials, it is necessary to continue safe and economic nuclear operations with the retained knowledge for the future. Proposals have been made for several actions by the Agency and these are commended to you. □

More information about the Forum and IAEA General Conference is available on WorldAtom at www.iaea.org.

HIGHLIGHTS OF IAEA DIRECTOR GENERAL STATEMENT AT SCIENTIFIC FORUM

NUCLEAR POWER LIFE CYCLE MANAGEMENT

Extending the operating life of existing nuclear plants will help to reduce the short term need for new generating capacity - without new capital costs. However, these extensions must take place in the context of careful safety analysis and monitoring of equipment ageing concerns. As this process begins to go forward in more countries, it will be vital that insights are shared on all fronts - technical data, safety considerations and regulatory policies. I hope that this Forum will identify opportunities for such networking.

Decommissioning also remains a challenge. While successful decommissioning and site restoration has been effectively and safely demonstrated, some public concerns remain. Again, it is vital that we learn from experience and share insights, to optimize the use of existing decommissioning resources, to address waste storage and disposal concerns, and to enhance public acceptance of the process. Experience has also shown that by improving up front the design and operation of nuclear facilities, using simple, low cost measures, we can make their eventual decommissioning safer and less costly.

MANAGING NUCLEAR KNOWLEDGE

Like any highly technical endeavor, the use of nuclear technology relies heavily on a vast accumulation of knowledge - volumes of scientific research, engineering analysis, operational data, regulatory reviews and many other types of technical information - combined with a complex assortment of people with the requisite educational background, expertise and acquired insight to apply that body of knowledge safely and effectively.

The effective management of nuclear knowledge includes ensuring the continued availability of this essential reservoir of qualified personnel. As the nuclear workforce ages and retires, and support decreases for university programmes in nuclear science and engineering, this issue is becoming critical to ensuring safety and security, encouraging innovation, and making certain that the benefits of nuclear energy - related to human health, food and agriculture, water management,

electricity supply, and a host of other applications - remain available for future generations.

The Agency in June 2002 convened a meeting to learn what Member States are doing and to determine what more can be achieved through cooperative international efforts. We hope through this Forum discussion to extend that dialogue - to better understand, for example, how to attract more young people to nuclear fields, how to promote better networking among academic institutions with nuclear programmes, and how to promote mutual support on this issue among governments, industry leaders, and universities.

NUCLEAR SECURITY

Well before 11 September 2001, the Agency was conscious of the need for the security of nuclear material, as evidenced by the Convention on Physical Protection of Nuclear Material - although this was somewhat limited in its coverage - and by the presence of Agency guidelines. However, 11 September was clearly a wake-up call for us in this area. For radioactive sources, the security element has also been an essential component for many years, but primarily as a pre-condition for radiation safety. One aspect that I hope you will consider in the Forum discussions is to what extent the security framework for nuclear material can be adapted for radioactive sources - in terms of the methods and modalities for assessing risk and threat, as well as the means of achieving adequate protection.

In a similar sense, given the extensive efforts to strengthen and expand all aspects of our nuclear security programme over the past twelve months, I believe the time is ripe for a reflective look at the scope and effectiveness of our approach. Nuclear security must be considered for all nuclear applications, in a manner that encompasses all phases of nuclear activity - the use, storage and transport of nuclear and other radioactive material, as well as the design, operation, and decommissioning of nuclear facilities. Our framework must also be broad enough to consider the needs of all States, regardless of the size of their nuclear programme, and should be supported by all.