

NEA

Annual Report

2002



N U C L E A R • E N E R G Y • A G E N C Y

Organisation for Economic Co-operation and Development

The NEA in Brief

28 member countries (22 in the Data Bank)

Governing body: the Steering Committee for Nuclear Energy

44 years of international service

7 standing technical committees

14 international joint projects funded by participants

72 professional and support staff

572 national experts participating in NEA committees

4 000 experts participating annually, on average, in policy and technical meetings organised at OECD headquarters

€ 9.5 million budget for the NEA in 2002, supplemented by voluntary contributions

€ 2.6 million budget for the Data Bank in 2002, supplemented by voluntary contributions

64 publications produced in 2002



The Nuclear Energy Agency (NEA) is a semi-autonomous body within the Organisation for Economic Co-operation and Development (OECD), located in the Paris area in France. The objective of the Agency is to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes.

The European Commission (EC) takes part in the work of the NEA. A co-operation agreement is in force with the International Atomic Energy Agency (IAEA). The NEA also maintains contacts with several non-member countries as well as the nuclear industry and a number of civil society organisations.

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Mr. Luis Echávarri
Director-General of the NEA

2002 in Perspective

Reflecting developments in OECD countries in the nuclear energy field, the year 2002 was a very productive one for the Nuclear Energy Agency (NEA), putting to test its capabilities to adjust quickly to a changing environment and to pool member countries' resources to bolster new concepts, new analyses and new projects in a variety of areas, where the need for multilateral co-operation was felt by the membership.

Common denominators influencing these efforts included energy market deregulation, environmental policies to limit greenhouse gas emissions and the commitment to develop future reactor and nuclear fuel cycle technologies.

This annual report highlights the main directions pursued in the NEA programme of work, and the most significant results achieved during the year. It may be mentioned that one of the challenges confronting the NEA in establishing and carrying out its programme of work is to maintain a careful balance among the different areas in which it is active in order to best meet the wishes and needs of a diversified membership, which includes countries with nuclear power programmes, and others without such programmes or in the process of phasing them out.

The following highlights of the Agency's 2002 activities help demonstrate the point:

- The analysis by the NEA of the role of nuclear energy in the context of sustainable development, which was tabled at the OECD Ministerial Meeting and the UN Commission on Sustainable Development, paving the way to the Rio +10 meeting in Johannesburg where the NEA presented its report on *Nuclear Energy and the Kyoto Protocol*. Further work was carried out in 2002, notably on indicators of sustainable development.





- The Agency's technical support to the Generation IV International Forum, which concerns the development of innovative reactors and associated fuel cycles for commissioning by 2030.
- NEA activities regarding the analysis, prevention and management of accidents to limit their occurrence and reduce their potential consequences, including in particular the creation and continued operation of joint nuclear safety R&D projects.
- Work on how to maintain regulatory effectiveness and adequate capability in regulatory research.
- The support provided by the Agency to the International Commission on Radiological Protection (ICRP) in modernising the latter's radiological protection recommendations, and the investigation of solutions for better integrating radiological protection within current concepts of and approaches to risk governance.
- NEA efforts concerning radioactive waste management, including ways to improve technical experts' and civil society's confidence in geological disposal of long-lived high-level waste, and an international peer review of a United States Department of Energy study regarding the recommendation process for the Yucca Mountain spent fuel and high-level waste disposal site.
- The organisation of the second session of the International School of Nuclear Law, in France, to enhance the training of young lawyers across NEA membership and beyond, in the multifaceted aspects of nuclear legislation and regulation.

These few examples testify to the diversity and versatility of the role that the Nuclear Energy Agency continued to play in 2002, putting to good use the resources of international co-operation for the benefit of all its members.



Trends in Nuclear Power

Nuclear energy development

At the end of 2002, 362 nuclear power units were connected to the grid in OECD countries, providing approximately 24% of total electricity supply in the OECD area. Three new nuclear power units were brought into operation: one in the Czech Republic and two in Korea; two units were retired in the United Kingdom. Seven units were under construction: three in Japan, two in Korea and two in the Slovak Republic. While total electricity generation in OECD countries is projected to increase in the next decade, the nuclear share is likely to decline slowly due to expected closure of ageing plants. Licence extensions and the commissioning of new units will, however, offset part of this trend.

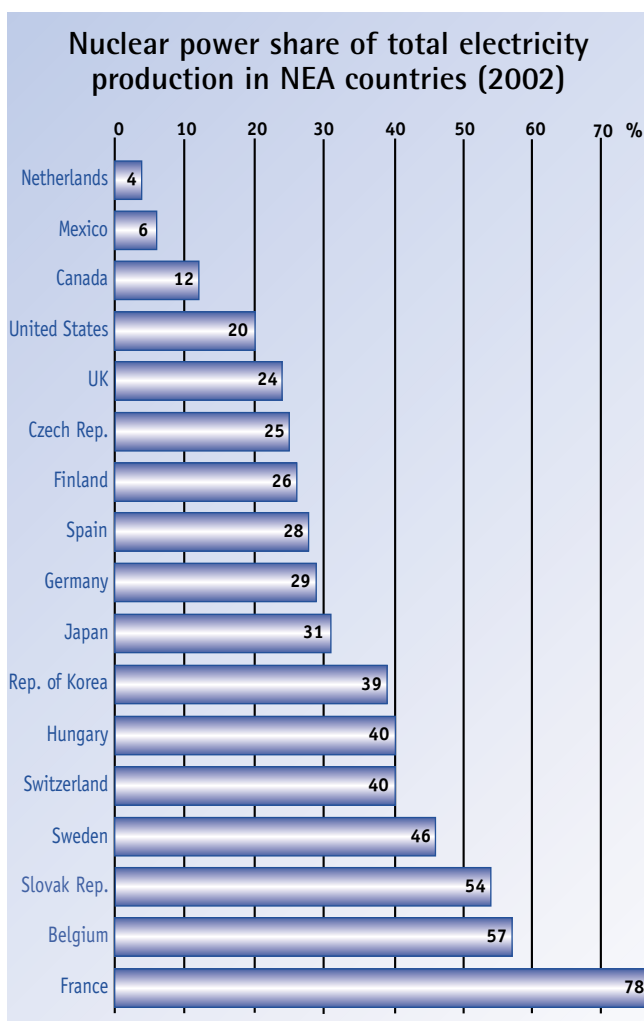
Some OECD member countries have recently been showing renewed interest in nuclear energy due to its potential role in ensuring stable energy supply, increasing diversification and reducing external dependence on oil and gas, as well as alleviating the risk of climate change. The nuclear option has been brought back on the agenda of several energy policy makers in Europe and North America. For example, the "G8 energy summit", held in Detroit, Michigan (United States), stressed the importance of the nuclear option for energy security and diversification, and environmental protection.

The role of nuclear energy in reducing carbon dioxide emissions and alleviating the risk of global climate change has been recognised by several national and international studies and fora. For example, the Performance and Innovation Unit (PIU) report in the United Kingdom recognised the role of nuclear power as a carbon-free energy source and the EU Green Paper on energy noted the contribution of nuclear energy to meeting the Kyoto Protocol targets. However, the role of nuclear energy in sustainable development remained a controversial issue at the international level as demonstrated by the World Summit on Sustainable Development (WSSD), held in Johannesburg, South Africa, and the 8th Conference of the Parties to the UN Framework Convention on Climate Change (COP8), held in New Delhi, India.

In the United States, the Secretary of Energy released a "Roadmap to Deploy New Nuclear Power Plants in the United States by 2010", which concludes that "New nuclear plants can be deployed in the US in this decade, provided that there is sufficient and timely private-sector financial investment." At present, the industry is reviewing several reactor designs. In Finland, the Parliament authorised industry to pursue the project of constructing a new nuclear power plant. This was based on the conclusion that, in addition to the favourable consequences on reduced CO₂ emissions, the nuclear option chosen would have a more positive impact on both unemployment and the national economy.

On the other hand, some European countries are pursuing nuclear phase-out policies with varying speeds and horizons. For example, in Belgium and Germany nuclear phase-out laws have been introduced and implementation measures are planned for the coming years. However, in all countries that have chosen to relinquish the use of nuclear power, the implementation of alternatives remains an issue in the face of increasing electricity demand. In this context, Sweden, which decided on a phase-out in 1981, postponed the early closure of nuclear power plants due to the lack of appropriate alternative energy resources. To date only one unit has been shut down.

Electricity market deregulation has progressed in many member countries, accelerating consolidations of power plant ownership and mergers in the industry at the international level. The European



Union (EU) is in the process of completing an agreement on full deregulation of domestic electricity markets within several years. At the same time, market liberalisation has pushed many utilities to enhance economic effectiveness through increased availability factors, lifetime extensions and capacity uprating. Such highly competitive situations have led to the downfall of some. An example is the financial failure of the nuclear electricity generator British Energy plc in the UK, which arose following the introduction of new electricity trading arrangements there. Difficulties are also, however, being experienced by fossil-fuel electricity generators. Generally speaking, existing nuclear power plants are competing successfully with gas- and coal-fired power plants owing to their low marginal production costs and their good safety and reliability performance. Lifetime extensions and capacity uprating have proven to be cost-effective in many cases and often the cheapest way to increase electricity generation, provided that nuclear safety and regulatory requirements continue to be met.

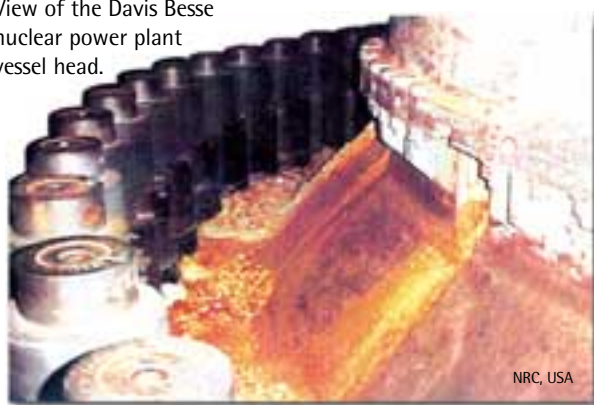
In a long-term perspective, the renewed interest in nuclear energy is demonstrated by international endeavours seeking to develop and deploy a fourth generation of nuclear energy systems that will respond to society's future needs. In particular, the Generation IV International Forum (GIF), a group of ten countries, released in December 2002 a comprehensive report entitled "A Technology Roadmap for Generation IV Nuclear Energy Systems".

The GIF Roadmap proposes international R&D programmes to demonstrate the viability and performance of six systems identified by the project members as promising in terms of: sustainability; safety and reliability; economics; and proliferation resistance and physical protection. The anticipated schedule, based upon the assumption of increased international collaboration in the field, would bring Generation IV nuclear energy systems to the market by the 2030 timeframe.

Nuclear safety and regulation

The safety performance of nuclear power plants in OECD countries continued to be very good, as reflected in a wide range of published performance indicators. Nevertheless, a number of significant events took place in 2002. Some of the most important were the corrosion of the reactor pressure vessel at the Davis Besse-1 plant (United States) and pipe ruptures due to hydrogen deflagration in the Hamaoka (Japan) and Brunsbuettel (Germany) nuclear power stations.

View of the Davis Besse nuclear power plant vessel head.



The analysis of operating events indicated that aspects requiring close attention include organisational change, hardware modifications, loss of technical expertise and loss of corporate knowledge. Issues of special relevance that were discussed by the OECD regulatory bodies in 2002 included the decommissioning of nuclear reactors, public communication, performance indicators both of nuclear safety and of regulatory effectiveness, maintaining nuclear safety competence, external hazards and regulatory requirements for future nuclear reactors. The cover-up by some utilities in Japan of the recordings of licensee self-imposed inspection activities demonstrated the need for greater safety awareness as well as strict control by national safety authorities.

Radiation protection

In 2002 radiation protection philosophy and application continued to evolve. Much of this evolution is driven by modern approaches to risk governance aiming at stakeholders' needs being more directly taken into account in accepted solutions. Several areas of broadest concern are reflected in ongoing international discussions. First, there is a desire to simplify and clarify the internationally accepted system of radiological protection, based on the 1990 recommendations of the International Commission on Radiological Protection (ICRP), as the system has grown to be very complex and contains certain discrepancies. Here, more focus is being put on case-specific national and cultural differences. It has also been recognised that technical aspects are only part of the necessary input for decisions regarding radiological protection; societal aspects must also be considered.



The health physics laboratory at Callaway nuclear power plant, in the United States, where environmental samples are measured for radioactivity.

Another concern is the radiological protection of non-human species, which is being addressed in a sustainable development context. The philosophy of what needs to be protected and why, and its scientific underpinning, are being further developed. Finally, work is under way to develop clear guidance on radiological protection from naturally occurring radioactive materials.

The radiation protection community continued its reflections on nuclear emergency management, focusing on possible longer-term aspects of decisions in this area. Interest and activity also increased in response to radiological accidents, such as lost sources, and as related to possible terrorist acts.

The radiological exposure of workers in nuclear power plants seems to have reached a level that can be called "as low as reasonably achievable" (ALARA). Over the past decade, exposures have fallen significantly and consistently, but are now beginning to show a more stable trend. This most likely reflects the balance that has been achieved between the need to perform dose-causing maintenance work on an ageing fleet of plants for nuclear-safety and/or plant upgrading, and the need to maintain worker exposures ALARA.

Radioactive waste management

The US spent fuel programme took a major step forward in July 2002 when the US Congress voted to endorse the Department of Energy's selection of Yucca Mountain as the site for the first national long-term geological repository for radioactive waste. Approximately one month later the President confirmed the Congress's action, paving the way for the next stage of the process; the Department of Energy will prepare and submit a construction licence application to the Nuclear Regulatory Commission. When considered with the developments in Finland and Sweden on repository siting, a clear trend can be seen towards implementing, in a realistic and practical way, measures for the final disposal of spent fuel and high-level waste (HLW).

In Canada and Germany, where significant ongoing waste management projects had been delayed, important steps have been taken to restructure the national programmes. In Germany, a committee, established by the government following the moratorium on the Gorleben site exploration, proposed a new procedure and general criteria for site selection which include both societal and geoscientific aspects. Regarding the disposal of waste with negligible heat generation, a licence has been given to convert the Konrad mine into a repository for radioactive waste. By the licensee's choice, however, the licence will not be executed until all court cases are settled. In Canada, a new Nuclear Fuel Waste Act entered into force in November 2002, which puts the onus on the waste owners to recommend an approach to managing the waste and to finance the long-term management. It also requires the establishment of a non-profit waste management organisation, which must consult with the general public.

Mixed messages came from Switzerland. The national implementer, NAGRA, submitted a feasibility study for disposal in Opalinus Clay, which demonstrates that high-level waste and spent fuel can be safely disposed of in Switzerland, and which will facilitate decision making in 2006 on further procedures for managing these wastes. New obstacles arose, however, for the long-term management of low- and intermediate-level waste when the Nidwalden canton rejected for the second time by public vote a project on research for, and construction of, a final repository for these wastes in the Wellenberg area. This negative vote may have reverberations on the forthcoming discussions on the nuclear law.

Finally, progress was noted in Japan, where the national implementing agency NUMO officially announced the start of "open solicitation for volunteers for primary investigation areas" for a HLW repository. This approach is based on the need for local community support in conducting a geological disposal programme for HLW, and is part of a three-tiered approach outlined in the radioactive waste disposal act of 2000.

Nuclear science

New challenges in the field of nuclear science are mainly related to proposals emerging from the recently launched studies on advanced reactor technology, for example those of the Generation IV International Forum (GIF), and continued studies on the feasibility of partitioning and transmutation of nuclear waste.

During the GIF selection process of new reactor concepts to be studied, considerable interest was expressed in high-temperature, fast reactors with closed fuel cycles. To respond to these interests, new materials that can withstand the high temperatures and also have good irradiation characteristics will have to be developed. In addition, the proposed closed fuel cycle option will initiate more research in the field of fuel reprocessing chemistry, for example pyrochemistry (dry reprocessing) methods.

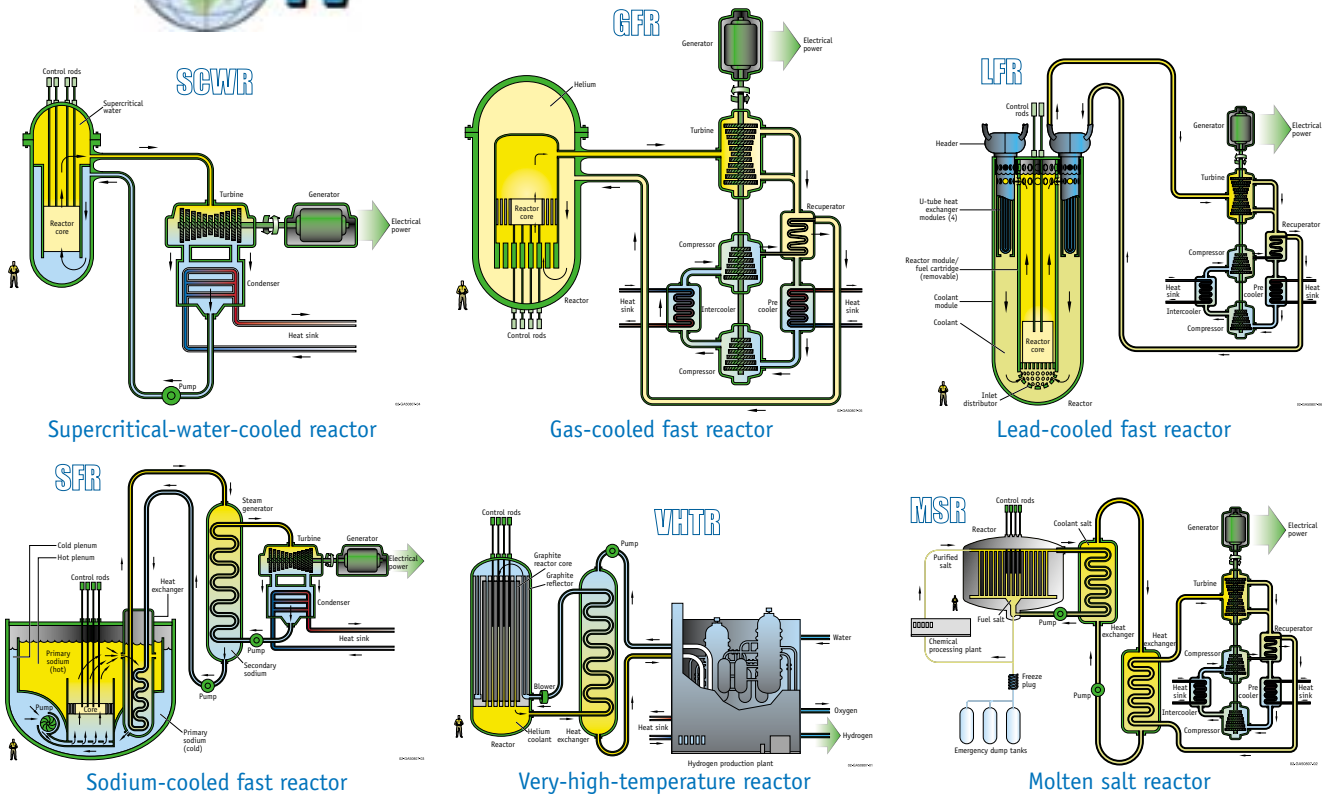
Studies are being pursued of different options to transmute nuclear waste, and therefore reduce the duration of its radiotoxicity and the volumes requiring disposal. The options for transmutation

Entrance to one of the tunnels at the Yucca Mountain site for radioactive waste disposal.





The next generation of nuclear reactors



Supercritical-water-cooled reactor

Gas-cooled fast reactor

Lead-cooled fast reactor

Sodium-cooled fast reactor

Very-high-temperature reactor

Molten salt reactor

include both conventional reactors and more advanced accelerator-driven, sub-critical reactors that use different coolants. Programmes are being carried out to model these systems in order to validate, against experimental data, both the calculation methods and the data used, before constructing any demonstration system.

Knowledge preservation and nuclear data

To validate both present and future nuclear systems, there is a need for well-documented experimental data and computer programs. In order to meet this requirement, it is important to collect and classify, in a central place, the information already available in laboratories around the world. This is especially important in today's context when the skilled workforce in the nuclear field is declining and experimental installations are becoming scarce. This issue of knowledge preservation is presently being addressed by the major international organisations working in the nuclear field.

Nuclear law

Modernising the international nuclear liability conventions and encouraging adherence to them will help ensure the equitable compensation of nuclear damage in the event of a nuclear incident, while at the same time facilitating international trade of nuclear materials and equipment. In response to efforts made by the international

community in 1997 to reform the Vienna Convention on Civil Liability for Nuclear Damage and to establish a global Convention on Supplementary Compensation for Nuclear Damage, the Contracting Parties to the Paris and Brussels Supplementary Conventions completed their negotiations on the revision of both Conventions, approved the final texts of both amending Protocols and agreed to convene a diplomatic conference in 2003 to adopt the Protocols. The major reasons for this revision were to ensure that significantly higher compensation amounts would be made available to a greater number of victims for a broader range of nuclear damage suffered, while at the same time ensuring compatibility with other international instruments in the nuclear liability field.

The trend towards strengthening institutional and legislative frameworks in the nuclear energy field in the countries of Central and Eastern Europe and the New Independent States remained evident. Countries from these regions continued in their efforts to adhere to the international nuclear conventions and to adopt or modify their national legislation accordingly.

The marked interest in maintaining a specialised summer course on nuclear law at the University of Montpellier 1, in close co-operation with the NEA, has been firmly demonstrated by the success of the first two sessions and in the number of applications received. This programme meets the concerns of OECD member countries to ensure that nuclear education and training are maintained at a high level, including in the field of nuclear law.

Nuclear Development and the Fuel Cycle

Nuclear Development Committee (NDC)

Set against the backdrop of renewed government interest in ensuring long-term security of energy supply and alleviating the risk of global climate change, the NDC has been focusing its activities on the technical, economic and policy issues of relevance for assessing the nuclear option as a sustainable supply source, taking into account environmental and social goals as well as economic efficiency objectives.

Nuclear policy issues

NDC activities in the field of sustainable development were pursued with emphasis this year on climate change issues. The Agency participated in the organisation of the OECD Forum Round Table on Nuclear Energy and Sustainable Development. A report was published on *Nuclear Energy and the Kyoto Protocol*, providing key facts and highlighting the challenges and opportunities for the future of nuclear energy in the context of implementing the Kyoto Protocol and beyond. It served as a basis for NEA informal presentations and discussions in side events organised in connection with the World Summit on Sustainable Development, held in Johannesburg, South Africa, in August, and in parallel with the Eighth Conference of the Parties to the UN Framework Convention on Climate Change (COP8), held in New Delhi, India, at the end of October.

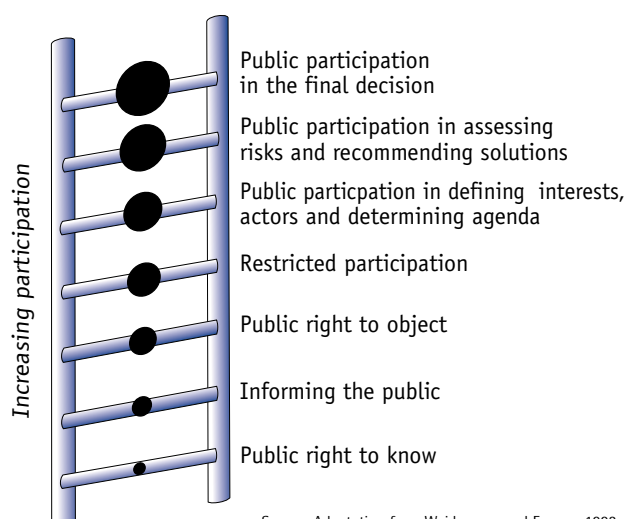
A report on *Society and Nuclear Energy: Towards a Better Understanding*, prepared under NDC auspices, was published. The publication is essentially a desk study compiling and analysing literature and research work on risk perception and communication, and public participation in decision making on nuclear energy projects. It provides a robust basis for further work on the societal aspects of nuclear energy that will be undertaken by the NDC in 2003. For more detailed information about NDC work in the area of civil society and nuclear energy, see page 32.

The NEA participated in the International Energy Agency (IEA) energy policy reviews of Germany, Hungary and Switzerland, countries where nuclear energy is a significant component of the supply mix. Nuclear policy issues were particularly important in Germany where an accelerated shut-down of nuclear power plants has been decided by the Government and the Parliament.

Economics

The proceedings of the joint IEA/NEA workshop on "Externalities and Energy Policy: The Life Cycle Analysis Approach" were published early in 2002. The publication includes all the papers presented at the workshop as well as a summary of the round table discussion and an executive summary that pulls together the conclusions and findings of the workshop. Building upon the outcome of the workshop and

The public participation ladder



Source: Adaptation from Weidemann and Femers, 1993

other work carried out previously at the NEA, the Secretariat is preparing a short report on external costs of nuclear energy for policy makers and analysts. Once reviewed and endorsed by the NDC, the report will be published as a free booklet for wide distribution.

Technology

The Seventh Information Exchange Meeting on "Actinide and Fission Product Partitioning and Transmutation" (P&T), which for the first time was organised jointly with the NEA Nuclear Science Committee, was held in Jeju, Korea on 14-16 October 2002. It brought together a large number of experts in the field and provided opportunities for very fruitful discussions between scientists and P&T experts. The proceedings from the meeting will be published in 2003. The Eighth Information Exchange Meeting will be held in Las Vegas, Nevada in 2004.

The comparative study on accelerator-driven systems and fast reactors in advanced fuel cycles aiming at partitioning and transmutation of minor actinides was completed and published. The experts

concluded that multiple recycling based on very efficient technologies could achieve drastic reductions in radiotoxicity of nuclear waste, up to 100-fold, but that a considerable amount of R&D was needed to reach this objective. Furthermore, the report stresses that the full potential of a transmutation system could be exploited only if it was utilised for a period equal to or exceeding a century.

Further work concerning the back-end of the fuel cycle will be undertaken in 2003 and will focus on the impact of advanced fuel cycles, including P&T, on the required physical characteristics and costs of repositories for high-level waste disposal.

The key findings and conclusions from the "Three Agency Study" on innovative nuclear energy systems were published mid-year in a summary report entitled *Innovative Nuclear Reactor Development: Opportunities for International Co-operation*. The report includes recommendations for enhanced collaborative R&D on advanced reactors within international frameworks.

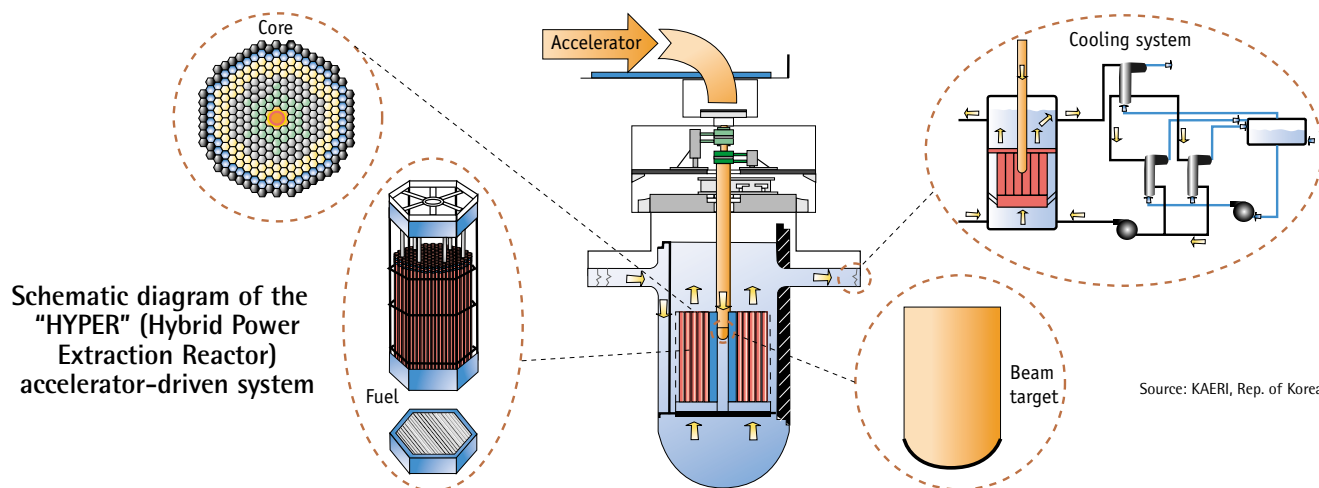
The Agency continued supporting the activities of the Generation IV International Forum (GIF), initiated by the US Department of Energy and carried out by ten countries (including three non-NEA member countries). The selection of six Generation IV concepts and the completion of the GIF Roadmap by the end of 2002 constituted key milestones in the project. The Technology Roadmap recommended concept-specific and cross-cutting R&D programmes that are expected to be pursued jointly by GIF countries in 2003 and beyond. A small programme on cross-cutting economic issues will start early in 2003 with the support of the NEA.

- Issues related to nuclear energy and sustainable development were addressed in several high-level meetings, including the OECD Forum 2002, the World Summit on Sustainable Development and the Eighth Conference of the Parties to the UN Framework Convention on Climate Change (COP8). The Agency contributed to the debate drawing from findings of its study on *Nuclear Energy and the Kyoto Protocol* as well as earlier works.

- A report on society and nuclear energy was published addressing risk perception and communication, and public participation in decision making on nuclear energy projects.

- A comparative study on accelerator-driven systems and fast reactors in advanced nuclear fuel cycles was completed and published in 2002. It provides an overview of opportunities and challenges associated with partitioning and transmutation (P&T) of minor actinides.

- The Agency continued to participate in the activities of the Generation IV International Forum (GIF) and provided assistance to GIF countries during the preparation of the technology roadmap, issued at the end of 2002.



Data and resource assessment

In the field of resource assessment, the 19th edition was published of the Joint NEA/IAEA report on *Uranium: Resources, Production and Demand*, familiarly known as the "Red Book". Efforts are under way to improve the methods for gathering data, notably by allowing the use of the internet. Trials of the system are planned for 2003 and if successful, this concept would be extended to *Nuclear Energy Data* (the "Brown Book").

The 2002 edition of *Nuclear Energy Data* offers additional data and graphical representation of key statistics on nuclear energy in OECD countries. It provides a comprehensive international overview

of nuclear electricity capacity, generation and fuel cycle activities. The 2002 edition includes additional textual information provided by member country governments on nuclear energy programmes and policies.



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Nuclear Safety and Regulation

Committee on the Safety of Nuclear Installations (CSNI)

The CSNI contributes to maintaining a high level of safety performance and safety competence by identifying emerging safety issues through the analysis of operating experience and research results, contributing to the resolution of these issues and, when needed, establishing international research projects.

Regulator and industry co-operation on safety research

A group of senior experts representing research organisations, the nuclear industry and regulatory bodies analysed the potential advantages and disadvantages of regulator-industry collaboration in safety research and provided recommendations on how to overcome possible difficulties. The group's report is intended to provide research managers with information on current practices, to identify means of establishing effective collaboration and to highlight possible areas of concern. Principles to be used in deciding when and how to collaborate are also discussed in the report. These principles are meant to ensure that transparency and the independence of the regulatory decision-making process are maintained.

Nuclear installations and external hazards

A workshop on nuclear installations and external hazards was held in Paris in April. The workshop allowed specialists from 19 countries to exchange information on the methodologies used to analyse impacts and large fires affecting concrete structures. The workshop concluded that well-established methods exist for some aspects of the analysis, but for others, important gaps exist that will require research and analytical development to achieve adequate capability.

Advanced reactor safety issues and research needs

A workshop was organised on this subject in collaboration with the International Atomic Energy Agency (IAEA). Its purpose was to bring together a broad cross-section of parties – designers, utilities, regulators and researchers – with a potential stake in the development and deployment of advanced nuclear power plants. The meeting discussed safety issues raised by various advanced reactor concepts, the scope of research needed to address these issues and a potential approach to their resolution.

Analysis and management of accidents

As in previous years, the largest part of CSNI activities in the area of safety research continues to relate to the analysis and management of accidents. Such work primarily concerns the thermal-hydraulics of the reactor coolant system and related safety and auxiliary systems, in-vessel behaviour of degraded cores and in-vessel protection, containment behaviour and containment protection, and fission product release, transport, deposition and retention.

In the area of thermal-hydraulics, the main objective of current work is to improve and expand the application of best-estimate

Cracks in the stainless steel lining at the bottom of the reactor vessel at Three Mile Island Unit 2 (USA), scene of a nuclear accident in 1979.



GPU Nuclear, United States

codes, including uncertainty analysis, in nuclear power plant safety and design evaluations. This also involves the coupling of current thermal-hydraulic system codes with codes in the areas of 3-D neutronics, structure mechanics, computational fluid dynamics (CFD) and containment, as well as, on a longer time scale, the application of CFD codes to nuclear safety. A joint workshop was organised with the IAEA on the use of CFD codes for safety analysis of reactor systems, including containment. The International Standard Problem (ISP) 42 exercise, based on experiments at the Swiss PANDA facilities, was completed during the year.

Other ISP exercises were being carried out or were completed in the following areas in 2002:

- in-vessel behaviour of degraded cores: ISP-46 (PHEBUS facility) and ISP-45 (QUENCH facility);
- containment behaviour: ISP-47 (TOSQAN, MISTRA and ThAI facilities);
- fission product release, transport, deposition and retention: ISP-46 (PHEBUS facility), a follow-up exercise to ISP-41 (RTF and CAIMAN facilities) and ISP-44 (KAEVER facility).

Good progress continued to be made on the SERENA (Steam Explosion Resolution for Nuclear Applications) Co-ordinated Programme, investigating the field of steam explosions resulting from fuel/coolant interactions, with a view to determining by mid-2005 whether current knowledge is sufficient for risk management under reactor conditions, and whether additional analytical or experimental work is needed.

A meeting was held to discuss future plans regarding the PHEBUS facility in France and its possible use as part of an international programme; large consensus and broad interest in the technical community was obtained.

Safety aspects of improved performance

In recent years, largely as a result of economic pressures arising from the liberalisation of electricity markets, the nuclear industry has tried to maximise the outputs of operating plants. This has resulted in changes to the main parameters of the reactor core. Such modifications require an in-depth safety analysis to evaluate the possible safety impact. More generally, the effect of cumulative, small, design and operational changes that are not individually tested can produce significant differences to the original design. A comprehensive, integrated assessment is needed in order to evaluate the impact of multiple synergistic safety margin reductions (related to power uprates, longer operating cycles, fuel design, increased fuel burn-up, etc.), combined with plant ageing and plant life extension. Extensive discussions during the year culminated in the development of an action plan in this area.

Risk assessment

The main mission of the Working Group on Risk Assessment (WGRisk) continues to be to advance the understanding and utilisation of

■ Three international research projects were established in 2002:

- MCCI (Melt Coolability and Concrete Interaction), a research project to study the interaction of molten core and concrete;
- OPDE (Piping Failure Data Exchange), a database on nuclear piping failures; and
- FIRE, a database on fire events in nuclear installations.

■ The CSNI and the CNRA completed 27 reports dealing with both technical and regulatory policy issues. The reports on industry/regulator collaboration on safety research and on the regulatory challenges of decommissioning nuclear reactors are of particular note.

■ The CSNI and the CNRA organised 15 workshops; notably the workshops on the safety research needs of advanced reactors, on nuclear installations and external hazards, and on regulator-industry interface issues.

probabilistic safety assessment (PSA) techniques in ensuring the continued safety of nuclear installations in member countries. While PSA methodology has matured greatly over the past years, further work is required. The CSNI/WGRisk has been active in several areas, including human reliability, low power and shutdown risk. In order to maintain a current perspective, the working group collaborates and assists other working groups within the CSNI, such as those on operating experience and organisational factors as well as keeping close co-ordination with other international organisations.

In 2002 a report was issued on "The Use and Development of PSA in NEA Member Countries", as were proceedings on "Human Reliability: Errors of Commission from Research to Application", and on "Passive System Reliability". Two major workshops were held: one on human reliability analysis and one on the development and use of risk monitors. In addition, WGRisk is proposing to start work on several new tasks including the use of risk information in the regulatory process, the use of Level 2 PSA information for emergency planning and the development of methods to quantify common cause failure data.

Ageing and structural integrity of reactors

The main topics investigated include the ageing of metal components and concrete structures, and seismic behaviour. Two workshops and a seminar were held and six technical reports were issued. In particular, a reference report summarising technical aspects of ageing for the long-term operation of NPPs was issued.

In the area of metal components, a future programme of work has been defined in three major areas: non-destructive examination, reactor pressure vessel integrity and thermal fatigue.

Regarding concrete structures, a report on long-term behaviour of concrete structures was published. This report also provides the basis to define future research activities in this new area. Another report reviewing member country capabilities and priorities with regard to finite element analysis of ageing concrete structures was published. A workshop on the evaluation of defects, repair criteria and methods of repair for concrete structures on nuclear power plants was held.

In the field of seismic engineering, a workshop was held in October on relations between seismological data and seismic engineering analysis. Participants showed wide interest and stressed the importance of communication between seismologists and structural engineers. A report drawing lessons learnt from high magnitude earthquakes with respect to nuclear codes was published as was a report on discrepancies between nuclear and non-nuclear codes.

Operating experience

The joint NEA/IAEA Incident Reporting System (IRS) is the only international system providing regulators and governmental bodies with information and lessons learnt from safety-significant events occurring in nuclear power plants. During their annual meetings, the IRS co-ordinators exchange information about recent events and discuss their safety significance. In 2002, the safety issues identified from the analysis of the IRS reports were recurrence of events; events due to weaknesses in detection capability; events related to plant modifications; and loss of corporate knowledge. Actions to clearly identify the lessons and bring them to the attention of the nuclear safety community are ongoing or planned in all these areas. They included a report related to the proper operation of the emergency

core cooling system in the event of an accident and a workshop to discuss actions required to prevent recurring events.

Fuel safety margins

The NEA Special Expert Group on Fuel Safety Margins is seeking, in particular, to systematically assess the technical basis for current safety criteria and their applicability to high burn-up, as well as to the new fuel designs and materials being introduced in nuclear power plants. A topical meeting was organised in May in collaboration with the IRSN Cadarache in order to review reactivity initiated accident (RIA) fuel acceptance criteria. The meeting showed that the performance of existing and new cladding materials under RIA situations, especially at high burn-up, is not well understood at this time. In consequence, there is a need to increase the database, to introduce relevant burn-up dependent limits for these materials and to verify the safety margins, as is being done in the CABRI and NSRR experimental programmes.

Human and organisational factors

The Special Expert Group on Human and Organisational Factors (SEGHOF) concentrated its activities on developing a state-of-the-art report on the scientific methods for safety management and a technical opinion paper about the management of change. A workshop on the former issue was organised in Paris during April with wide participation by utilities, regulators and research bodies. SEGHOF will consider the findings of the workshop in its integrated plan to be issued during 2003. Two workshop proceedings were issued in 2002. In addition, a new task about human and organisational factors related to NPP modifications was begun.

Nuclear Regulation

Committee on Nuclear Regulatory Activities (CNRA)

The CNRA contributes to developing a consistent and effective regulatory response to current and future regulatory challenges. These challenges include the interface between the public and the regulator, the effectiveness of the regulatory process, the introduction of competition in the electricity market, the maintenance of a high level of safety competence and the development of advanced reactors.

Regulatory challenges of decommissioning nuclear reactors

A group of senior regulators developed a report outlining the broad set of issues that may arise during the decommissioning of nuclear reactors and that the regulatory body should be prepared to deal with in the framework of its regulatory system. Major regulatory policy issues discussed in the report include assurance of adequate funds, waste storage or disposal sites, material release criteria and site

release criteria. Regulatory challenges include human and organisational factors; shutdown and preparation of dismantling; radiological and environmental controls; safety and security; waste management; and licence termination.

Nuclear regulators and the public

Efficiency in decision making by governmental authorities is increasingly dependent upon public trust. Public communication is one of

the keys to the future of nuclear power. A working group on public communication of nuclear regulatory organisations discussed topics such as how their organisations handled public questions following the 11 September 2001 events in the US, how to deal with questions from the public concerning terrorist attacks on nuclear installations, the public impact in the US and other countries of the Davis-Besse reactor vessel head corrosion, the public impact from cover-ups of inspection findings by several Japanese utilities, how to communicate to the public information related to radiological releases of nuclear installations, and experience gained with the organisation of public meetings. For further details concerning the work of this group, see the section on "Nuclear Energy and Civil Society" (page 32).

Assuring future nuclear safety competence

Maintaining nuclear safety competencies in the regulatory authorities, and industry, will be one of the most critical challenges to effective regulation of the nuclear power industry in coming decades. It is increasingly clear that in many technical fields transmittal of information and knowledge from the older to the younger generations does not work properly anymore, and that training and competence transfer are becoming inadequate. The CNRA organised a survey to review the current situation in member countries and determine the progress achieved on the recommendations made in a report published in 2001.

Regulatory inspection practices

Inspectors from regulatory bodies meet periodically to exchange information and experience related to regulatory safety inspections, discuss commendable inspection practices and carry out studies. The sixth international workshop covering these issues took place in 2002. In addition, a report on "Inspection of Nuclear Fuel Cycle Facilities" was issued.

Current studies address several inspection issues including: inspection of research reactors; inspection of site selection, construction and commissioning; and inspections of contracted work. A seventh international workshop is being planned for 2004 on inspection activities related to risk-informed inspections, inspection

In-service inspection robot at the Bugey nuclear power plant in France.



of plants at or near end-of-life and inspections of the performance of licensee organisations.

Regulatory effectiveness

Work in this area continued in 2002 and a pilot project on measuring regulatory effectiveness began. Regulatory authorities from 10 member countries are involved in this exercise which consists of using a subset of the 45 indicators of regulatory effectiveness previously identified. Planning was also started for a workshop scheduled in June 2003 on "Measuring, Assessing and Communicating Regulatory Effectiveness" (MACRE 2003). The objective is to establish an exchange at high level between member countries on the different perspectives for measuring and assessing regulatory effectiveness, with a goal towards better defining the roles of the key players, understanding achievements over the past few years and applying lessons learnt.

A report including the results of the pilot project and other documents (e.g. definitions, etc.) will be prepared as background material for MACRE 2003. In addition, an update of the report on *Improving Nuclear Regulatory Effectiveness*, to include *inter alia* the work on indicators, will be made.

Regulator-licensee interface

An international gathering of high-level executives from nuclear regulatory organisations and nuclear utilities was held on 18-19 June in Paris, France. Organised jointly with the World Association of Nuclear Operators (WANO), the forum examined ways to improve regulator-licensee communications and to understand the rationale used by the parties to enhance the effectiveness and efficiency of both.



Discussions focused on three main areas: market competition, asset management, and measuring and communicating safety performance. Follow-up activities are currently under discussion by both the NEA and WANO.



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Radiation Protection

Committee on Radiation Protection and Public Health (CRPPH)

The CRPPH is contributing to the definition of new directions and approaches for the international system of radiological protection in order to achieve a clearer and more streamlined result. The ultimate objective is to achieve a system that will better address regulator and practitioner needs, and will more appropriately position scientific radiological protection considerations within the broader context of social judgement and risk governance.

Towards new ICRP recommendations: stakeholder input

The CRPPH continued to provide direct scientific and technical feedback and input to the International Commission on Radiological Protection (ICRP) as the latter's new recommendations are developed to replace its current ones (as documented in ICRP Publication 60 of 1990 and subsequent publications). The Commission's goal is to simplify and consolidate its current recommendations, and to publish its new recommendations in the 2005 timeframe. Based on the work of an expert group, the CRPPH published its views on several key areas in which current ICRP recommendations could be improved (*The Way Forward in Radiological Protection*, OECD/NEA, 2002). To validate these ideas a case-study approach was undertaken, which showed that the CRPPH ideas, if applied, would be of assistance to regulators and practitioners.

NEA/ICRP workshops

In parallel with its efforts to develop ideas and approaches, the CRPPH has been providing comments on the ideas put forth by the ICRP. The Commission published, during 2002, two significant framework documents describing its new approach to general recommendations on a new system of radiological protection, and to the new and more specific area of the radiological protection of non-human species. The CRPPH collected comments from within the NEA family of technical committees and commissioned a study of the possible implications of the draft ICRP ideas and concepts. This feedback to the ICRP should assist it in the preparation of recommendations useful to regulators and practitioners concerned with their application.

In order to encourage the broad participation of stakeholders in the development of new ICRP recommendations, the NEA has launched a series of fora in collaboration with the ICRP. The 1st NEA/ICRP Forum on the "Radiological Protection of the Environment: The Path Forward to a New Policy?" took place in February 2002, in Taormina, Italy, and was hosted by the Italian *Agenzia*

Nazionale per la Protezione dell'Ambiente (ANPA). The meeting focused on identifying the policy aspects needed to support the development of protection objectives. Proceedings and a policy-level summary document have been published.

To further broaden its base of input, the CRPPH held an "Asian Regional Conference on the Evolution of the System of Radiological Protection", in September 2002 in Tokyo, to collect regional and cultural suggestions and concerns. Conference proceedings and a policy-level summary document will be published in 2003.

Continuing this work, preparations have been made for the 2nd NEA/ICRP Forum on "The Future Policy for Radiological Protection: A Stakeholder Dialogue on the Implications of the ICRP Proposal". Possible policy, regulation and application implications of the ICRP recommendation framework documents will be discussed. The Spanish *Consejo de Seguridad Nuclear* (CSN) will host this meeting in Lanzarote, Spain. Proceedings and policy-level summary documents will be published following the forum.

Stakeholder participation in decision making involving radiation

The CRPPH has explored in detail the implications of stakeholder involvement in decision-making processes for several years and held important workshops in this area in 1998 and 2001. Based on this experience, the CRPPH has been exploring various process aspects of stakeholder involvement. Three specific case studies have been analysed to extract commonalities of stakeholder involvement process aspects that, to some extent, transcend geographic and cultural frontiers. These analyses will be used as fundamental input to a workshop that will take place in October 2003. Stakeholder aspects also form an essential element in the evolution of the system of radiological protection. This work will therefore also serve as NEA input to ICRP discussions on new recommendations. For a fuller description of NEA work in this area, see the section on "Nuclear Energy and Civil Society" (page 32).

Implications of effluent release options

Radioactive effluent releases from nuclear installations during normal operation have been reduced in recent years, but are still subject to discussion. The demand for further reductions is generally driven by societal concerns about the protection of the environment. Regarding the optimisation of effluent releases, several different approaches exist, such as the concept of "best available technology" (BAT), or the "as low as reasonably achievable" (ALARA) approach that is well known in radiation protection. The OSPAR Commission, a political body concerned with the pollution of the marine environment, introduced the *OSPAR Strategy with Regard to Radioactive Substances* (Sintra, 1998), which calls for a reduction of radioactive emissions to a level that would result in concentrations of artificial radionuclides in the environment that are "close to zero". In order to assist experts and decision makers in fully understanding the technical implications and feasibility of the various effluent release options being discussed, an expert group was created. Its work will serve as background information for CRPPH members and other experts faced with decision-making choices, as well as input to the CRPPH views on the evolution of the system of radiological protection. The group's final report will be published in 2003.

View of the Penly nuclear power plant, France.



Nuclear emergency matters

After successful completion of the first series of international nuclear emergency exercises (INEX 1 in 1993; the INEX 2 Series from 1996 to 1999; INEX 2000 in 2001), the NEA has started the preparation of INEX 3. Member countries expressed specific interest

- The Committee finalised its views on how the system of radiological protection should evolve, and performed a road test of its key ideas (using a case-study approach) to illustrate the practical benefits.
- The policy aspects and broad framework of radiological protection of non-human species were actively debated at the 1st NEA/ICRP Forum.
- The Committee analysed ICRP draft framework documents for their possible implications on policy, regulation and application.
- Commonalities of stakeholder involvement processes have been extracted from existing cases and analysed.
- The "Asian Regional Conference on the Evolution of the System of Radiological Protection" highlighted the importance of flexibility to allow for cultural differences.
- The Emergency Management Programme consolidated its INEX experience and assessed member country needs to develop its future programme of work.

in decision-making mechanisms in the medium and late phase after a nuclear or radiological accident with serious contamination. This could include various aspects of the appropriate management of severe contamination after an accident, such as agricultural countermeasures, food restriction, socio-economic aspects, psychological damage, compensation issues, decisions on "soft/light" countermeasures, trade and travel, and harmonisation of response. This exercise would be co-ordinated with the NEA Nuclear Law Committee in order to include compensation and liability aspects. It would also be co-ordinated with other interested international organisations. The new INEX 3 exercise may take place in the 2004-2005 timeframe.

In 2002, the NEA performed a survey on national practices regarding the implementation of short-term countermeasures after a nuclear accident. The results of this survey will be published early in 2003.



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Radioactive Waste Management

Radioactive Waste Management Committee (RWMC)

The RWMC is helping member countries find long-term, sustainable solutions for radioactive waste management and is currently focusing its efforts on improving both technical and societal confidence in geological disposal. In addition to long-lived radioactive waste, materials from decommissioning are of specific concern for the RWMC.

Waste management policy and governance issues

Although there is common acceptance that the development of a repository is a stepwise process, approaches and requirements need to be defined more clearly in order to progress from one stage to the next. The establishment of principles of stepwise development, including the provision of supporting documents, has become an important item of RWMC work in this area.

In this context, a policy report was drafted to clarify the concept of stepwise decision making, to address the associated challenges and to summarise experience from studies. An important element in decision making at the various stages of geological repository development is a safety case, which should address repository safety in its widest context. Work was pursued on a document describing the main elements of the safety case and the approaches available for fulfilling the related objectives. This document should help harmonise member countries' general views on how to demonstrate confidence in the long-term safety of repositories. This work was also supported by a publication released under the IPAG initiative (on integrated performance assessments of deep repositories) that reviewed the role of performance assessment, and evaluated the approaches and arguments which have been used to establish and communicate technical confidence in the safety of deep geological disposal.

The regulatory structure, which governs the implementation of national waste management programmes, is a key element for understanding the different national approaches to disposal safety. A database of national fact sheets has been created at the NEA, comprising relevant information on institutional, organisational and policy aspects. This database is a source of quality-assured information for all stakeholders in radioactive waste management. Furthermore, a study analysing commonalities and differences in regulation and practices is under way.

International peer reviews

The RWMC has traditionally organised, on request from the member countries, peer reviews of national programmes in relation to safety assessment of deep repositories. On behalf of the Belgian Government, the NEA established an international review team to

perform a peer review of the SAFIR-2 report, produced by the Belgian Agency for Radioactive Waste and Fissile Materials (ONDRAF/NIRAS). The SAFIR-2 study describes the research, development and demonstration activities in the Belgian programme on the disposal of high-level and long-lived radioactive waste in a deep geological repository excavated within an argillaceous formation. The review is scheduled to be delivered in April 2003.



ONDRAF, Belgium

The "Ophélie" mock-up of backfill blocks being considered in Belgium for sealing underground waste disposal galleries.

The NEA also instituted a peer review team that began reviewing a report by the French waste management agency ANDRA on the clay disposal project. The "Dossier 2001 Argile" describes the scientific and technical results obtained thus far in the French programme on the disposal of radioactive waste in a repository within an argillaceous formation. This international peer review will be completed in 2003.

Finally, the Swiss Federal Office of Energy has asked the NEA to carry out an international peer review of the Swiss long-term safety analysis of the disposal of high-level waste, prepared by NAGRA, the Swiss organisation for nuclear waste. It is foreseen that this international peer review will take place during 2003/4.

Stakeholder involvement

Public confidence is significantly affected by social considerations, such as public participation in decision-making processes, transparency of activities, developmental opportunities and social justice issues. The NEA addresses these issues through a series of workshops in national context organised by its Forum on Stakeholder Confidence (FSC). The third interactive workshop of the FSC, held in Ottawa in October, brought together a wide range of Canadian stakeholders to present their views and to discuss them with international delegates from other waste management programmes. It focused on such key

areas as the social concerns at play in radioactive waste management, how these concerns can be addressed, and the development of opportunities for local communities.

An information document on member countries' experience with stakeholder involvement is being updated and analysed under the auspices of the FSC. It will provide both the practitioner and the non-specialist with a valuable baseline of detailed, comparative information. Work has also been started on a document to identify commonalities in national approaches to stakeholder issues in waste management, and compiling and analysing lessons learnt so far. The document will be refined over the next year. For further details concerning NEA work in this area, see the section on "Nuclear Energy and Civil Society" (page 32).

Integration of science

The RWMC further supported the development of geological disposal through new projects that address the role of engineered barrier systems (EBS), the better integration of the science of geology into repository development (AMIGO), and the handling of timescales in long-term safety assessment.

The AMIGO project on "Approaches and Methods for Integrating Geologic Information in the Safety Case" has been launched in follow-up to the GEOTRAP project. This new project is organised as a series of biannual workshops on the state of the art in collecting and integrating all types of geological information, e.g. geophysical, hydrogeological, geochemical and structural, in performance assessment models. The first workshop is planned in Switzerland in June 2003.

The Engineered Barrier System (EBS) project looks at the man-made barriers of a repository (casks, backfill, etc.) and addresses their role in the context of the entire safety case. The project was started in 2002 with a first workshop held under the joint auspices of the EC and the NEA in September. The workshop, which was hosted by Nirex in the United Kingdom, provided a status report on engineered barrier systems in various national programmes.

The issue of how to deal with phenomena and uncertainties that are characterised by widely different timescales was addressed in a workshop on the "Handling of Timescales in Assessing Post-closure Safety", held in Paris in April. The workshop identified common elements for handling timescales in future safety cases.

Decommissioning

The RWMC collected experience available in its decommissioning groups in a report on the status, approaches and challenges in decommissioning, which is meant to inform the interested public and to support specialists and policy makers in their work. Associated with the release of this publication is a database of national fact sheets to facilitate information exchange amongst professionals, comprising information on status, objectives, funding, techniques and waste in decommissioning. These fact sheets will be complemented by a set of country leaflets addressing a broader public audience. Finally, a

- A workshop was organised as part of the Forum on Stakeholder Confidence (FSC) on Canadian experience with stakeholder involvement in developing radioactive waste management solutions.
- To support member countries in decision making on the development of their radioactive waste management programmes, international peer reviews were organised on important safety studies of the Belgian and French programmes for geological disposal.
- A report on decommissioning was published to inform policy makers and interested members of the public about the status, approaches and challenges in decommissioning.
- A workshop on engineered barrier systems addressed their role in the context of the safety case for geological disposal.
- AMIGO, a new initiative to better integrate geologic information into safety assessments of waste repositories, has been started.

roadmap is being maintained as a reference for ongoing international activities addressing decommissioning issues.

RWMC work in this area is supported by the Co-operative Programme on Decommissioning (CPD), a joint undertaking of 39 decommissioning projects in 14 countries (see page 29).

Technical studies and databases

Various other scientific and technical issues have been pursued to define the state of the art and to provide shared instruments essential for repository development and safety assessment. The International Database on Features, Events and Processes (FEPs) for geological disposal of radioactive waste has been reviewed and the database enlarged. The RWMC "Clay Club" revised a catalogue of characteristics and a database of bibliographic references on clay media, and is examining in detail current knowledge of self-healing properties in clay and argillaceous media. The FEPCAT project evaluates features, events and processes specific to argillaceous media. In the area of sorption modelling and associated thermochemical data, the Thermochemical Database (TDB) project and the Sorption project have accomplished important steps (see page 29 for further information).



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Nuclear Science

Nuclear Science Committee (NSC)

The NEA science programme contributes to the basic scientific and technical knowledge needed to maintain the safe, reliable and economic operation of current nuclear systems and the development of next generation technologies. Special emphasis is being placed on the validation of calculation methods used in light water reactor stability investigations, advanced reactor fuel performance and behaviour, and the preservation of information from integral experiments.

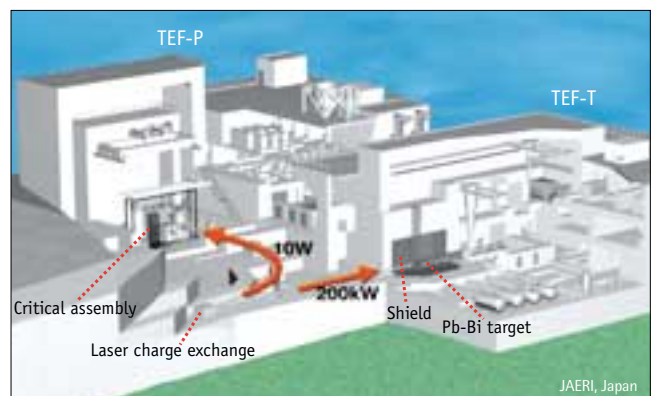
The NEA nuclear science programme is to a very large extent based on different benchmark studies, i.e. the comparison of results from international standard problem exercises. These benchmark studies are often based on well-documented integral experiments, of which a large number are collected, reviewed and safeguarded in a joint effort between the NEA Nuclear Science Division and the Data Bank. The main areas covered by the nuclear science programme are reactor physics, fuel behaviour, criticality safety and radiation shielding.

R&D needs in nuclear science

A workshop on scientific research and development needs for current and future nuclear systems was organised in Paris, France, on 6-8 November. Past and ongoing NEA scientific activities, as well as recent studies for future nuclear systems, including fourth generation reactors and accelerator-driven systems, were presented. The subject areas discussed during the workshop comprised nuclear data, reactor physics and system behaviour, fuels, materials, coolants and chemistry. The draft recommendations from the workshop were transmitted to the NEA Nuclear Science Committee for further discussion. The workshop proceedings and the final recommendations will be published in 2003.

Scientific issues in partitioning and transmutation

The Seventh Information Exchange Meeting on "Actinide and Fission Product Partitioning and Transmutation" (P&T) was organised in Jeju, Korea on 14-16 October. The main topics discussed were national and international P&T programmes, partitioning and waste forms, spallation targets and advanced coolants, and transmutation system design and safety. The meeting ended with a panel discussion on future P&T development. The proceedings will be issued in 2003. The Working Party on Scientific Issues in Partitioning and Transmutation (WPPT) also organised a workshop on the "Utilisation and Reliability of High Power Proton Accelerators" (HPPA) in Santa Fe, USA on 12-16 May. The proceedings will be issued in early 2003.



Conceptual view of the transmutation experimental facility, planned to be part of the Japanese proton accelerator research complex.

Two benchmark exercises related to nuclear waste transmutation systems are presently being conducted. One concerns a benchmark related to the effects of an accelerator beam interruption in a lead-bismuth-cooled, MOX-fuelled, accelerator-driven system (ADS). The other benchmark is devoted to the simulation of an experiment of a coupled accelerator-subcritical reactor system (MUSE-4), an experiment which will be performed at CEA Cadarache, France in 2003.

Reactor physics: reactor stability studies

A benchmark study of a pressurised water reactor (PWR) main steam line break was conducted based on reference design and data from Unit 1 of the Three Mile Island Nuclear Power Plant in the United States. The benchmark included a description of the event sequence with all activated system functions and typical plant conditions during the transient. The results of this study, using coupled 3-D neutronics/core thermal-hydraulics calculation methods, were published in November.

Two other reactor stability benchmarks are being conducted. One concerns the simulation of a turbine trip in a boiling water reactor

(BWR) based on experimental data from a BWR/4 in the United States. The results of this benchmark will be published in the first half of 2003. The other benchmark involves the study of a coolant transient in a Russian VVER-1000 reactor.

Fuel cycle physics

One of the main questions related to the recycling of plutonium as mixed-oxide (MOX) fuel in a pressurised water reactor (PWR) is the number of times the plutonium can effectively be recycled. This question was addressed in a report published in October entitled *Multiple Plutonium Recycling in Advanced PWRs*. The report describes an exercise that followed plutonium through five generations of recycling in a PWR. It considered both a standard PWR design and a highly moderated design. The study of these two designs in parallel has provided a better understanding of their different merits, as well as insight into the limitations of multiple recycling and the long-term toxicity of fission products and actinides.

The international agreement to dispose of weapons-grade plutonium led the NEA to launch a benchmark to study the possibility of burning such plutonium in the form of mixed-oxide (MOX) reactor fuel. This specific study concerned a Russian light water (VVER-1000) reactor. The report, published in 2002, contains results for low-enriched uranium (LEU) and MOX fuel, and contributes to the computer code certification process and to the verification of calculation methods used in the Russian Federation.

Nuclear criticality safety

The International Criticality Safety Benchmark Evaluation Project (ICSBEPE) issued a new version of the ICSBEPE handbook on CD-ROM in November. The new version contains 330 evaluations with benchmark specifications for 2 881 critical or near-critical configurations. An upgraded version of the DICE database, to facilitate the retrieval of data from ICSBEPE, was also included on the CD-ROM. This new version has enhanced capabilities, such as the plotting of detailed neutron spectra and reaction rates.

A database providing information on the isotopic composition of spent fuel from light water reactors, SFCOMPO, has been installed at the NEA and can be accessed directly online through the NEA Internet pages. The database will be further developed to allow more refined retrievals to be performed.

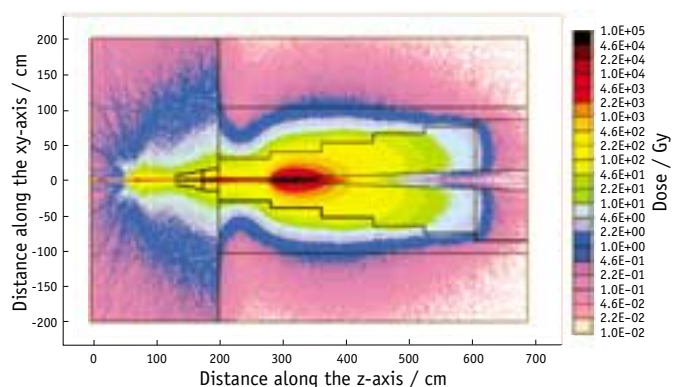
Radiation shielding

The sixth workshop on "Shielding of Accelerators, Targets and Irradiation Facilities" (SATIF-6) was hosted by the Stanford Linear Accelerator Center, Menlo Park, USA, on 10-12 April. The workshop reviewed recent progress in radiation shielding of accelerator facilities and the status of computer codes, cross-sections and shielding data libraries. A discussion was also held on further developments needed with respect to international co-operation in this field. The proceedings will be published in early 2003.

- A workshop was held to discuss research and development needs for current and future nuclear systems, specifically in the area of nuclear science.
- A workshop on actinide and fission product partitioning and transmutation was organised in close collaboration with the NEA Nuclear Development Division.
- A study on *Multiple Plutonium Recycling in Advanced PWRs* was published.
- A report was released on the modelling of the effects of a main steam line break in a pressurised water reactor (PWR).

A benchmark on deterministic 2-D/3-D MOX fuel assembly calculations, without spatial homogenisation, was conducted. Calculated solutions for the two- and three-dimensional configurations were collected and analysed. The results of the exercise will be published in early 2003.

Calculation of the radiation dose close to the target area of the NA60 experiment at CERN, to determine the optimum placement of electronic equipment. (Results presented at the SATIF-6 meeting.)



The SINBAD database containing data from radiation shielding experiments have been updated and new versions were issued on CD-ROM by the Data Bank in March and October.



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Data Bank

The Data Bank serves as a centre of reference for computer programs, basic nuclear data and chemical thermodynamic data by providing scientists with a reliable, up-to-date and rapid computer program and nuclear data service. It continues the effort to preserve data from integral experiments and to develop user-friendly tools for handling nuclear data.

Computer program services

The Data Bank has a collection of about 2 500 computer programs covering all nuclear energy application areas. During 2002, a total of 85 new or revised versions of computer codes were acquired. The main topics covered by this acquisition were reactor physics and radiation transport codes (25%) and application data libraries (20%). Of particular interest were three-dimensional radiation transport codes.

Close to 3 000 computer programs and associated data libraries were distributed upon request during the year. This was a record high distribution compared with previous years (roughly 2 200 programs in 2001 and 2 300 programs in 2000). The three most requested program categories coincide with the three most popular acquisition topics mentioned above.

The scanning of the computer program manuals and associated documentation has now been completed, allowing fully automatic package dispatching on CD-ROM. A complete collection of program abstracts on CD-ROM was prepared for publication in December. In addition, five electronic newsletters, providing information on newly arrived material as well as planned program-training courses, were sent out during the year to liaison officers and subscribers.

Computer program training courses

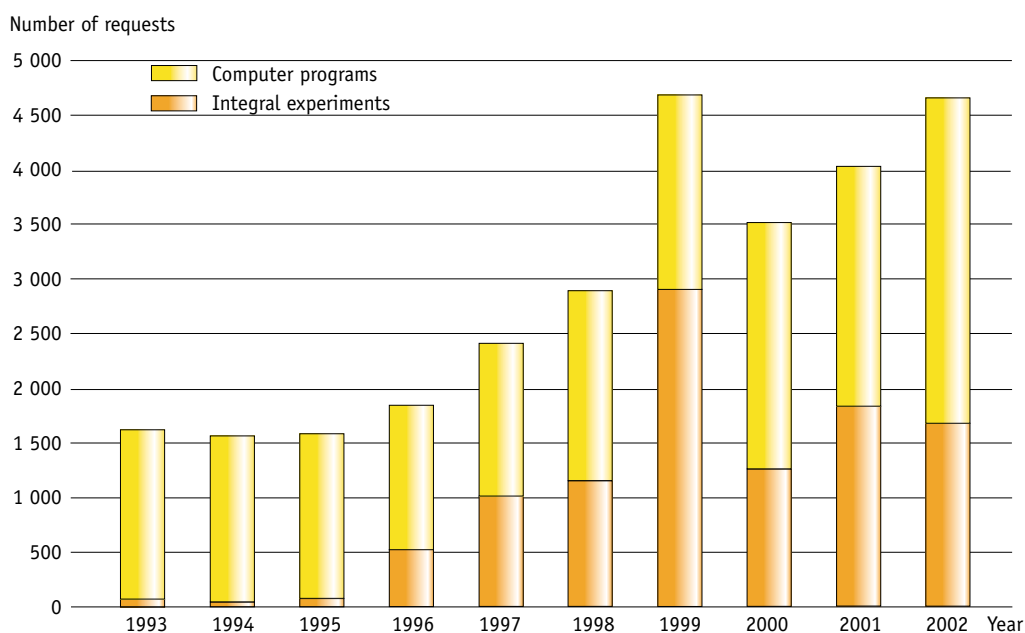
The following training courses were organised in 2002:

- MCNP – Advanced Course including MCNP5 Features, held on 18-22 March at the Imperial College, London, UK.
- Workshop on Computing Radiation Dosimetry (CRD-2002) with an embedded training course on MCNPX (Monte Carlo Code System for Multiparticle and High Energy Applications), held on 22-28 June at the *Instituto Tecnológico e Nuclear* (ITN), Sacavém, Lisbon, Portugal.
- MCNP – Introductory Course including MCNP5 Features, held on 9-13 September at the University of Stuttgart, Germany.
- MCNPX – Monte Carlo Code System for Multiparticle and High Energy Applications, held on 18-22 November at SCK•CEN, Mol, Belgium.

Preservation of information from integral experiments

In close co-operation with other parts of the NEA, the Data Bank has established a number of databases containing information from integral experiments. These data are especially important for the validation

Evolution of requests for computer programs and integral experiments data



and benchmarking of computation methods and programs used in member countries to model different nuclear systems. The databases maintained and updated by the Data Bank are:

- SINBAD (Integral Shielding Experiments),
- IFPE (International Fuel Performance Experiments),
- ICSBEP (International Criticality Safety Benchmark Evaluation Project),
- CCVM (CSNI Code Validation Matrix for LWR LOCA and transients),
- IRPhE (International Reactor Physics Benchmark Experiments).

New editions of the SINBAD, IFPE and ICSBEP databases were issued in 2002. Concerning IRPhE, a demonstration CD-ROM with results of a pilot project was issued, containing in total several hundred reactor configurations.

About 500 CD-ROMs of the complete ICSBEP database, containing close to 2 800 experiments, were distributed in 2002. The most popular of the other databases was the IFPE with more than 800 experiments distributed, followed by the three databases with an annual distribution of about 300 experiments.

Nuclear data services

The Data Bank participates in a worldwide network of nuclear data centres that compiles and makes available nuclear reaction data to scientists and engineers. The Data Bank services its member countries with bibliographic, experimental and evaluated scientific nuclear data. Most of the data are accessible directly online, but the Data Bank also provides guidance to users on the availability and choice of data.

More than 15 000 accesses to the nuclear data services' databases were registered in 2002. A major part (60%) of the requests were for experimental data (EXFOR); the databases of bibliographic (CINDA) and evaluated nuclear data (EVA) followed with 20% each.

The bibliographic references to neutron data publications (CINDA) are also issued in paper form, with an accompanying CD-ROM containing all data on an easily searchable database. The latest version was issued in November.

The JEFF project

Further improvements were made to the Joint Evaluated Fission and Fusion (JEFF) file and culminated in the release of the JEFF-3.0 general-purpose library in April. Evaluated nuclear data are given for 340 isotopes or elements and for five molecular/lattice structures in the case of thermal scattering data. This library is intended for use in fission and fusion neutronic applications, and is used in many member countries as the standard data library for most nuclear energy applications. The documentation of the general-purpose library will be issued in early 2003.

Work on the JEFF project will continue in 2003 with the processing and validation of the general-purpose library, and with the goal of releasing the JEFF-3.0 activation, radioactive decay data and fission yields libraries in 2003.

- Demand for the Data Bank's computer program and nuclear data services was record high in 2002. More than 4 600 computer programs and integral data sets were distributed upon request and the nuclear data services recorded more than 17 000 accesses to the online databases.
- A new version of the Joint Evaluated Fission and Fusion (JEFF-3) nuclear data file was released in April.
- A pilot project to compile and format information from reactor physics integral experiments was completed.
- It was agreed to start a new phase of the Thermochemical Database (TDB) project.

International nuclear data evaluation co-operation

The NEA is coordinating international collaboration among the major nuclear data evaluation projects in the world. In 2002, the working party that manages this co-operation published a report on delayed neutron data. The report contains recommended delayed neutron data for the major actinides, ^{235}U , ^{238}U and ^{239}Pu , as well as for the time dependence of delayed neutron emission and for the associated energy spectra for fission in 20 isotopes. The report is accompanied by a CD-ROM, which contains a number of documents providing details about the origin of the recommended data.

The High Priority Request List for nuclear data has been made generally available on the NEA website to facilitate feedback on the requests listed. An expert group is presently discussing ways to reorganise the list in order to clearly indicate the very high priority requests, as well as the origin and reason for the requests.

The Thermochemical Database (TDB) Project

The Data Bank is working with the NEA Radioactive Waste Management Committee to develop a database of recommended chemical thermodynamic data for the safety assessment of nuclear waste repositories. The present phase of the project is coming to an end and the TDB Management Board decided in November 2002 to launch a new four-year phase of the project. The details of this programme can be found in the section "Joint Projects and Other Co-operative Projects".



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Legal Affairs

Nuclear Law Committee (NLC)

The NLC promotes the harmonisation of nuclear legislation governing the peaceful uses of nuclear energy, particularly nuclear liability legislation. It supports the modernisation and strengthening of national and international nuclear liability regimes.

Under the supervision of the NLC, the NEA also compiles, analyses and disseminates information on nuclear law through a regular publications programme and organises the International School of Nuclear Law educational programme.

Nuclear third party liability

In 2002, the objective of promoting the modernisation and strengthening of international nuclear liability regimes was accomplished through the successful completion of negotiations to revise the Paris and Brussels Supplementary Conventions, the approval of both amending Protocols by the Contracting Parties thereto and agreement to hold a diplomatic conference in 2003 to adopt those Protocols. The revision of these Conventions will ensure that significantly more money will be made available to compensate a greater number of victims for a much broader range of nuclear damage than is currently the case; in fact under the revised Conventions up to 1.5 billion euros of compensation will be made available. At the same time, the revised Conventions will remain compatible with other existing international nuclear liability instruments, including the 1988 Joint Protocol on the Application of the Vienna and Paris Conventions, the 1997 Protocol to Amend the Vienna Convention, and the 1997 Convention on Supplementary Compensation for Nuclear Damage.

The Nuclear Law Committee continued to serve as a forum for the examination of topical issues in the nuclear field in 2002. Particular emphasis was given to studying the potential conflict between proposed European Union legislation and existing international nuclear liability instruments related to liability and compensation for environmental damage arising from a nuclear incident, and to the implications of terrorist activities upon the ability of nuclear operators to obtain financial security in respect of nuclear damage caused by such activities.

Co-operation with non-member countries

In keeping with its objectives, the Agency provided assistance to certain non-member countries in which NEA member countries have a special interest, particularly those of Central and Eastern Europe and the New Independent States. This assistance is primarily aimed at helping those countries develop nuclear legislation that reflects internationally accepted principles for the peaceful utilisation of

nuclear energy. The most significant accomplishment in 2002 in this area was the very successful Special Session of the Joint Task Force on Nuclear Legislation in Ukraine, held in June, during which the NEA and several experts from NEA member countries provided assistance to Ukraine on drafting legislation to establish and manage a fund for the costs of decommissioning nuclear installations in that country.

Information on nuclear law

Issues No. 69 and 70 of the *Nuclear Law Bulletin* were published in June and December 2002, along with their respective Supplements which reproduced new nuclear legislation adopted in Germany, Romania and Ukraine. This periodical, issued twice per year, provides up-to-date information on recent developments in legislation, regulations, case law and institutional structures in the field of nuclear law at the national and international levels. The *Bulletin* has proved to be an invaluable tool over the past thirty years for those in government, regulatory, academic, industry and international circles that work closely with nuclear law.

The proceedings of the INEX "Workshop on the Indemnification of Nuclear Damage in the Event of a Nuclear Accident" were also prepared. The objective of this workshop, held in November 2001, was to test the capacity of existing national nuclear liability and compensation mechanisms to manage the consequences of a nuclear accident. These proceedings contain a comparative analysis of the legislative and regulatory regime governing emergency response and nuclear third party liability in force in those countries that replied to the questionnaire circulated for this purpose. A compilation of the responses provided to that questionnaire is also included. The proceedings reproduce the texts of presentations made by special guests from Germany and Japan describing the manner in which the public authorities in their respective countries responded to two nuclear accidents of a very different nature and scale. This publication provides food for thought on the optimisation of methods and procedures to be used in the aftermath of a nuclear emergency and on their possible harmonisation.

International School of Nuclear Law

The second session of the International School of Nuclear Law (ISNL) was held at the University of Montpellier 1, France, in August-September 2002. Following the success of the inaugural session of the school in 2001, it was deemed useful to organise a second course with similar content the following year. The ISNL is jointly managed by the NEA and the University of Montpellier 1 on the basis of close co-operation between these institutions. On the occasion of the 2002 session, a Co-operation Agreement was signed by Professor Alain Uziel, President of the University of Montpellier 1, and by Ms. Carol Kessler, Deputy Director-General of the NEA, in order to establish an official framework for this partnership. The International Nuclear Law Association, the European Commission and the International Atomic Energy Agency also provide sponsorship or direct support to this programme.

The objective of the ISNL is to provide high-quality courses on the various aspects of this discipline both to law students pursuing their studies at doctoral and masters level, who wish to follow an introductory course on nuclear law and familiarise themselves with career

- The Contracting Parties to the Paris and Brussels Supplementary Conventions completed their negotiations to revise both Conventions, approved the final texts of both amending Protocols and agreed to hold a diplomatic conference to adopt the amending Protocols early in 2003.
- A Special Session of the Joint Task Force on Nuclear Legislation in Ukraine was organised to provide assistance to Ukraine in drafting legislation to establish and manage a decommissioning fund.
- The second session of the International School of Nuclear Law was held in the summer of 2002 at the University of Montpellier 1, enabling 57 participants from 34 countries to attend high-quality courses on the various aspects of this discipline.

2002 Session of the International School of Nuclear Law



Students came from 34 countries

| | |
|-------------|--------------------|
| Brazil | Mexico |
| Bulgaria | Nigeria |
| Cameroon | Romania |
| Canada | Russian Federation |
| China | Slovak Republic |
| Egypt | Slovenia |
| Finland | South Africa |
| France | Spain |
| Germany | Sudan |
| Hungary | Sweden |
| Indonesia | Syria |
| Iran | Tanzania |
| Ireland | Turkey |
| Ivory Coast | Uganda |
| Japan | Ukraine |
| Lithuania | United Kingdom |
| Malaysia | United States |

opportunities open to them in this field, as well as to young legal professionals already active in the nuclear sector and who wish to develop their knowledge. A total of 57 participants from 34 countries attended the 2002 programme, which was comprised of ten days of classes, held in English over a two-week period, combining main lectures in the morning with practical exercises and case studies in the afternoon. Subjects explored included:

- The origins and uniqueness of nuclear law;
- Protection against ionising radiation;
- Nuclear safety and prevention and management of nuclear accidents;
- Management of spent fuel and radioactive waste;
- Transport of nuclear materials and fuel;
- Physical protection of nuclear materials and installations;
- Preventing the proliferation of nuclear weapons;
- Liability and compensation for nuclear damage, including insurance;
- International trade of nuclear materials and equipment.

Plans are currently under way to explore the possibility of awarding a diploma of the University of Montpellier 1 to future ISNL participants, and to arrange the validation by other universities of university credits for participation in this course.

Further information on the 2003 session (scheduled to take place from 25 August to 5 September 2003) and application forms are available on the NEA website at www.nea.fr/html/law/isnl/index.html.



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Joint Projects and Other Co-operative Projects

NUCLEAR SAFETY

The Halden Reactor Project

The Halden Reactor Project has been in operation for more than 40 years and is the largest NEA project. It brings together an important international technical network in the areas of nuclear fuel reliability, integrity of reactor internals, plant control/monitoring and human factors. The programme is primarily based on experiments, product developments and analyses carried out at the Halden establishment in Norway, and is supported by approximately 100 organisations in 20 countries.

The 2002 programme of work in the fuel and materials area addressed the preparation of an important loss-of-coolant experiment aimed at clarifying such phenomena as fuel relocation after ballooning. The programme continued to focus on high burn-up fuel properties. The scope of work encompasses studies on PWR cladding corrosion, where many different alloys are directly compared. The work on high burn-up properties of mixed-oxide and gadolinium fuels, in addition to uranium-oxide fuel, continued in 2002, and it was enlarged to comprehend inert matrix fuels. Investigations of embrittlement and cracking behaviour of reactor internals material have provided valuable data on how the cracking progresses in highly irradiated materials. The programme on plant control and monitoring has provided verification and upgrades of systems for signal validation, performance monitoring and alarm handling. The latter has been investigated within the framework of the human factor programme, mainly by means of experiments in the Halden man-machine laboratory.

The Halden Project operates by way of three-year renewable mandates, and 2002 was the last year of the 2000-2002 mandate. Discussions among the Halden Project participants on the continuation of the Halden Project were successful. The framework programme for the new three-year period 2003-2005 was completed and submitted to the Halden Board of Management, which approved it at its December 2002 meeting. The new legal Agreement for 2003-2005 is being circulated to members for signature.

The project continued its summer school programme, which is supported by the NEA Nuclear Safety Division. This is in follow-up to a recommendation of the Halden Board to actively pursue the transfer of nuclear technology and know-how to the younger generation. It also held several workshops and a large technical meeting ("Enlarged HPG") where recent results of Halden research were presented.

The Cabri Water Loop Project

The Cabri Water Loop Project is investigating the ability of high burn-up fuel to withstand the sharp power peaks that can occur in power reactors due to rapid reactivity insertion in the core (RIA accidents). It involves substantial facility modifications and upgrades and consists of 12 experiments to be performed with fuel retrieved from power reactors and re-fabricated to suitable length. The project began in 2000 and will run for eight years. The experimental work will be carried out at the *Institut de radioprotection et de sûreté nucléaire* (IRSN) in Cadarache, France, where the Cabri reactor is located. Programme execution also involves laboratories in participating organisations for fuel preparation, post-irradiation examinations and test channel instrumentation. Thus far, the Cabri Agreement has been signed by 14 organisations in 12 countries, including regulators, industry and research organisations; the project's bilateral agreements are being finalised.

Two meetings of the Technical Advisory Group (TAG) took place in 2002. Progress was made to gather all relevant information, define the test conditions and make the necessary preparations for the first two tests, which were carried out in October-November. They involved fuel with very high burn-up (~ 70 MWd/kg) and having two types of modern cladding materials. No fuel failure was registered in the first test, whereas the outcome of the second is still being investigated.

Two meetings of the project Steering Committee were also held in 2002 during which discussions on the different phases of the project took place, especially in relation to the plan for installing the water loop and to test conditions that had been discussed in the TAG meetings.

The MASCA Project

The MASCA Project investigates the consequences of a severe accident involving core melt. It started in mid-2000 and will be completed in July 2003. The programme, which is supported by organisations in 17 countries, is based on experiments that are mainly carried out at the Kurchatov Institute and that make use of a variety of facilities in which corium compositions prototypical of power reactors can be tested. The experiments aim to resolve remaining uncertainties on heat load to the reactor vessel and thus on the possibility of retaining the melt within the vessel. These uncertainties are primarily associated with scaling effects and coupling between thermal-hydraulic and chemical behaviour of the melt. To achieve this basic objective, supporting experiments and analyses are to be

performed with a view to providing an understanding of the phenomena of interest, and producing a consistent interpretation of the results by means of mechanistic models.

The investigations on the effect of the chemical composition of the molten corium on stratification continued in 2002. These comprised experiments in which carbon and boron were added to the melt. Experiments with liquid steel present in the corium were also carried out. Investigations on partitioning of different chemical elements – including fission products – were completed in 2002. Materials property data continued to be produced in the programme. Since the current MASCA Project is approaching conclusion, discussions are taking place among participants on a possible continuation of the project for another three-year period, in consideration of the experimental needs that still exist as well as the quality of the experimental work performed so far.

The Sandia Lower Head Failure Project

This project started in 1999 and was completed in 2001. It brought together eight member countries for the purpose of studying the creep rupture behaviour of models of light water reactor lower heads. The information obtained is useful for the development of severe accident management strategies for coping with ex-vessel behaviour.

A total of four tests were carried out. A benchmark based on the results of the first test was also performed. The results of this exercise as well as the overall outcome of the Lower Head Failure Project and participants analyses were reviewed at a seminar that was held in June 2002.

The MCCI Project

The Melt Coolability and Concrete Interaction (MCCI) Project is managed by the USNRC and carried out at the Argonne National Laboratory (USA). It was started early in 2002 with participation from 13 countries and will continue for four years. It addresses ex-vessel phenomena, which occur in the hypothetical case that the molten core is not retained inside the reactor vessel, and is spread in the reactor cavity where it can interact with the concrete structure.

The MCCI Project is to provide experimental data relevant for the severe accident mentioned above and to resolve two important accident management issues. The first one concerns the verification that the molten debris that has spread on the base of the containment can be stabilised and cooled by water flooding from the top. The second issue concerns the two-dimensional, long-term interaction of the molten mass with the concrete structure of the containment, as the kinetics of such interaction is essential for assessing the consequences of a severe accident. To achieve these basic objectives, supporting experiments and analyses will be performed, with a view to providing an understanding of the phenomena of interest, and to producing a consistent interpretation of the results relevant for accident management.

The first experiments have focused on water ingress mechanisms, as these are thought to be the most effective ones for cooling the melt. Three of these types of tests were carried out in 2002. At the

same time, progress was made in defining the follow-up programme, in particular the design of the long-term, two-dimensional, melt-concrete interaction test.

The SETH Project

The SETH Project is supported by 14 NEA member countries. It started in 2001 and will run for four years. It consists of thermal-hydraulic experiments in support of accident management, which are carried out at facilities identified by the CSNI as those requiring international collaboration to sponsor their continued operation. The tests to be carried out at Framatome's *Primär Kreislauf* (PKL) in Germany will investigate two pressurised water reactor (PWR) safety issues: boron dilution accidents that can arise from a small-break loss-of-coolant accident (LOCA) and during mid-loop operation (shutdown conditions). The first category of tests will verify if conditions can arise for core reactivity insertion due to formation of low-borated water slugs during a small-break LOCA followed by natural circulation restart. The second test series will assess whether conditions exist for a boron dilution accident as a consequence of loss-of-heat removal during mid-loop operation. The experiments to be carried out at the Paul Scherrer Institute (PSI) PANDA facility in Switzerland are to provide data on containment three-dimensional gas flow and distribution issues that are important for code prediction capability improvements, accident management and design of mitigating measures.

The PKL tests, which were run in the first phase of the SETH Project, were completed in 2002. They included one mid-loop operation test (with an open primary circuit) and LOCA tests. From these, one can derive that boron dilution can occur under some conditions. For this reason, the possibility of continuing the PKL tests under a separate arrangement – but still as an OECD/NEA project – is being considered. The planning of the PANDA tests was discussed in great detail during the two SETH meetings that were convened in 2002. In particular, the test matrix was reviewed in depth and modified to include condensation phenomena. Details of the test set-up and the instrumentation in particular were also discussed.

The Bubbler Condenser Project

Following a CSNI recommendation in June 2001, the NEA proceeded with the constitution of a project to resolve remaining issues on bubbler-condenser performance under accident conditions. The project started in December 2001 and was successfully completed in December 2002.

The bubbler condenser is a system for VVER 440/213 reactors which is devised to reduce the pressure build-up in the reactor building during a loss-of-coolant accident. The project provided answers to the remaining issues by means of in-depth analyses of previous experimental results and three new experiments carried out at the Electrogorsk Research Center (EREC) in Russia. Regulatory bodies and utilities from the Czech Republic, Hungary and the Slovak Republic, as well as experts from France, Germany and the USA participated in the project and supported the experimental work with pre- and post-test analyses. The European Union also participated in



Bubbler condensers at the Bohunice nuclear power plant, Slovak Republic.

the project. Czech, Hungarian and Slovak utilities provided the financing for the test programme.

Three project meetings were held in 2002. The first two focused on the analyses of earlier tests and the preparation of the new experiments. The third meeting was used to review the experimental results and associated pre- and post-test analyses, as well as to plan the preparation of the final report of the project. The latter will be published during the first half of 2003.

The ICDE Project

The International Common-cause Data Exchange (ICDE) Project collects and analyses operating data related to "common-cause" failures (CCF), which have the potential to affect several systems, including safety systems. The project has been in operation since 1998, and a new agreement covering the period 2002-2005 entered into force in 2002.

Japan and the Republic of Korea joined the project in 2002. The other participating countries are Canada, Finland, France, Germany, Spain, Sweden, Switzerland, the United Kingdom and the United States.

The ICDE Project is envisaged to include all possible events of interest, comprising complete, partial and incipient CCF events. The project covers the key components of the main safety systems, such as centrifugal pumps, diesel generators, motor-operated valves, power-operated relief valves, safety relief valves, check valves, reactor protection system circuit breakers, batteries and transmitters.

These components have been selected because probabilistic safety assessments have identified them as major risk contributors in the case of common-cause failures. Qualitative insights from analysis of the data will help reduce the number of CCF events that are risk contributors. In the long term, the project will provide a broad basis, which would enable the quantification of CCF events.

The Fire Project

The Fire Project started in 2002 and will run for three years. Its main purpose is to encourage multilateral co-operation in the collection and analysis of data relating to fire events in nuclear environments.

The objectives are to:

- Define the format for, and collect fire event experience (by international exchange) in, a quality-assured and consistent database.
- Collect and analyse fire events data over the long term so as to better understand such events, their causes and their prevention.
- Generate qualitative insights into the root causes of fire events that can then be used to derive approaches or mechanisms for their prevention or for mitigating their consequences.
- Establish a mechanism for the efficient feedback of experience gained in connection with fire events, including the development of defences against their occurrence, such as indicators for risk-based inspections; and to record event attributes to enable quantification of fire frequencies and risk analysis.

At present, the project participants are the Czech Republic, Finland, France, Germany, Japan, Sweden and Switzerland. Several more are expected to join in the near future.

The OPDE Project

The OECD Piping Failure Data Exchange (OPDE) Project started in 2002 and will run for three years. Its goals are to:

- Collect and analyse piping failure event data to promote a better understanding of underlying causes, impact on operations and safety, and prevention.
- Generate qualitative insights into the root causes of piping failure events.
- Establish a mechanism for efficient feedback of experience gained in connection with piping failure phenomena, including the development of defence against their occurrence.
- Collect information on piping reliability attributes and factors of influence to facilitate estimation of piping failure frequencies.

The OPDE Project is envisaged to include all possible events of interest with regard to piping failures. It will cover piping components of the main safety systems (e.g. ASME Code Classes 1, 2 and 3). It will also cover non-safety piping systems that, if leaking, could lead to common-cause initiating events such as internal flooding of vital plant areas. As an example, raw water systems such as non-essential service water could be a significant flood source given a pipe break. Specific items may be added or deleted upon the unanimous decision of the Project Review Group. Steam generator tubes are excluded from the OPDE project scope.

The current project participants are Belgium, Canada, the Czech Republic, Finland, France, Germany, Japan, the Republic of Korea, Spain, Sweden, Switzerland and the United States.

RADIATION PROTECTION

ISOE: The Information System on Occupational Exposure

The Information System on Occupational Exposure (ISOE) is a joint NEA/IAEA programme that was launched in the early 1990s. ISOE has

since become a unique worldwide programme to discuss, promote and co-ordinate international co-operative undertakings for the radiological protection of workers at nuclear power plants; a forum for discussing occupational exposure management issues; as well as the repository for the world's largest database on occupational exposure from nuclear power plants. ISOE is the only programme in the field of occupational exposure which enjoys active participation of radiation protection experts from both utilities and national regulatory authorities. This programme supplies data to the European Commission and to UNSCEAR.

At the end of 2002, data in the ISOE programme had grown to include 407 operating commercial nuclear reactors and 54 commercial nuclear reactors in cold-shutdown or some stage of decommissioning, representing 72 utilities from 29 countries. Regulatory authorities from 25 countries participate in the ISOE programme. During 2002, the software used to manage and analyse the information in the ISOE database was finalised and issued. An international "Workshop on Occupational Exposure in Nuclear Power Plants" was held in Slovenia to exchange operational dose reduction experience. The first "International Conference on Occupational Radiation Protection: Protecting Workers Against Exposure to Ionizing Radiation", which was held in Switzerland and sponsored by several international organisations including the NEA, discussed issues in occupational radiation protection, and explicitly recognised the ISOE system to be "...a very useful mechanism for disseminating information, examples of good practice and lessons learned."

RADIOACTIVE WASTE MANAGEMENT

The Sorption Project

The NEA Sorption II Project was launched in October 2000 with the objective of demonstrating the applicability of different chemical thermodynamic modelling approaches to support safety assessments of geological repositories. The project has taken the form of a "benchmarking" exercise for the different modelling approaches being pursued by the participating organisations. By applying the various modelling approaches in a systematic way to the same measured data, an evaluation of the merits and limitations of the approaches is made possible and thus recommendations on their use.

With the help of five international experts, reference data sets were analysed in respect of their suitability for the benchmarking exercise. Seven cases were selected for modelling in order to reduce the potential bias that could be introduced from a smaller number of examples.

The actual modelling exercise began at the end of 2001 for a period of six months. Twenty teams, supported by national waste management organisations, submitted 49 test cases. A project workshop was organised in Spain, at the end of October 2002, to analyse the results and discuss unresolved issues. The project is now in its final phase. A report on the results of the exercise and lessons learnt will be available for participants in spring 2003. It will be submitted to an

international peer review before publication, which is intended for the end of 2003.

The Thermochemical Database (TDB) Project

The NEA is developing a database of recommended chemical thermodynamic data for the safety assessment of nuclear waste repositories. The work is performed by the Data Bank, under the scientific guidance of the Integration Group for the Safety Case (IGSC) of the NEA Radioactive Waste Management Committee (RWMC).

The present programme is based on reviews of the following data:

- updates of the existing reviews for inorganic species of U, Am, Tc, Np and Pu;
- organic ligands with U, Am, Tc, Np, Pu, Se, Ni and Zr;
- inorganic species of Se, Ni and Zr.

The first two reviews are ready for peer review, as well as the report on the inorganic species of Se. The reports on the inorganic species of Ni and Zr will be finalised in 2003.

Considering the good advancement of the present phase of the project, the TDB Management Board decided in November 2002 to launch a new four-year phase. This new phase will cover the maintenance of the existing database, as well as the review of inorganic species and compounds of Fe, Nb, Sn and Th. In addition, the project will aim to improve communication and interface with the user community.

The Co-operative Programme on Decommissioning

The Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD) has been a joint research project operating under Article 5 of the NEA Statute since its inception in 1985. Half way through its fourth 5-year Agreement, the CPD is focusing its efforts on the exchange of decommissioning experience among its participating projects. This exchange continues to include biannual meetings of the Technical Advisory Group (TAG), during which the site of one of the participating projects is visited, and good and bad examples of decommissioning experience are openly exchanged for the benefit of all. The new membership of four organisations during 2002 attests to the continued interest in this programme.

During 2002, the practical experience of the CPD was brought to the service of the NEA through participation of CPD experts in two key groups. The RWMC Working Party on Decommissioning and Dismantling (WPDD), with several members from the CPD, produced during 2002 a significant document on the status, approaches and challenges of the decommissioning and dismantling of nuclear facilities, as well as an update of its decommissioning fact sheets on national decommissioning programmes. The NDC Expert Group on Decommissioning Strategies and Costs, again with several members who were also members of the CPD, produced a draft report on this subject. The practical experience of the CPD has thus served to help the NEA expert groups involved in regulatory and policy aspects of decommissioning to develop products that are solidly grounded in real-world experience.

Information Programme

Decision making in the field of nuclear energy and stakeholder participation need to be based on understanding. The NEA Information Programme seeks to provide member governments and other interested parties with a large array of information resulting from the Agency's activities, thereby enhancing awareness and understanding of the scientific, technical and economic aspects of the nuclear option.

The NEA is an intergovernmental agency specialised in studying the scientific, technical and economic aspects of nuclear energy. It has no commercial interests in the nuclear industry and is not a lobby group. It strives to provide high-quality, factual information in a timely manner to those with a need to know for their professional activities, as well as to those with an interest in learning about nuclear energy's multiple aspects. NEA activities cover the full range of the fuel cycle and consider future technological developments. All of these activities are reflected in the Agency's publications and information programme.

Publications

The Agency produced 64 publications in 2002, of which 32 were on sale and 32 were distributed free of charge. The list of these publications is provided on page 34. Best sellers included *Uranium 2001: Resources, Production and Demand*; *Fission Gas Behaviour in Water Reactor Fuels*; and *Advanced Reactors with Innovative Fuels*.



In addition to standard distribution of free publications (some 50 000 copies), over 600 individual requests were received involving the shipment of more than 1 800 reports.

Two issues of *NEA News* were published in English and French. In addition to feature articles covering the latest developments in the nuclear energy field, they provided updates on NEA work, news briefs, information about NEA publications and forthcoming events. The 2002 yearly subscription price was € 37. Sample articles and back issues are available on the NEA website at www.nea.fr/html/pub.

Internet-based communication

A complete revamp of the NEA website's graphical interface was completed during 2002. In addition to standardising the overall look of the site, the new interface has improved the speed with which web pages from the site load. The Agency welcomes comments and feedback from website visitors.

A new section on "Civil Society" (www.nea.fr/html/civil) presenting information on the Agency's four main areas of activity in this field was added to the site in 2002 (see page 32 for details about these activities). The new section also provides links to OECD work on government-citizen relations and a range of NEA reports of related interest.



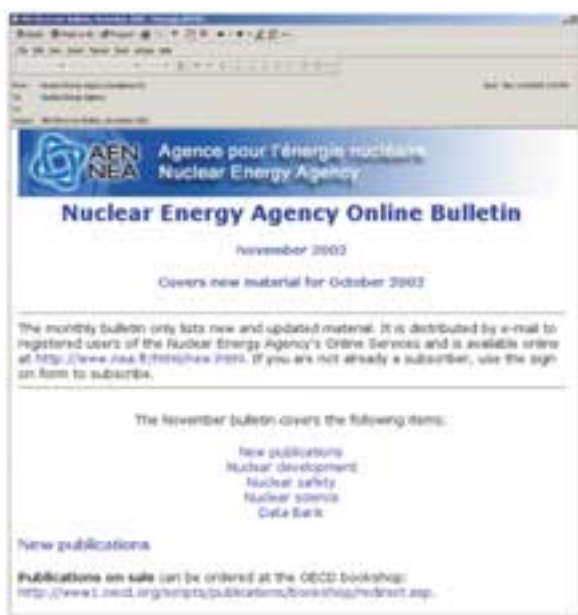
Work is under way to introduce another new section early in 2003 to cater in particular to the needs of journalists and the staff of policy makers. The "NEA Press Room" will also provide background information of the sort that students and the general public often request.

While the number of visits to the NEA website remained more or less constant, the "quality" of visits to the site improved. The percentage of visitors who downloaded a report during their visit increased

from 52% in 2001 to 66% in 2002. The most downloaded report remained the perennial *Chernobyl – Ten Years On: Radiological and Health Impact* followed by *Externalities and Energy Policy: The Life Cycle Analysis Approach*. The 2002 update of the Chernobyl report will be available on the site from January 2003.

The "Delegates' area" on the NEA website now constitutes an important tool for many NEA committees and working groups. This section of the website provides authorised users with OECD official documents, information on forthcoming NEA meetings and contact details for other committee members. Over 4 000 official documents are now available in the Delegates' area, 342 of which were added during the course of 2002.

Individual subscriptions to the Agency's monthly electronic bulletin continued to grow during 2002, reaching 5 500 by December. The HTML bulletin's format was streamlined and brought into line with the website's graphical interface in November. The bulletin is distributed free of charge and includes monthly updates on important NEA activities and newly released reports. Subscription requests can be made at www.nea.fr/html/signon.html.



Several projects are also under way to enhance the NEA Intranet in order to improve communication within the Agency.

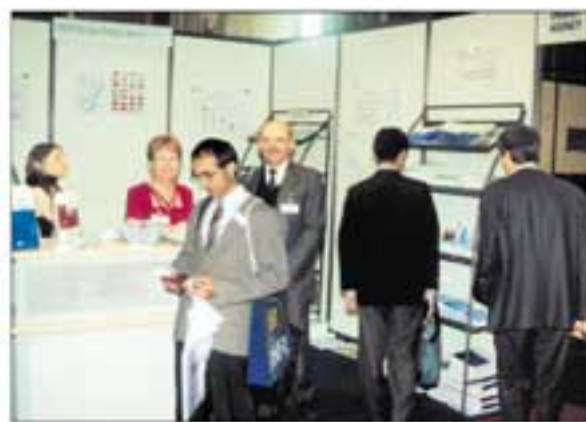
NEA visibility in international fora

NEA information and publications stands were organised at six international conferences in 2002:

- The OECD Forum 2002 on "Taking Care of the Fundamentals: Security, Equity, Education and Growth", Paris, France, 13-15 May.
- The World Summit on Sustainable Development (WSSD), Johannesburg, South Africa, 17 August-8 September.
- ENC 2002, Lille, France, 7-9 October.

- The Agency produced 64 publications in 2002, of which 32 were on sale and 32 were distributed free of charge.
- A section on "Civil Society" was added to the NEA website.
- NEA information and publications stands were organised at six international conferences.
- The NEA co-sponsored 13 international conferences during 2002.

- The 13th Pacific Basin Nuclear Conference, Shenzhen, China, 21-25 October.
- The ANS Winter meeting, Washington, DC, 17-19 November.
- The ANDRA International Meeting on Clays in Natural and Engineered Barriers for Radioactive Waste Confinement, Reims, France, 9-12 December.



The NEA stand at the ENC 2002 international nuclear congress and world nuclear exposition.

The NEA co-sponsored 13 international conferences. Some of the events at which the NEA made significant contributions included the IAEA international conferences on "Occupational Radiation Protection: Protecting Workers Against Exposure to Ionizing Radiation" and "Issues and Trends in Radioactive Waste Management".



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Nuclear Energy and Civil Society

Since 1999, the OECD has been conducting a broad-ranging programme on governance issues ultimately aimed at strengthening pluralistic democracy, promoting economic prosperity and social cohesion, and maintaining confidence in public administration. This programme stems from the view expressed at the 1999 OECD Council Meeting at Ministerial Level that: *"The political, economic and social challenges of the next century require informed and actively participating citizens. Ministers recognise their heightened responsibility to ensure transparency and clarity in policy making, and look to the Organisation to assist governments in the important task of improving communication and consultation with civil society."*

Faced with the complexity of the relationship between government and citizens, and a perceived loss of direct influence over national and local policy decisions, many citizens are looking for ways to make wider use of participatory democracy. For their part, governments increasingly realise that they will not be able to conduct and effectively implement policies if their citizens do not understand and support them. Governments are thus looking to new or improved models and approaches for better informing and involving citizens in the policy-making process.

Nuclear energy is among those industrial activities that are particularly challenged to show transparency and accountability in decision making. Care must be taken to address citizens' concerns over its potential implications, particularly for public health and safety, including in respect of future generations. The NEA began studying specific aspects of the issue of nuclear energy and civil society two decades ago, and more recently several of the Agency's standing technical committees have launched activities that aim to analyse national and local experience and to communicate lessons learned. NEA activities currently under way are briefly described below.

Society and nuclear energy: towards a better understanding

As the social dimension is playing an increasingly important role in the nuclear energy policies of member countries, the NEA Nuclear Development Committee (NDC) initiated a study on society and nuclear energy, examining in particular public perception of the related risks and benefits. The first phase of the study, an in-depth review of authoritative literature and expert opinions on the topic, was completed in 2001. It covered nuclear-specific issues, the decision-making process and communication issues. The study was published in 2002 under the title *Society and Nuclear Energy: Towards a Better Understanding* and is available free of charge on the NEA website.

Results from this first phase of the project highlighted the importance of risk perception and communication and showed that more work in this field could contribute to facilitate the dialogue between civil society, nuclear energy experts and policy makers. In this connection, it was felt that the analysis of practical experience in different member countries would provide opportunities to draw lessons from successes and best practices as well as failures. An Expert Group on Society and Nuclear Energy has since been created to carry out a study that would provide policy makers with findings, guidance and recommendations on communication and consultation with civil society in connection with nuclear energy policy decisions. The processes used or intended to be used in member countries would be mapped and experiences on consultation and communication aspects reported and analysed. The combined programmes of industry and government would be addressed, and if the examples were too numerous, case studies would be selected. The results of the study would be discussed at a workshop before being published.

Nuclear regulators and the public

Regulatory bodies, in fulfilling their responsibilities to inform the public about their role in contributing to nuclear safety, face increasing communication needs. At the same time, good governance and efficiency in decision making by government authorities are increasingly depending upon mutual trust and confidence between those authorities and the public. It was in this context that the NEA Working Group on Public Communication of Nuclear Regulatory Organisations was established in June 2001.

In 2002, the working group discussed topics such as how their organisations handled public questions following the 11 September 2001 events in the US, how to deal with questions from the public concerning terrorist attacks on nuclear installations, the public impact in the US and other countries of the Davis-Besse reactor vessel head corrosion, the public impact from cover-ups of inspection findings by several Japanese utilities, how to communicate to the public information related to radiological releases of nuclear installations, and experience gained with the organisation of public meetings.

The issue of how to communicate to the public information related to authorised radiological releases from nuclear installations was discussed in detail. The problems associated with this issue involve the fact that measured figures are very much below the regulatory limits, variations from one report to the next can be very wide, it is next to impossible to deduce trends, and some safety

authorities prefer to lower regulatory limits (as part of a wider policy taking into account technological improvements, the precaution principle, etc.) while others are opposed to such a change in regulation. The group reached consensus on the following position: changing regulatory limits without giving at the same time good technical justification to support the change may cause communication problems; for this reason, communication strategy should be taken into account in this aspect of the regulatory process.

Stakeholder involvement in radiological protection decision making

Contemporary society has become increasingly interested in participating more actively in public decision making regarding health, safety and environmental protection issues. As governments have tried to understand these interests better, and to integrate societal needs in their decision-making processes more adequately, it has become possible to begin to glean some common policy-level issues and lessons from the wide variety of situations in which stakeholders participated effectively in the elaboration of decisions.

The trends within the nuclear industry mirror those of broader governance questions, and public interest in some situations can be extremely high. Within the radiological protection community, these stakeholder issues have moved steadily to the forefront of policy discussions, and clearly form key elements in decisions regarding the development and implementation of radiological protection policy.

The NEA Committee on Radiation Protection and Public Health (CRPPH) has explored the details and implications of stakeholder involvement in decision-making processes for several years. Through CRPPH work in this area, and following the results of two workshops hosted by the Swiss Nuclear Safety Inspectorate in 1998 and 2001, the consensus is growing that stakeholder involvement is an important component of the decision-making process, and that in some cases it is an essential component for arriving at an accepted solution and for building (or rebuilding) trust in decision-making authorities.

Based on this experience, the CRPPH has been exploring various process aspects of stakeholder involvement, using three specific case studies to extract commonalities that, to some extent, transcend geographic and cultural frontiers. Stakeholder aspects also form an essential element in the evolution of the system of radiological protection. This work will therefore also serve as NEA input to ICRP discussions on new recommendations.

Radioactive waste management

Any significant decisions regarding the long-term management of radioactive waste will be accompanied by a comprehensive public review with involvement of a diverse range of stakeholders. These stakeholders include not just the waste generators, waste management agencies and regulatory authorities, all of whom have a primarily technical focus, but also interested or concerned parties with a non-technical focus such as local communities, elected officials, non-governmental organisations and the general public. The Forum on Stakeholder Confidence (FSC) facilitates the sharing of international experience in addressing the societal dimension of radioactive waste management. It explores means of ensuring an effective dialogue with the public, and considers ways to strengthen confidence in decision-making processes.

The latest in a series of international workshops organised by the Forum in national contexts was held in Canada in October 2002 and was hosted by the Department of Natural Resources. Three key areas of inquiry were examined: what are the social concerns at play in radioactive waste management; how can these concerns be

addressed; and development opportunities for local communities. The workshop enabled an analysis and appraisal of the Port Hope case and the longer-range spent fuel disposal programme, and allowed a wide range of Canadian stakeholders to meet and exchange views, in some cases for the first time. External experts in radiological protection, community governance, ethics and stakeholder deliberation provided additional feedback. The site visit allowed the FSC delegates to meet actors in the decision process for the

final clean-up and disposition of mill tailings in Port Hope, Ontario. The Canadian workshop and site visit confirmed:

- the very important role that local communities and municipalities will play, which needs to be encouraged;
- that nuclear municipalities have a special interest in seeing solutions brought forward; they are especially receptive to dialogue and are already active to that effect;
- the importance of having a government body that is active in having the process of dialogue carried out and the decisions implemented.

The FSC also completed several studies that will be available as NEA publications in 2003. They concern the evolving image and role of the regulator, stepwise decision making, and a survey of outreach activities in NEA member countries in the field of radioactive waste management.

The uranium conversion facility at Port Hope, Canada, and the surrounding residential community.



NEA Publications Produced in 2002

➔ Publications of General Interest

2001 Annual Report – ISBN 92-64-18483-X – 40 pages – Available on the web.

Catalogue of Publications 2002-2003 – 68 pages – Free: paper or web versions.

NEA News – 2002, Nos. 20.1 and 20.2

2002 Subscription (2 issues): ISSN 1605-9581 – Price: € 37, US\$ 45, £ 26, ¥ 4 800.

➔ Economic and Technical Aspects of the Nuclear Fuel Cycle

Accelerator-driven Systems (ADS) and Fast Reactors (FR) in Advanced Nuclear Fuel Cycles

A Comparative Study

ISBN 92-64-18482-1 – 352 pages – Free: paper or web versions.

Environmental Remediation of Uranium Production Facilities

ISBN 92-64-19509-2 – 350 pages – Price: € 70, US\$ 63, £ 43, ¥ 7 050.

Externalities and Energy Policy: The Life Cycle Analysis Approach

Workshop Proceedings, Paris, France, 15-16 November 2001

ISBN 92-64-18481-3 – 240 pages – Free: paper or web versions.

Nuclear Energy and the Kyoto Protocol

ISBN 92-64-18486-4 – 52 pages – Free: paper or web versions.

Nuclear Energy Data – 2002

Bilingual – ISBN 92-64-09899-2 – 86 pages – Price: € 20, US\$ 20, £ 13, ¥ 2 350.

Society and Nuclear Energy: Towards a Better Understanding

ISBN 92-64-18494-5 – 128 pages – Free: paper or web versions.

Trends in the Nuclear Fuel Cycle – Economic, Environmental and Social Aspects

ISBN 92-64-19664-1 – 160 pages – Price: € 37, US\$ 33, £ 23, ¥ 3 700.

Uranium 2001: Resources, Production and Demand

ISBN 92-64-19823-7 – 340 pages – Price: € 85, US\$ 74, £ 52, ¥ 9 850.

➔ Nuclear Safety

Advanced Nuclear Reactor Safety Issues and Research Needs

Workshop Proceedings, Paris, France, 18-20 February 2002

ISBN 92-64-19781-8 – 344 pages – Price: € 75, US\$ 65, £ 46, ¥ 8 700.

CSNI Technical Opinion Papers

No. 1: Fire Probabilistic Safety Assessment for Nuclear Power Plants

No. 2: Seismic Probabilistic Safety Assessment for Nuclear Facilities

ISBN 92-64-18490-2 – 28 pages – Free: paper or web versions.

Improving Versus Maintaining Nuclear Safety

ISBN 92-64-18493-7 – 36 pages – Free: paper or web versions.

Nuclear Regulation

Nuclear Regulatory Challenge of Judging Safety Backfits (The)

ISBN 92-64-18484-8 – 24 pages – Free: paper or web versions.

Radiation Protection

Better Integration of Radiation Protection in Modern Society

Workshop Proceedings, Villigen, Switzerland, 23-25 January 2001

ISBN 92-64-19694-3 – 280 pages – Price: € 60, US\$ 54, £ 37, ¥ 6 050.

Chernobyl: Assessment of Radiological and Health Impacts

2002 Update of *Chernobyl: Ten Years On*

ISBN 92-64-18487-2 – 160 pages – Free: paper or web versions.

ISOE – Information System on Occupational Exposure

Ten Years of Experience

ISBN 92-64-18480-5 – 40 pages – Free: paper or web versions.

Occupational Exposures at Nuclear Power Plants

Eleventh Annual Report of the ISOE Programme, 2001

ISBN 92-64-18492-9 – 104 pages – Free: paper or web versions.

Way Forward in Radiological Protection (The)

An Expert Group Report

ISBN 92-64-18489-9 – 48 pages – Free: paper or web versions.

Radioactive Waste Management

Decommissioning and Dismantling of Nuclear Facilities (The)

Status, Approaches, Challenges

ISBN 92-64-18488-0 – 52 pages – Free: paper or web versions.

Establishing and Communicating Confidence in the Safety of Deep Geologic Disposal

Approaches and Arguments

Bilingual. ISBN 92-64-09782-1 – 188 pages – Price: € 45, US\$ 40, £ 28, ¥ 5 150.

GEOTRAP: Radionuclide Migration in Geologic, Heterogeneous Media

Summary of Accomplishments

ISBN 92-64-18479-1 – 52 pages – Free: paper or web versions.

Handling of Timescales in Assessing Post-closure Safety of Deep Geological Disposal (The)

Workshop Proceedings, Paris, France, 16-18 April 2002

ISBN 92-64-09911-5 – 216 pages – Price: € 49, US\$ 49, £ 31, ¥ 5 700.

International Peer Review of the Yucca Mountain Project TSPA-SR (An)

Total System Performance Assessment for the Site Recommendation (TSPA-SR)

ISBN 92-64-18477-5 – 96 pages – Free: paper or web versions.

Radionuclide Retention in Geologic Media

Workshop Proceedings, Oskarshamn, Sweden, 7-9 May 2001

ISBN 92-64-19695-1 – 272 pages – Price: € 55, US\$ 49, £ 34, ¥ 5 550.

Stepwise Decision Making in Finland for the Disposal of Spent Nuclear Fuel

Workshop Proceedings, Turku, Finland, 15-16 November 2001

ISBN 92-64-19941-1 – 152 pages – Price: € 45, US\$ 45, £ 28, ¥ 5 250.

Nuclear Legislation

Nuclear Law Bulletin No. 69 & Supplement (Volume 2002/1)
Nuclear Law Bulletin No. 70 & Supplement (Volume 2002/2)
2002 Subscription (2 issues + supplements): ISSN 0304-341X – Price: € 75, US\$ 80, £ 48, ¥ 9 550.

Nuclear Legislation: Analytical Study – 2001 Update
Regulatory and Institutional Framework for Nuclear Activities
ISBN 92-64-19743-5 – 180 pages – Price: € 40, US\$ 36, £ 25, ¥ 4 000.

Nuclear Science

Advanced Reactors with Innovative Fuels
Workshop Proceedings, Chester, United Kingdom, 22-24 October 2001
ISBN 92-64-19847-4 – 512 pages – Price: € 130, US\$ 113, £ 79, ¥ 15 000.

Basic Studies on High-temperature Engineering
Second Information Exchange Meeting, Paris, France, 10-12 October 2001
ISBN 92-64-19796-6 – 360 pages – Price: € 75, US\$ 66, £ 46, ¥ 8 600.

Comparison Calculations for an Accelerator-driven Minor Actinide Burner
ISBN 92-64-18478-3 – 200 pages – Free: paper or web versions.

Fission Gas Behaviour in Water Reactor Fuels
Workshop Proceedings, Cadarache, France, 26-29 September 2000
ISBN 92-64-19715-X – 564 pages – Price: € 120, US\$ 107, £ 74, ¥ 12 100.

International Evaluation Co-operation
Volume 6: Delayed Neutron Data for the Major Actinides
132 pages – Free: paper or web versions.

Physics of Plutonium Recycling
Volume VI: Multiple Plutonium Recycling in Advanced PWRs
ISBN 92-64-19957-8 – 162 pages – Price: € 45, US\$ 45, £ 28, ¥ 5 250.

Pressurised Water Reactor Main Steam Line Break (MSLB) Benchmark
Volume III: Results of Phase 2 on 3-D Core Boundary Conditions Modelling
ISBN 92-64-18495-3 – 172 pages – Free: paper or web versions.

Speciation, Techniques and Facilities for Radioactive Materials at Synchrotron Light Sources
Workshop Proceedings, Grenoble, France, 10-12 September 2000
ISBN 92-64-18485-6 – 380 pages – Free: paper or web versions.

VVER-1000 Coolant Transient Benchmark – Phase I (V1000CT-1)
Volume I: Main Coolant Pump (MCP) Switching On – Final Specifications
ISBN 92-64-18496-1 – 172 pages – Free: paper or web versions.

VVER-1000 LEU and MOX Assembly Computational Benchmark (A)
Specification and Results
ISBN 92-64-18491-0 – 156 pages – Free: paper or web versions.

The Data Bank

CINDA 2002
CD-ROM – Free on request.

Use of Thermodynamic Databases in Performance Assessment (The)
Workshop Proceedings, Barcelona, Spain, 29-30 May 2001
ISBN 92-64-19846-6 – 216 pages – Price: € 55, US\$ 50, £ 34, ¥ 6 350.

Main Workshops and Seminars Held in 2002

February

- 12-14** NEA/ICRP Forum on Radiological Protection of the Environment: The Path Forward to a New Policy? – Taormina, Sicily, Italy.
- 18-20** Workshop on Advanced Nuclear Reactor Safety Issues and Research Needs – Paris, France.

March

- 6-8** Workshop on How to Prevent Recurring Events More Effectively – Schloss Böttstein, Switzerland.

April

- 08-10** Conference on the Scientific Approach to Safety Management – Paris, France.
- 16-18** Workshop on the Handling of Timescales in Assessing Post-closure Safety – Paris, France.
- 28-02** International Workshop on Regulatory Inspection Activities Related to the Inspection of Events and Incidents; Internal and External Hazards; and Challenges Arising from Competition in the Electricity Market – Veracruz, Mexico.

May

- 27-31** SMORN VIII, Symposium on Nuclear Reactor Surveillance and Diagnostics – Göteborg, Sweden.

June

- 18-19** NEA/WANO International Forum on Nuclear Regulator-Licensee Interface Issues – Paris, France.
- 26-27** OECD Lower Head Failure (OLHF) Project Seminar – Madrid, Spain.

September

- 25-27** EC/NEA Workshop on the Engineered Barrier System in the Context of the Entire Safety Case – Oxford, United Kingdom.

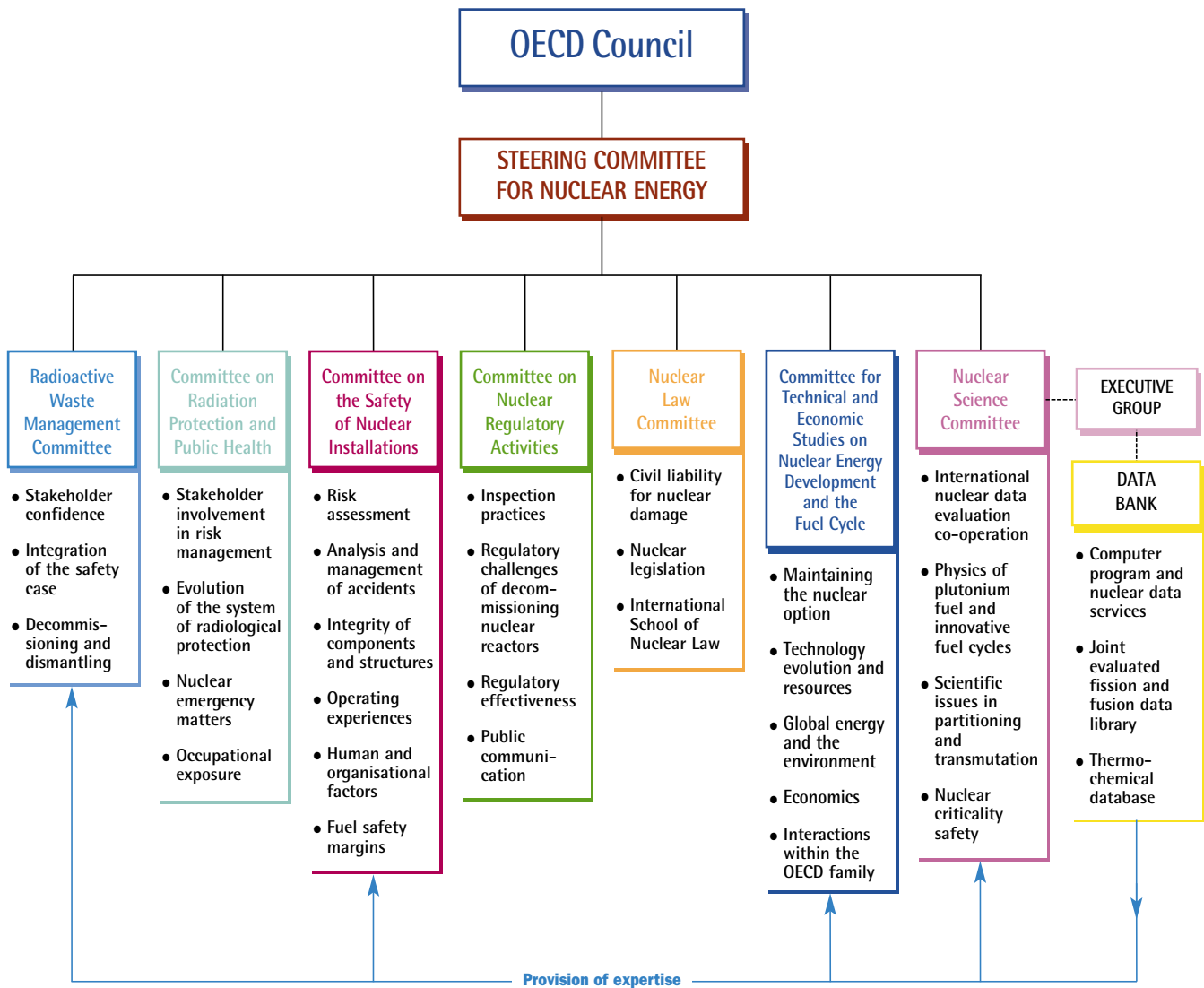
October

- 06** Fourth Workshop of the NRC Boiling Water Reactor Turbine Trip Benchmark – Seoul, Republic of Korea.
- 15-18** Workshop of the Forum on Stakeholder Confidence (FSC) – Chalk River, Ontario, Canada.
- 15-18** Joint HSK-IAEA-NEA Workshop on Regulatory Decision-making Processes – Brienz, Switzerland.
- 16-18** Workshop on Seismic Relations Between Seismological Data and Seismic Engineering Analysis – Istanbul, Turkey.
- 24-25** Asian Regional Conference on the Evolution of the System of Radiological Protection – Tokyo, Japan.

November

- 06-08** Workshop on R&D Needs for Current and Future Nuclear Systems – Paris, France.
- 11-13** Joint IAEA/NEA Workshop on the Use of CFD Codes for Safety Analysis of Reactor Systems – Pisa, Italy.
- 18-20** Workshop on the Development and Use of Risk Monitors – Madrid, Spain.

Organisation Charts of the NEA



NEA Secretariat Structure in 2002



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Luis Echávarri



**Deputy
Director-General**
Carol Kessler



**Safety and
Regulation**
Kazuo Shimomura
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**Nuclear
Science and
Data Bank**
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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Pursuant to Article 1 of the Convention signed in Paris on 14th December 1960, and which came into force on 30th September 1961, the Organisation for Economic Co-operation and Development (OECD) shall promote policies designed:

- to achieve the highest sustainable economic growth and employment and a rising standard of living in member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

The original member countries of the OECD are Austria, Belgium, Canada, Denmark, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The following countries became members subsequently through accession at the dates indicated hereafter: Japan (28th April 1964), Finland (28th January 1969), Australia (7th June 1971), New Zealand (29th May 1973), Mexico (18th May 1994), the Czech Republic (21st December 1995), Hungary (7th May 1996), Poland (22nd November 1996), Korea (12th December 1996) and the Slovak Republic (14 December 2000). The Commission of the European Communities takes part in the work of the OECD (Article 13 of the OECD Convention).

NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1st February 1958 under the name of the OEEC European Nuclear Energy Agency. It received its present designation on 20th April 1972, when Japan became its first non-European full member. NEA membership today consists of 28 OECD member countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Portugal, the Republic of Korea, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities also takes part in the work of the Agency.

The mission of the NEA is:

- to assist its member countries in maintaining and further developing, through international co-operation, the scientific, technological and legal bases required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes, as well as
- to provide authoritative assessments and to forge common understandings on key issues, as input to government decisions on nuclear energy policy and to broader OECD policy analyses in areas such as energy and sustainable development.

Specific areas of competence of the NEA include safety and regulation of nuclear activities, radioactive waste management, radiological protection, nuclear science, economic and technical analyses of the nuclear fuel cycle, nuclear law and liability, and public information. The NEA Data Bank provides nuclear data and computer program services for participating countries.

In these and related tasks, the NEA works in close collaboration with the International Atomic Energy Agency in Vienna, with which it has a Co-operation Agreement, as well as with other international organisations in the nuclear field.

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