# NEA
# Annual Report
# 2005

NUCLEAR • ENERGY • AGENCY

Organisation for Economic Co-operation and Development

# The NEA in Brief

Governing body:
the Steering Committee for Nuclear Energy

28 member countries
(22 in the Data Bank)

47 years of international service

7 standing technical committees

17 international joint projects
funded by participants

69 professional and support staff (NEA and the Data Bank combined)

580 national experts participating in NEA committees

3 600 experts participating annually, on average, in policy
and technical meetings organised at OECD headquarters

€10 million budget for the NEA in 2005,
supplemented by voluntary contributions

€2.8 million budget for the Data Bank in 2005,
supplemented by voluntary contributions

66 publications produced in 2005

# The NEA and its Mission

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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Shikoku Electric Power Co., Inc. Japan

# Message from the Director-General

The trend towards renewed interest in nuclear power was largely confirmed in 2005, both within and outside the OECD area.

Early in the year, ministers from around the world gathered at the international conference on Nuclear Power for the 21st Century, held in Paris, France, showing in most cases renewed or strengthened interest in nuclear energy's capacity to enhance security of energy supply, reduce environmental impacts of energy production and provide electricity at affordable costs. The importance of providing reliable, affordable, clean energy was echoed by ministers attending the Meeting of the International Energy Agency (IEA) Governing Board at Ministerial Level in May.

During the summer, the US Energy Policy Act of 2005 laid the official groundwork for nuclear energy to take on new life across the United States. It provides, *inter alia*, a wide range of measures to support currently operating nuclear power plants, incentives for building new plants and risk protection for companies pursuing the construction of new reactors. Other US initiatives, including the Global Nuclear Energy Partnership (GNEP), are adding to the recent momentum building in favour of nuclear energy use. In Japan, the year saw two new reactors come on line, as well as the adoption of a new Policy Framework for Nuclear Energy. Other country developments are described on page 6.

At the NEA Steering Committee policy debate in October, many NEA member countries upheld that nuclear energy has a role to play in contributing to security of electricity supply. They also agreed that governments have a role to play in ensuring security of energy supply, as a complement to market forces.

Against this backdrop, the NEA Secretariat is playing an active role in helping to develop the scientific, technological and legal bases that will assist those member countries that wish to make use of nuclear energy, to do so in a safe, environmentally friendly and economical manner. In addition to the many activities in its regular programme of work, the NEA provides Technical Secretariat services for the Generation IV International Forum (GIF), a major international initiative aimed at developing the next generation of nuclear energy systems for commercialisation by 2030. These systems are to offer significant advances in terms of sustainability, safety and reliability, economics, proliferation resistance and physical protection. Further details about GIF and the full range of NEA activities can be found in this year's *Annual Report*.

Mr. Luis Echávarri
NEA Director-General

# Nuclear Power in 2005

## Nuclear energy development

As of 31 December 2005, 351 reactors were in operation in OECD countries constituting some 83% of the world's total nuclear electricity generating capacity and about 23.4% of the total electricity supply in the OECD area. During 2005, three reactors were started up in OECD countries: two in Japan and one in Korea. After being in lay-up since 1997, the Pickering-1 reactor was reconnected to the grid in Canada. Two reactors were shut down – one in Germany and one in Sweden – as part of those countries' phase-out plans.

Tohoku Electric Power, Japan

View of the Higashidori-1 nuclear power plant, Japan.

OECD countries continue to have different approaches to the production and use of nuclear energy. At present, several countries officially have policies in place which exclude or plan to phase out the production of nuclear energy (this currently includes Austria, Belgium, Germany, Italy, Spain and Sweden, but the policies could evolve in certain countries given recent debates). Others are actively pursuing plans to increase their nuclear capacity in the future (Canada, Finland, France, Japan, Korea, the Slovak Republic and the United States) or are considering the possible introduction of nuclear power into their energy mix. A number of other OECD countries continue to use nuclear energy, but have not announced any plans for expansion or new construction. Overall, however, momentum to build new nuclear capacity grew. Key events that support this perception were that:

- In Finland, TVO began construction of the Olkiluoto-3 reactor, using the advanced European pressurised reactor (EPR) design.
- The French government and EDF, the country's primarily state-owned electricity utility, continued preparations for the construction of an EPR to be located near Flamanville in the Basse-Normandie region. Plans have also been announced to construct additional units in the future to replace those due to be retired.
- In Japan, Higashidori-1 and Shika-2, both boiling water reactors (one of which is an ABWR), were connected to the grid in March and July 2005 respectively. In October, the Japanese government adopted a new Policy Framework for Nuclear Energy, which stipulated *inter alia* that Japan should maintain its nuclear share of total domestic electricity generation at around 30-40% after 2030, and should aim to introduce fast breeder reactors (FBRs) commercially by 2050 and pursue a domestic nuclear fuel cycle policy based on spent fuel reprocessing. Following that decision, the Agency for Natural Resources and Energy of the Ministry of Economy, Trade and Industry (METI) began work on the Framework's implementation plan.
- In Korea, the Ulchin-6 reactor was started up and connected to the grid in January 2005. In June, construction of the Shin Kori-1 and -2 nuclear power reactors was approved by the Ministry of Science and Technology. The two new KSNP+ 1 000 MWe pressurised water reactors are expected to be completed respectively by 2010 and 2011.
- In the United States, Congress adopted the Energy Policy Act, which was signed by the President in August 2005. The law contains several incentives intended to encourage construction of new nuclear power plants, including electricity production tax credits, loan guarantees and risk protection for the first few companies pursuing construction of new reactors. Also, in December 2005, the Nuclear Regulatory Commission (NRC) certified the design of the AP-1000 advanced pressurised water reactor, which can now be referenced in a combined construction and operating license application. AREVA announced its intent to pursue design certification of the US evolutionary power reactor (US EPR) as a step towards marketing that design in the United States.

Similar developments in non-OECD countries tend to confirm the growth in momentum. Three additional units came on line in 2005, and construction of another two units officially started. Plans for further expansion have been adopted in a number

## 2005 Nuclear Data Summary
(as of 31 December 2005)

| Country | Operational reactors | Installed capacity (GWe net) | 2005 uranium requirements (tonnes U) | Nuclear share of 2005 electricity production (%) |
|---|---|---|---|---|
| Belgium | 7 | 5.8 | 1 367 | 55.0 |
| Canada | 20 | 12.5 | 1 800 | 14.4 |
| Czech Republic | 6 | 3.5 | 756 | 30.6 |
| Finland | 4 | 2.7 | 524 | 32.9 |
| France* | 59 | 63.4 | 7 185 | 78.1** |
| Germany* | 17 | 20.3 | 2 900 | 30.1** |
| Hungary | 4 | 1.8 | 370 | 39.4 |
| Japan | 54 | 46.3* | 7 819 | 31.8 |
| Mexico | 2 | 1.4 | 360 | 5.2 |
| Netherlands | 1 | 0.5 | 65 | 3.7 |
| Republic of Korea* | 20 | 16.8 | 3 400 | 38.0** |
| Slovak Republic* | 6 | 2.5 | 450 | 55.5** |
| Spain | 9 | 7.5 | 1 177 | 19.8 |
| Sweden* | 11 | 9.4 | 1 400 | 50.6** |
| Switzerland* | 5 | 3.2 | 270 | 39.4** |
| United Kingdom | 23 | 11.8 | 2 300 | 20.6 |
| United States | 104 | 99.8 | 22 875 | 19.3 |
| **Total (OECD)** | **352** | **309.2** | **55 018** | **23.4** |

* Estimates. ** 2004 data.

of countries, and in a selection of others consideration is being given to the introduction of nuclear energy.

At the same time, plant life extensions, extending operating licences in many instances by an additional 20 years, contributes to available capacity. Extensions have been approved or are being pursued in several OECD countries, including Hungary, the Netherlands and the United States.

### *Uranium production, conversion and enrichment*

In 2004 (the last year for which data is available), uranium was produced in just seven OECD countries, three of which produced only small amounts as part of mine remediation efforts. However, Canada (29%) and Australia (22%) accounted for half of world production. Production in OECD countries amounted to approximately 22 000 tonnes of uranium (tU) in 2004 and was expected to increase just slightly in 2005. Production in 2004 accounted for only about 40% of the uranium requirements in the OECD area, with the remainder being met by secondary sources (for example, excess commercial inventories).

Over the past several years there has been a significant and sustained increase in uranium market price. Since late 2001 the price of uranium has steadily increased, over five-fold by the end of 2005. This increase in price, coming after nearly two decades of price stagnation, has stimulated considerable exploration activities and has led to plans being announced for significant new production. This should help to meet expected demand in the years to come as secondary sources diminish and reactor requirements need to be met by primary production.

During 2005, conversion facilities continued to operate in Canada, France, the United Kingdom and the United States. In March 2005, Cameco announced a 10-year contract for conversion services to be performed at the BNFL Springfield site in the United Kingdom, thereby extending the life of the plant which had been slated to close in 2006.

In terms of uranium enrichment, the worldwide trend towards the use of centrifuge technology continued. In the United States, two efforts remain under way to create a commercial centrifuge enrichment capability. One, sponsored by the US Enrichment Corporation (USEC), will use advanced centrifuge technology adapted from prior US Government research. A second initiative, under Louisiana Energy Services (LES), is based on Urenco centrifuge technology. The USEC plant is expected to be constructed in Piketon, Ohio while the LES

plant would be located in Lea County, New Mexico. On 15 June 2005, the NRC issued a Final Environmental Impact Statement and a Safety Evaluation Report for the proposed LES facility. Construction of the LES facility is expected to begin in 2006, and in 2007 for the USEC facility.

In Germany, in February 2005 the Northrhine-Westphalia State Ministry of Energy issued a licence for the planned capacity increase to 4 500 t SWU/y at Urenco's Gronau enrichment plant, which represents a potential increase of 150% over current capacity. The licence comprises the construction of a second enrichment plant next to the existing plant. First production at the new plant is expected to begin in the second half of 2007. In October, the European Commission conditionally approved AREVA's plans to acquire 50% of Urenco's Enrichment Technology Company as a means to gain access to centrifuge technology and to use it to replace the ageing Georges Besse gaseous diffusion plant in France.

## Nuclear safety and regulation

Overall, the safety performance of nuclear power plants in OECD countries continues to be very good, as reflected in a number of published performance indicators. The current safety record is built upon a mature industry, a robust regulatory system and a strong foundation of research. There is a general consensus that safety research can improve the efficiency and effectiveness of a regulatory system by helping to identify the items most important to safety and by anticipating future regulatory challenges, thus allowing resources to be focused on the most significant concerns.

In 2005, some significant events took place, drawing attention to latent failures on piping, switchboards and cable insulation. Latent failures have been an issue of concern in recent years and illustrate the continuing need to respond to operating experience and to implement an appropriate and timely corrective action programme. OECD nuclear safety and nuclear regulatory authorities have been active in revealing and resolving issues in this field and aim to improve nuclear safety continuously in OECD countries and beyond. They have established several joint activities and multilateral research projects to this effect.

A. Gonin, CEA, France

Radiological conditions are systematically monitored in and around nuclear power plants. Any releases are strictly regulated.

## Radiological protection

Several of the evolving aspects of radiological protection are beginning to converge, building an increasingly clear picture of the issues that will shape radiological protection policy, regulation and application for the coming 10 to 15 years. The most important of these are the development of new International Commission on Radiological Protection (ICRP) recommendations, which traditionally have been the basis for most national RP regulations, and the increasing influence of stakeholder involvement in radiological protection decision-making processes.

Progress has been made towards the finalisation of the ICRP's general recommendations, which are now expected to be approved in late 2006 after further public comment on a yet-to-be-released new draft. It should also be noted that the ICRP is continuing its work on the radiological protection of the environment. Both of these activities will have a significant influence on the update of another important document, the International Basic Safety Standards (BSS). The work to develop a new BSS, as well as the parallel development of a new European Commission BSS Directive, began in 2005 and is expected to take several years.

The main current issues in radiological protection – accident management and rehabilitation, new site selection, decommissioning and site release, and operational releases – are significantly influenced by stakeholder involvement issues. As a result, regulatory policies and frameworks, organisational structures and decision-making processes are being revisited, and in some cases modified to ensure that they can appropriately and transparently address stakeholder involvement and the views and concerns it might generate. Radiological protection is, in general, moving towards more inclusive risk governance approaches, and this trend will most likely continue to evolve. The implications of this for the radiological protection profession will also continue to be explored, but will certainly include effects on education and training, as well as on processes and approaches for the formulation of issues and the development and implementation of solutions.

## Radioactive waste management

In 2005, Canada and France, two major producers of nuclear-generated electricity, prepared important decisions for their future management of spent nuclear fuel and radioactive waste. In Canada, the Nuclear Waste Management Organisation (NWMO), which was created by the Nuclear Fuel Waste Act of November 2002 to develop a long-term approach for managing used nuclear fuel, presented its final report. Based on a comprehensive three-year effort that engaged specialists, stakeholders and citizens, the NWMO recommended adaptive, phased management for the long-term care of used nuclear fuel. The concept presented aims to isolate and contain Canada's used nuclear fuel deep underground in a suitable rock formation and includes an interim step for temporary, shallow underground storage as well as potential for retrievability. Final construction of a deep repository may be postponed for about 50 years to allow for implementation in phased and adaptive stages. A decision is now awaited from the Canadian government on the way forward.

In France, the government started a broad public discussion to feed into the 2006 parliamentarian debate and decision-making processes, in advance of the expiration of the 1991 "Bataille" law which had hitherto supported three axes for the management of spent fuel and waste: partitioning and transmutation, geological disposal and long-term storage. A report published by the Parliamentary Office for Evaluation of Scientific and Technological Options (OPECST) emphasizes that these approaches complement each other and proposes the further development of geological disposal for long-lived waste, and the development of long-term intermediate storage for spent fuel that might become subject to transmutation. The concept assumes the operation of a geological repository in the time frame 2020-2025, and the availability of industrial transmutation by 2040.

While the decisions to be taken in 2006 by the Canadian government and the French parliament will be closely monitored worldwide, the two most advanced geological repository projects – Yucca Mountain in the United States and Olkiluoto in Finland – are progressing. An important Yucca Mountain safety standard issued by the US Environmental Protection Agency (EPA) is under revision to include timescales beyond 10 000 years and up to 1 million years for which a dose limit based on natural background radiation is proposed. At the Olkiluoto site in Finland, construction work is progressing to build the ONKALO underground characterisation facility that will precede the geological repository planned at the same site.

Encouraging news regarding progress in the siting of low- and intermediate-level waste repositories came from Hungary and Korea. In Bátaapáti, about 60 km south of the Hungarian Paks nuclear power plant, the municipality held a referendum on whether it should allow a final waste repository on its territory. A clear majority of citizens voted in favour of hosting the geological waste disposal facility, thus paving the way for a parliamentarian decision to start the process. On a much larger scale, a similar vote was taken in the Korean town of Gyeongju, in North Gyeongsang province, to host the country's first low- and intermediate-level radioactive waste repository. Four communities had been selected as main candidates, and each of them held a referendum to decide whether its residents approved hosting the facility. While in all candidate cities more than two-thirds of the citizens voted

The site of the Bátaapáti waste repository, Hungary.

Attila Nagy, Index.hu, Hungary

View of the Gyeongju countryside, North Gyeongsang province, Korea.

positively for the project, Gyeongju had the highest approval rate and was selected by the government, which hopes to complete the facility by 2008/09.

## Nuclear science

Concerns over energy resource availability, climate change, air quality and energy security have generated a renewed interest in nuclear power and especially in more advanced systems having improved economic, safety and non-proliferation aspects, and producing less nuclear waste than current reactors. The Generation IV International Forum (GIF) is carrying out research on six advanced systems having these characteristics. The development of these systems also requires further research in a wide range of scientific areas, such as the validation of core designs and the development of new fuels and materials for high-temperature applications. OECD countries are active in this area.

The renewed interest in some member countries to continue developing nuclear power as part of their energy mix, in combination with an ageing workforce and weak student interest in nuclear subjects in recent years, has spurred an awareness of the need to preserve the knowledge accumulated in the field of nuclear science and technology. A number of national and international initiatives, including the preservation of technical information in databases and strategies to transfer knowledge, have been undertaken with the goal of safeguarding and sharing existing knowledge, and facilitating the transfer of that knowledge to future generations.

## Nuclear data and software

It is commonly recognised that well-validated computer codes and nuclear data are needed for assessing the quality of results from modelling exercises of current and advanced nuclear systems. The notable development in computing power is having a strong impact on the predictive calculations of different reactor and fuel cycle parameters. An increased use of Monte Carlo methods and calculations of full 3-dimensional models are improving the accuracy of the results by eliminating the approximations associated with earlier computation methods.

In addition to more advanced computing techniques and models, more information about the accuracy of the associated nuclear data is also required, and the major nuclear data libraries are now devoting more efforts towards the inclusion of uncertainty information in the form of covariance matrices. This uncertainty information, together with proper sensitivity analysis and advanced nuclear model codes, will assist nuclear physicists in better evaluating the confidence bounds of the calculated parameters, providing prospects to improve reactor safety margins as well as the economics of current nuclear power plants.

## Nuclear law

OECD countries continue to show significant interest in ensuring that adequate and equitable compensation is made available to victims who suffer injury or damage as a result of a nuclear incident occurring at a nuclear installation or during the transport of nuclear substances. Those member countries which adopted the Protocols to amend the Paris and Brussels Supplementary Conventions in 2004 are now actively working to implement the provisions of those protocols into their national legislation, provisions which significantly increase the amount of compensation to be made available, which broaden the scope of compensable damage and which ensure more victims will be entitled to compensation than ever before. They are also

## Generation IV International Forum (GIF)

The Generation IV International Forum (GIF) is a major international initiative aimed at developing the next generation of nuclear energy systems. It was launched by the US Department of Energy in January 2000 and formally chartered in 2001.

The GIF's 2002 Generation IV Technology Roadmap evaluated over 100 system concepts, identifying six with the greatest promise and setting out the research and development necessary to bring them to commercialisation within the 2030 time frame. The six concepts selected were:

- Gas-cooled fast reactor system (GFR). The GFR features a fast neutron-spectrum, helium cooled reactor and a closed fuel cycle.
- Lead-cooled fast reactor system (LFR). The LFR features a fast spectrum lead or lead/bismuth eutectic liquid metal-cooled reactor and a closed fuel cycle.
- Molten salt reactor system (MSR). The MSR uses a circulating molten salt fuel mixture with an epithermal-spectrum reactor and a full actinide recycling fuel cycle.
- Sodium-cooled fast reactor system (SFR). The SFR features a fast-spectrum, sodium-cooled reactor and a closed fuel cycle.
- Supercritical-water-cooled reactor system (SCWR). The SCWR is a high temperature, high-pressure, water-cooled reactor that operates above the thermodynamic critical point of water.
- Very high temperature reactor system (VHTR). The VHTR is a graphite-moderated, helium-cooled reactor with a once-through uranium fuel cycle.

These systems offer significant advances in sustainability, safety and reliability, economics, proliferation resistance and physical protection.

The GIF reached a major milestone on 28 February 2005 when five of the forum's member countries (Canada, France, Japan, the United Kingdom and the United States) signed the GIF Framework Agreement for the R&D phase. By the end of 2005, Korea and Sweden had also acceded to the agreement.

For each of the six concepts selected, a system steering committee has been set up to manage the R&D collaboration. The NEA serves as Technical Secretariat to the GIF.

aiming to finalise the two *Exposés des Motifs* for those conventions. Other OECD members are examining the benefits of adhering to the 1997 Protocol to Amend the Vienna Convention and still others are considering amending their national legislation to reflect the trends incorporated in these various amending protocols. All OECD members continue to evaluate the advantages of adhering to the 1997 Convention on Supplementary Compensation for Nuclear Damage.

Member countries are striving to eliminate or minimise legal impediments to the safe use of nuclear energy and, to the greatest extent possible, harmonise legislation governing the peaceful uses of nuclear energy. To that end, they continue to search for solutions to problems arising from nuclear operators' inability to adequately insure against third party liability and material damage risks where nuclear incidents are caused by terrorist acts; to determine whether nuclear fusion installations should be covered by special nuclear liability regimes; to find means of avoiding potential conflicts between the international nuclear liability conventions and European Community legislation; to assess the impact of various international conventions on nuclear activities; and to help the development and implementation of nuclear safety assistance programmes with non-members. They are also active in supporting nuclear law education and information dissemination programmes.

CEA/Cogema, France

# Technical Programmes

# Nuclear Development and the Fuel Cycle

## Nuclear Development Committee (NDC)

*The NDC continues to support member countries in the field of nuclear energy policy, addressing issues of relevance for governments and the industry at a time of nuclear technology renaissance and sustained government interest in ensuring long-term security of energy supply, reducing the risk of global climate change and pursuing sustainable development.*

## Highlights

- An international conference at ministerial level on Nuclear Energy for the 21st Century was held in Paris on 21-22 March, hosted by the French government, and organised by the IAEA in co-operation with the OECD and the NEA.
- The joint NEA/IEA study on *Projected Costs of Generating Electricity*, published in March, highlights the increasing competitiveness of nuclear power in countries relying on this option.
- The joint NEA/IEA workshop on security of supply for electricity generation, held in Paris in May, brought together experts and decision makers to discuss the role of technologies and policy measures in ensuring security of supply in liberalised electricity markets.
- The proceedings of the Eighth Information Exchange Meeting on Partitioning and Transmutation provide a comprehensive overview of ongoing research in the field and reflect the interest of scientists and policy makers for advanced fuel cycle technologies.

### Nuclear policy issues

The NEA co-operated in the organisation of the international conference at ministerial level on Nuclear Energy for the 21st Century. Some 65 countries were represented at the conference, which included presentations by more than 30 ministers and two round-table sessions addressing world energy needs, resource and environmental challenges, and driving factors for government and industry policy choices. The conference demonstrated a renewed interest among policy makers for the nuclear option in terms of its capacity to enhance security of energy supply, to reduce environmental impacts of energy production and use, and to provide electricity to consumers at affordable costs.

Mr. D. Johnston, OECD Secretary-General and Mr. P. Devedjian, *ministre délégué à l'Industrie*, France, during the Nuclear Energy for the 21st Century press conference.

*Ministère délégué à l'Industrie*, France

The NEA also participated in the in-depth energy policy reviews of Belgium and Spain, carried out by the International Energy Agency (IEA). In both of those countries, nuclear energy plays a significant role in the electricity generation mix, but the development of nuclear power programmes is on hold. NEA participation in the reviews provides specific expertise on nuclear technology issues and promotes a fair and comprehensive assessment of the opportunities and challenges facing government policy makers in the field of nuclear energy.

### Economics

The study on *Projected Costs of Generating Electricity* carried out jointly with the IEA was published in March. The study, based on data provided by 22 countries, covers some 130 power plants using coal, gas, nuclear, hydro and other renewable sources. It shows an increasing competitive margin for nuclear energy in most countries which have chosen to rely on this option. The conclusions of the study were presented by senior NEA staff in several international conferences and seminars, serving as the basis for discussions among policy makers on the future role of nuclear energy in liberalised electricity markets.

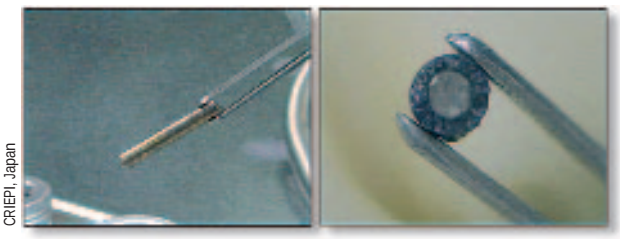
| Shares of uranium resources and production (in %) | | |
|---|---|---|
| | Resources* | Production** |
| Australia | 23 | 20 |
| Canada | 12 | 27 |
| United States | 7.5 | 2 |
| Namibia | 5.5 | 7 |
| Niger | 5 | 8.5 |
| South Africa | 8.5 | 2.5 |
| Kazakhstan | 18.5 | 9 |
| Russian Federation | 6 | 8.5 |
| Uzbekistan | 2.5 | 6.5 |
| Ukraine | 1.5 | 2 |
| Others | 10 | 7 |

* Total known resources recoverable at less than 130 USD/tU; ** in 2003.

Jointly with the IEA, the NEA organised a workshop on security of supply for electricity generation, held in May. The workshop addressed security of supply issues from the technology and policy viewpoints, with emphasis on the role of government in liberalised markets and on the specific contributions of different energy sources to securing electricity supply at affordable costs and prices for consumers. The proceedings of the workshop were published mid-year on the two agencies' websites. The main findings and conclusions of the workshop were presented in a background paper which served as an introduction to the NEA Steering Committee policy debate on security of energy supply held in October.

## Technology

The proceedings of the Eighth Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation held in Las Vegas, Nevada, USA, on 9-11 November 2004 were published. They contain all of the papers presented orally or as posters and an executive summary of the five technical sessions and the two poster sessions. The ninth meeting in the series will be held in Nîmes, France, during the autumn of 2006, and will be hosted by the French *Commissariat à l'énergie atomique*.



CRIEPI, Japan

A U-Pu-Zr alloy before (left) and after (right) an experiment designed to study the partitioning process.

The study on advanced fuel cycles and waste management was completed and will be published in 2006. It continues the series on advanced fuel cycles, emphasizing comparative assessment of waste repository performance for high-level waste generated by various advanced fuel cycle schemes. The findings from the study confirm those of previous reports, and show that fuel cycle schemes existing and under development offer a wide range of options for satisfying sustainable development goals in terms of natural resource management, waste minimisation and economic effectiveness.

The study on innovation in nuclear energy, launched in October 2004, continued to progress. Based on country reports and case studies from ten member countries, the study seeks to identify the special characteristics of nuclear innovation systems and the main elements determining nuclear innovation performance, which will enable the development of policy recommendations on ways and means to enhance nuclear innovation in support of advanced nuclear energy systems. A second meeting was held in May 2005. The final report of the study is expected to be published in 2006.

## Data and resource assessment

In the area of uranium resource assessment, the Joint NEA/IAEA Uranium Group pursued its activities placing emphasis on the preparation of the 2005 update of the "Red Book", to be published in 2006. Under the leadership of the Uranium Group, the Secretariat also began preparing a retrospective of data on uranium resources and production, drawing from the series of Red Books published since 1968. The retrospective is expected to be available by mid-2006.

The yearly edition of the "Brown Book", *Nuclear Energy Data*, provides statistical data on nuclear electricity capacity and generation, as well as nuclear material and fuel cycle service production and demand in member countries. The 2005 edition offered projections to 2025 and country reports highlighting key events in the nuclear energy field.

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# Nuclear Safety and Regulation

## Highlights

- Recognising 40 years of successful co-operation on nuclear safety issues, the CSNI and the CNRA jointly organised in June the NEA Safety and Regulation Forum on Multilateral Co-operation in Nuclear Safety Research and Regulation.
- The CSNI and the CNRA organised several workshops, most notable were those on licensees' nuclear safety management and the effectiveness of inspections; evaluation of uncertainties in relation to severe accidents and level-2 probabilistic safety analysis; fire probabilistic safety analysis; and better nuclear power plant maintenance: improving human and organisational performance.
- In 2005 two new multilateral "Joint Projects", one on PWR thermal-hydraulics, called the ROSA Project, and another on computer-based safety systems, named the COMPSIS Project, were started (see the section on page 30 for details). A number of technical proposals for new joint projects organised under NEA auspices were also put forth and discussed during the year.

## Committee on Nuclear Regulatory Activities (CNRA)

*The CNRA contributes to developing a consistent and effective regulatory response to current and future challenges. These challenges include operational experience feedback, increased public expectations concerning safety in the use of nuclear energy, industry initiatives to improve economics and inspection practices, the necessity to ensure safety over a plant's entire life cycle, and new reactors and technology.*

### Operating experience

The joint NEA/IAEA Incident Reporting System (IRS) is the only international system providing regulators and government bodies with information about lessons learnt from safety-significant events at nuclear power plants. The IRS co-ordinators exchange information about recent events during their annual meetings and jointly define topics of interest for further work.

In June 2005 the CSNI and the CNRA agreed to transfer responsibility for the Working Group on Operating Experience (WGOE) from the CSNI to the CNRA. A new mandate for the group was approved with the main objective to share experience and knowledge, to analyse and to provide expert insights from operating experience in order to reach timely conclusions on trends, lessons learnt and effective responses in the short to medium term, as well as to promote proposals for re-assessment of safety, additional research, new or revised regulatory inspection practices, improvements in managing operations, and other actions to maintain and improve safety in the longer term. The newly constituted group will hold its first meeting in early 2006 to establish its programme of work. It will also organise an International Conference on Improving Nuclear Safety through Operational Experience Feedback in May.

The "Blue Book", which is a periodic publication jointly issued by the NEA and the IAEA, and including a summary of lessons learnt from significant operating events and generic studies performed in the last three years, was approved by both committees and will be published by the NEA early in 2006.

### Regulatory challenges in using operational experience

The fundamental objective of all nuclear safety regulatory bodies is to ensure that nuclear utilities operate their plants at all times in an acceptably safe manner. In meeting this objective, learning from experience has been a key element throughout the history of nuclear power, and the CNRA has recognised that there is a continuing need to further enhance international exchanges in this area.

In 2005, a report on *Regulatory Challenges in Using Nuclear Operational Experience* was finalised for publication early in 2006. The primary focus of this report is on how regulatory bodies can ensure that operating experience is used effectively to promote the safety of nuclear power plants. To the extent that the operator has responsibility for safely operating the nuclear power plant, it is important for that operator to have an active programme for collecting, analysing and acting on the lessons of operating experience that could affect the safety of the plant. It is the nuclear regulator's responsibility to oversee the operator's activities to ensure that the plant is operated safely. Therefore, a key topic in this report is the role of operating experience in the regulator's management system.

### Regulatory inspection practices

As part of the activities of the Working Group on Inspection Practices (WGIP), inspectors from regulatory bodies meet periodically to exchange information and experience related to regulatory safety inspection processes and to carry out related studies. A new mandate was approved for the WGIP; it notes the important relationship between inspection practices and operating experience and how regulatory inspections must be supplemented by reviews and by other regulatory controls to yield an integrated assessment of safety and to provide a basis for enforcement, an essential part of the regulatory oversight process.

A joint NEA/IAEA international workshop on Licensees' Nuclear Safety Management and the Effectiveness of Inspections

was held in January in Tokyo, and hosted by the Japan Nuclear Energy Safety Organisation (JNES) in co-operation with the Japanese Nuclear and Industrial Safety Agency (NISA). The relative roles of operators and regulators in evaluating the safety significance of inspection results, what determines how and when the operator reports the results, where the regulator fits into the picture and how they reconcile their differences were the key issues addressed during the meeting, which brought together head regulators and senior managers from industry.

The proceedings of the International Workshop on Risk-informed Inspection, Inspection of Performance of Licensee Organisation, and Inspection Aspects of Plant Near or at End-of-life were issued. The workshop was hosted by the Hungarian Atomic Energy Authority (HAEA).

In addition, several issues are currently being studied by the working group, including inspection efforts, regulatory inspection philosophy, inspection organisation and inspection practices. A proposal has also been approved to begin a new task on inspection of fire protection systems.

### Nuclear regulators and the public

Transparency is one of the keys to public acceptance of nuclear energy. Information officers from regulatory bodies meet once a year to exchange information and experience related to communication with the public and to carry out related studies. In 2005, the mandate of the Working Group on Public Communication (WGPC) was revised, and now includes the production of notes addressing developments, tools, procedures and achievements in the area of nuclear regulatory communication with the public and stakeholders. The notes aim to reach a large audience, identifying specific regulatory challenges in public communication and suggesting ways to deal with them.

The two main topics discussed in 2005 were the challenges associated with public communication during abnormal situations and the publicity given to regulatory decisions. The discussions should result in notes which will highlight lessons learnt and good practices. The WGPC will use the findings from this work to continue to assist its members on related matters of regulatory transparency. Regulatory transparency will also be the subject of a workshop planned to be held in Japan in 2007.

## 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 their resolution and, when needed, establishing international research projects.*

### Multilateral co-operation in nuclear safety research and regulation

The year 2005 marked 40 years of multilateral exchanges through NEA committees concerned with nuclear safety research and regulation. The first multilateral safety committee set up in 1965 under the European Nuclear Energy Agency (forerunner to the NEA) was the Committee on Reactor Safety Technology (CREST). To commemorate the occasion, the CSNI and the CNRA jointly organised the NEA Safety and Regulation Forum on Multilateral Co-operation in Nuclear Safety Research and Regulation on 14-15 June 2005 in Paris, France. Over 100 participants attended.

The forum sessions covered: What Have We Learnt; Learning from Each Other – International Approaches; and The Way Forward. Delegates also participated in smaller discussion groups to look more closely at how the safety committees should respond to new information and at ways to improve international harmonisation of nuclear safety practice and approaches. A special discussion group was formed, consisting of experienced committee members and nuclear professionals from the younger generation. This group's goal was to develop an outlook on the future of nuclear safety from different generational viewpoints.

The forum identified four areas to guide the NEA programme of work in view of providing efficient support to member countries. These areas were:

- the need to learn lessons from others – operating experience feedback;
- the need to have convergence of safety practices;
- the need to preserve safety research (multinational research);
- knowledge transfer and efficient use of current know-how.

### Analysis and management of accidents

Several CSNI activities in the area of safety assessment and research continue 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. According to CSNI recommendations, efforts will need to be made in some areas that do not fall within the framework of these disciplines, notably in the fire safety area.

The main objective regarding thermal-hydraulics of the reactor coolant system and related safety and auxiliary systems is to improve and expand the application of best-estimate codes, including uncertainty analysis, in nuclear power plant safety and design evaluations. During 2005, progress was made on the assessment of practicability, quality and reliability of best-estimate methods, including uncertainty evaluation, in applications relevant to nuclear reactor safety. The aim is to make recommendations regarding best-estimate methods and tools, and their application in the licensing process (a long-term objective). This work is mainly based on loss-of-coolant analyses using experimental data and plant data. It also involves the use of computerised fluid dynamics (CFD) codes and their application to nuclear

safety. Existing guidance for the application of single-phase CFD was reviewed in 2005, and its adequacy and completeness for nuclear reactor safety applications is being investigated, while the orientation of the future development and assessment of two-phase CFD tools to be used in nuclear reactor safety problems will be defined (a medium-term objective). A report was issued on this subject in 2005.

Regarding in-vessel behaviour of degraded cores, a report was issued in 2005 on the progress made on the TMI-2 accident analyses. The international standard problem based on experiments performed in the TOSQAN, MISTRA and ThAI facilities (ISP-47) remained the main 2005 activity in relation to containment behaviour. The final report was completed. The state-of-knowledge report on post-accident iodine chemistry was drafted in 2005 and is currently under review, while a state-of-the-art report on aerosols is in progress. The work on data preservation for thermal-hydraulic aspects of severe accidents continued. With regard to the Co-ordinated Programme on Steam Explosion Resolution for Nuclear Applications (SERENA), the code capability assessment part of the programme was completed in 2005 and a proposal for an experimental phase of the programme was presented to the CSNI. This proposal will be discussed at an ad hoc expert meeting in 2006.

A workshop on the evaluation of uncertainties in relation to severe accidents and level-2 PSA was held in 2005 in Aix-en-Provence, France. The workshop, which was hosted by the French *Institut de radioprotection et de sûreté nucléaire* (IRSN), attracted 80 participants and included the presentation of 25 papers. Recommendations on how to proceed in order to build consensus in this field were made in the final discussion panel.

## Ageing and structural integrity of reactor components

The main topics investigated in this area include metal components, concrete structures, seismic behaviour of structures and components and the ageing of wire systems. Maintenance, in-service inspection and testing of structures, systems and components important to safety need to be of such a standard and frequency as to ensure that levels of reliability and effectiveness remain in accordance with the design assumptions. Over the past few years, several guides and code cases have been developed to facilitate the practical implementation of risk-informed, in-service inspection (RI-ISI) programmes. The status report on RI-ISI methodologies was completed in 2005, showing that the concept of RI-ISI has been successfully implemented in several OECD countries and is now, along with non-destructive testing qualification, providing improved in-service inspection, reducing both plant risks and radiation exposure to inspection personnel.

In 2005, activities on fatigue and thermal fatigue were further pursued and the benchmark on thermal fatigue was completed. Reactor pressure vessel integrity was addressed through a benchmark on probabilistic structural integrity methods. The International Standard Problem on Containment Capacity (ISP-48) was completed and provided valuable insights into the behaviour of concrete containment under severe loadings. The workshop on seismic input motions incorporating recent geological studies was held in Japan on 15-17 November 2005, thus completing the series. Methods to calculate seismic input motions for nuclear power plants and related uncertainties will continue to be explored through close co-operation with geologists and seismologists.

## Risk assessment

The main mission of the Working Group on Risk Assessment (WGRisk) is to advance the understanding and utilisation of probabilistic safety assessment (PSA) as a tool to support decision making in member countries on matters related to nuclear safety. While PSA has matured greatly over the past decades, further work is still required to refine methods and to apply PSA methodology to new areas.

WGRisk conducted activities in several areas in 2005, including risk-informed regulation, fire risk assessment, developing a framework for information exchange on human reliability, uncertainties in severe accident management (level-2 PSA), uses of PSA in emergency management, passive system reliability and software reliability. The group also discussed PSA for advanced reactors in detail. The working group collaborates with other CSNI and CNRA working groups in the areas of operational experience, human factors, structural integrity and accident management. Co-operation also takes place with other NEA standing technical committees.

Four workshops were held during the year. The first one examined recent developments in fire risk analysis. The second, organised in the form of a technical meeting with the IAEA, addressed risk-informed decision making and risk-informed regulation. The third meeting was organised jointly with the CSNI groups on accident management and structural integrity to evaluate uncertainties in relation to severe accidents and level-2 PSA. Finally, a seminar was organised with the EC Joint Research Centre on emergency and risk zoning around nuclear power plants.

CSNI Technical Opinion Papers on *Living PSA and its Use in the Nuclear Safety Decision-making Process* and on *Development and Use of Risk Monitors at Nuclear Power Plants* were published. Work began on updating the state-of-the art report on level-2 PSA and the report on status, uses and developments in the use of PSA in member countries.

## Integrated assessment of safety margins

Factors such as ongoing power uprates, longer operating cycles, new fuel designs and increased fuel burn-up, combined with plant ageing and plant life extension require a comprehensive, integrated assessment in order to evaluate their potential cumulative safety impact. An extensive Action Plan on Integrated Assessment of Safety Margins (SMAP) began to be formulated in 2004, aiming to develop a methodology for the assessment of synergistic safety margin reductions. The proposed SMAP relies on the premise that an adequate combination of deterministic and probabilistic methods can provide the best achievable framework for solving the safety margin assessment. The Action Plan is due to be completed in 2006.

## Fuel safety margins

In 2005, the NEA Special Expert Group on Fuel Safety Margins (SEGFSM) continued the systematic assessment of 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 concise review of existing fuel experimental data under reactivity-induced accident (RIA) and loss-of-coolant accident (LOCA) conditions as well as how these data affect fuel safety criteria at increasing burn-up was carried out. The review encompasses the experience gained by the institutions that participate in the SEGFSM activities and

primarily addresses experimental results relevant to western BWR and PWR fuel, including Russian VVER fuel.

Experience shows that the results of the LOCA tests are very sensitive both to the way the tests samples are prepared for the tests and to the way the tests are performed. The preparation of test samples includes the selection of their geometry, surface treatment, the oxidation/corrosion process and pre-hydriding. At the same time, parameters, such as oxidation time and temperature, heating rate and cooling rate have a significant impact on the final ductility of testing samples. In 2005, SEGFSM completed its collection of information on LOCA test methodologies. This work will help better understand, interpret and/or compare LOCA test results from different laboratories, as well as harmonise test techniques for further experimental studies of LOCA fuel safety criteria.

In 2005, the SEGFSM also continued to review the adequacy of existing codes for the simulation of high burn-up fuel behaviour under accident conditions. A benchmark for the Halden irradiated LOCA test was organised in co-operation with the OECD Halden Reactor Project. The benchmark showed that further effort is needed to better model and validate high burn-up phenomena as related to internal pressure; transient fission gas release; collapse of the fuel pellet column after ballooning of the cladding; oxidation and related hydriding; ballooning; and related fuel blockage. The experimental database on actual irradiated fuel claddings requires additional data. Ongoing national and international fuel safety research programmes are expected to fill the existing gaps.

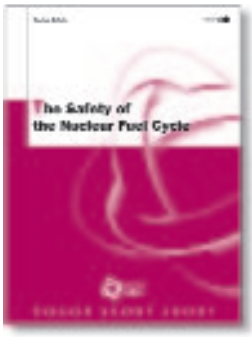
## Human and organisational factors

Activities of the Special Expert Group on Human and Organisational Factors (SEGHOF) included a report on systematic methods for safety management; a report on human factors in NPP modifications; investigation into the improvement of NPP maintenance safety by inclusion of human and organisational factors; and human performance in advanced control rooms. A new activity was undertaken on systematic approaches to safety culture.

As part of the SEGHOF activities, a workshop was organised in Ottawa on Improving Human and Organisational Performance. The conclusions show that maintainability must be integrated into design at an early stage (keeping in mind that this and regulation of maintenance require a multi-disciplinary approach), and that pre-job planning may significantly improve maintenance performance.

## Fuel cycle safety

The Fuel Cycle Safety Group brings together regulatory and industry specialists to address a broad range of interests, including safety assessments, nuclear criticality safety, probabilistic safety assessment, safety management, decommissioning and site remediation, fire protection and human factors. An important accomplishment in 2005 was the publication of the third edition of *The Safety of the Nuclear Fuel Cycle*, which represents the most up-to-date analysis of the safety aspects of the nuclear fuel cycle. The report addresses safety and technical aspects of fuel cycle operations and provides information on operating practices, experiences gained from operation and the lessons learnt from major incidents. The facilities associated with these activities have an extensive and well-documented safety record, which has been accumulated over the past 50 years by technical experts and safety authorities.




## Research facilities for existing and advanced reactors

Following a CSNI recommendation, a group of senior research managers was constituted with the aim of providing the necessary input and elaborating elements of strategy for maintaining key safety research facilities and possibly expanding their use. The group is to revise an earlier CSNI report on the subject, and will address a number of technical disciplines and related facilities, aiming to define priorities for possible joint international initiatives or programmes in the future. Extensive consultations and report revisions took place during 2005 and will continue in the first half of 2006, including consultation with industry. During 2005 the group developed a set of recommendations based on a systematic, comparative assessment of the various test facilities available in NEA countries, and on their value for resolving relevant safety issues. The report is due to be completed in mid-2006.

## Safety of digital instrumentation and control

Digital instrumentation and control (I&C) systems have replaced analogue systems almost completely in the industry, and they require different competencies, notably computer skills. In 2005, the joint CNRA and CSNI ad hoc expert group on digital instrumentation and control produced a document including recommendations for regulatory and operational safety research actions to be considered by the committees. The group concluded that regulators and the industry would benefit from a compilation of descriptions of national regulatory experiences with licensing digital I&C systems; developing a set of high-level practices for regulating digital I&C safety systems; and over the longer term, developing regulatory knowledge on the incorporation of new technologies in nuclear power plants. With regard to research needs, the OECD Halden Reactor Project and the COMPSIS Project are already carrying out several tasks in the area of digital I&C. Necessary future activities include data collection on failure modes and effects; determining acceptable diversity and defense-in-depth; improving the understanding of standards on environmental qualification; security issues and good practices; and managing the development and maintenance of digital systems over their life cycle.

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# Radioactive Waste Management

## Radioactive Waste Management Committee (RWMC)

*The RWMC is assisting member countries in the area of management of radioactive waste and materials, focusing on the development of strategies for the safe, sustainable and broadly acceptable management of all types of radioactive waste, in particular long-lived waste and spent fuel.*

## Highlights

- Under RWMC auspices, an international expert team reviewed a French study on the current programme considering deep geological disposal in clay.
- The role of modelling engineered barrier systems (EBS) in the framework of the safety case was the topic of the third NEA/EC EBS workshop, held in La Coruña, Spain.
- The Approaches and Methods for Integrating Geologic Information in the Safety Case (AMIGO) project held its second workshop addressing the use of geoscientific arguments and lines of evidence supporting the safety case.
- The Forum on Stakeholder Confidence (FSC) organised a workshop in national context in Spain to discuss the "Cowam Spain" methodology to arrive at broadly accepted facility-siting proposals.

### Waste management policy and governance issues

The safety case is a key input to decision making throughout the repository implementation process, which has evolved over the last decade from a numerical, performance-focused assessment to a collation of the broader range of evidence that supports and gives context to the safety argument. To collect and document progress and recent experience in drafting, presenting and reviewing safety cases, the RWMC has set up the International Experiences in Safety Cases (INTESC) initiative following the format of its earlier Integrated Performance Assessment Group (IPAG) exercises. The overall goals of this initiative are to analyse existing safety cases or elements of safety cases that are under development, and to identify key concepts; to provide a clear overview of the progress that has been made in the last decade; and to provide for an assessment to identify best practice in this area.

The INTESC initiative will be complemented by the organisation of an international conference, to be held in January 2007, to gather practical experience on preparing a safety case and to highlight progress made since 1989, when a similar symposium was held. At the time of the conference, many NEA activities are expected to report significant progress on databases (notably those of the TDB, Sorption and Clay Club projects), on the integration of science in safety cases (for example through the EBS and AMIGO projects), and on strategic areas such as those dealing with timescales in safety cases and with the definition and determination of compliance with long-term safety criteria.

NEA member countries have chosen different approaches to establishing criteria for the control of long-term safety of repositories, and to deciding how to make regulatory judgements against such criteria. The RWMC has undertaken to make the variety of these approaches more transparent, as well as their settings in different regulatory and safety/technical environments. The RWMC Long-term Safety Criteria Group reviewed the definitions used as a basis for setting these criteria, and in particular the ethical argumentation providing the basis for defining safety over extended timescales. Additional insight into the fundamental issues raised by very long timescales has been provided by another RWMC group which analysed the way different timescales are addressed in current safety cases, both from an implementer and regulatory point of view.

### International peer reviews

A major NEA activity in the field of radioactive waste management is the organisation of independent, international peer reviews of national studies and projects. Following a request from the French Government, the NEA organised an international peer review of documentation developed by Andra, collectively known as the *Dossier 2005 Argile*, by an international review team of independent specialists covering all relevant aspects of research, safety assessment and the geological sciences. The overall objective of the peer review was to inform the French Government whether the *Dossier 2005 Argile* is consistent with international practices, and whether future research needs are consistent with the available knowledge basis and priorities are well-identified.

The *Dossier 2005 Argile* review represents a key milestone in the waste management programme for which Andra is responsible, and provides a relevant and important basis of information for the forthcoming discussions and decisions in France regarding the formulation of an updated national policy for the final management of high-level and long-lived radioactive waste.

## Forum on Stakeholder Confidence

The RWMC Forum on Stakeholder Confidence (FSC) organised its fifth workshop in national context in Hospitalet, Spain, with the sponsorship of AMAC (the association of Spanish municipalities affected by nuclear facilities), and support from the national waste management agency ENRESA and the national safety authority CSN. The workshop focused on a methodology ("Cowam Spain") developed by these institutions in order to arrive at facility-siting proposals that are broadly accepted by society. FSC members, participants of the Cowam Spain project and Spanish stakeholders discussed the methodology to offer the results of their reflection to national politicians and administration. The methodology discussed at the FSC workshop will be proposed for identifying a national site for interim storage of spent fuel in Spain.

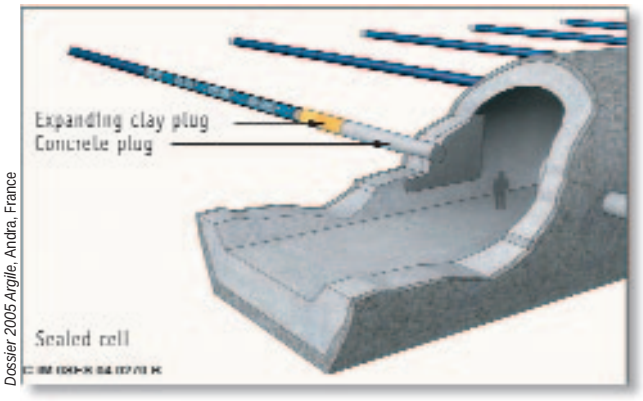
For the purpose of better understanding recent cultural and structural changes that are taking place within RWMC organisations, and thereby to better address stakeholder concerns, the Forum is preparing a desk study to extract lessons learnt from member institutions' experience. The study, which is being finalised, analyses the answers to a questionnaire received from 17 organisations in 11 countries. The FSC has also undertaken a study of the value added that waste storage or repository projects can bring to the hosting communities, focusing on cultural values and non-economic amenities.

In topical sessions at its annual meeting, the Forum addressed the link between research and development (R&D) and stakeholder confidence, and provided a platform to exchange experience in interaction with the media on waste management issues. For further information on the activities of the Forum as they relate to Nuclear Energy and Civil Society, see page 40.

## Repository safety and integration of science

In the series of workshops on the role of engineered barrier systems (EBS), the third workshop was held in La Coruña, Spain, to analyse the role of EBS modelling in the framework of the safety case. The workshop aimed to promote common understanding of approaches to performance assessment and process modelling, and discussed both specific examples of EBS assessment and optimisation, and alternative elements of EBS modelling that will help build confidence in the safety case.

The AMIGO project on Approaches and Methods for Integrating Geologic Information in the Safety Case held its second workshop on 20-22 September 2005 in Toronto, Canada, hosted by the Canadian utility OPG. The workshop addressed the use of geoscientific arguments and lines of evidence supporting the safety case. In addition to the series of AMIGO workshops, a compendium is being prepared to compile the current state of relevant geoscientific knowledge and its use in a safety case.




*Dossier 2005 Argile*, Andra, France

Disposal cells for high-level radioactive waste under consideration in the French *Dossier 2005 Argile*.

## Decommissioning

The safety case for decommissioning is characterised by the need to adapt to the changing features of the facility regarding its potential hazards, technical risks and managerial tasks. The RWMC Working Party on Decommissioning and Dismantling analysed the associated challenges in a report aimed at helping achieve the goals of a decommissioning safety case. In a similar manner, it also addressed issues of decommissioning strategy selection and the release of sites, from a decommissioning perspective.

The Working Party also prepared a status report on decommissioning funding, which will provide an overview of underlying principles, the implementation of funding schemes and associated uncertainties. The report is due to be published mid-2006.

## Understanding the scientific basis

To secure the scientific basis of its work, the RWMC continued to support the development and maintenance of quality-assured databases and models for use in the implementation of repositories. Work continued on the Thermochemical Database (TDB), and the Sorption Project has been completed (see page 35). The Working Group on the Characterisation, Understanding and the Performance of Argillaceous Rocks as Repository Host Formations (the "Clay Club") published a Catalogue of Characteristics that provides an overview of key geoscientific characteristics of clay formations studied with regard to deep geological disposal. The Clay Club continued its studies on specific clay properties, notably on long-term natural tracer profiles (CLAYTRAC) and on the self-sealing capacities of clays.

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# Radiological 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 framework. 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.*

## Highlights

- The most significant questions and issues in radiological protection, which will or could impact radiological protection policy, regulation and application in the coming 10 to 15 years, have been identified.
- Three NEA/ICRP stakeholder dialogue meetings have been planned with the International Commission on Radiological Protection (ICRP) to provide direct feedback from regulators and practitioners on the next draft recommendations.
- The most significant lessons for radiological protection professionals interacting with stakeholders affected by large-scale contamination have been identified, focusing on post-Chernobyl lessons, but applicable to any large-scale contamination situations.
- A total of 17 countries have participated in the Third International Nuclear Emergency Exercise (INEX 3), which should generate significant national and international lessons in consequence management.
- The Information System on Occupational Exposure (ISOE) databases were successfully transferred to a web-based access and analysis platform, forming the core of an ALARA manager web portal being created by the ISOE programme.

### Emerging challenges

The CRPPH began, in 2004, a study of emerging issues in radiological protection, and of ongoing issues whose management could evolve to remain better in line with social changes. Two parallel paths were followed in 2005: one looking at risk management issues of relevance to radiological protection (e.g. social/political, policy, regulation and application), and another looking at risk assessment issues (such as the possible results of ongoing radiological protection scientific research) and their implications. Similar to the CRPPH Collective Opinion that was published in 1995, these new CRPPH studies have documented the Committee's view on the trends and issues that will be the most significant over the next 10 to 15 years. Possible implications of these issues, and possible approaches to their handling, are being discussed. Two documents will be reviewed for approval by the CRPPH in March 2006, and subsequently provided to member countries as advice on these issues, and as guides for defining the Committee's programme of work for the coming years.

### Development of a new radiological protection framework

The CRPPH has, since its inception, taken an interest in the development of recommendations by the International Commission on Radiological Protection (ICRP). In recent years, the work of several of the CRPPH Expert Groups (notably those on Controllable Dose, the Evolution of Radiation Protection, the Processes of Stakeholder Involvement, the Implications of ICRP Recommendations, and Regulatory Authorisation) has been aimed at developing evolutionary ideas and suggestions that the ICRP can take into account in its work. Through this work, which has been sent directly to the ICRP for its consideration, the CRPPH has become an active partner with the ICRP, providing the views of regulators and experts from the NEA's 28 member countries.

The ICRP spent much of 2005 analysing and assessing comments that it had received on the draft recommendations it released in June 2004. As such, no further draft recommendations were released in 2005. However, the ICRP did release for comment two foundation documents that are of relevance to the work of the CRPPH: Optimisation of Radiological Protection; and Assessing Dose to the Representative Individual. No formal CRPPH commenting process was initiated for these draft documents. However, because it seems likely that the ICRP will release a new draft of its general recommendations during 2006, the CRPPH has made plans for three dialogue workshops with the ICRP (in Europe, Asia and North America), and has foreseen that a CRPPH Expert Group will perform a complete analysis of the draft and its implications.

Another document that will be affected by new ICRP recommendations is the International Basic Safety Standards (BSS). In view of the ongoing revision of the ICRP's recommendations, of experience with implementing the 1996 Basic Safety Standards (BSS), and of new IAEA standards developed since 1996, the six BSS co-sponsoring organisations agreed during a meeting hosted by the NEA in Paris in October 2005, that the current BSS should be reviewed by each of the co-sponsoring organisations.

As a co-sponsor of the current BSS, the NEA will take an active role in the development of the new standards. It is anticipated that the review of the current BSS will be completed by mid-2006, and that the process to develop text for the new BSS will begin in late 2006 or early 2007.

## Radiological protection science at the service of stakeholders

The recognition of the need for, and usefulness of, stakeholder involvement in decision making has enlarged the focus of radiological protection in recent years. The CRPPH has devoted a significant part of its programme of work to stakeholder involvement, primarily through the series of workshops held in 1998, 2001 and 2003 in Villigen, Switzerland. A key finding of these workshops suggests that when stakeholders are involved in radiological risk assessment and management, and science is brought to the service of "inclusive" decision-making processes, the resulting decisions can be of higher quality and greater sustainability than had stakeholders and radiological protection scientists and professionals not worked together.

The rehabilitation of contaminated lands and facilities often involves significant stakeholder concerns. Work to rebuild the lives of those living in the areas affected by the Chernobyl accident is a prime example of this, and with 2006 marking 20 years since the accident, the CRPPH revisited the case. While clearly not all of the experience is applicable to other circumstances in other countries, much has been gained by studying the stakeholder involvement aspects. Particular areas of interest include the interaction of stakeholders with radiological protection specialists, and the development of practical radiological protection approaches (a radiological protection culture) for all those living in a contaminated environment. A broad overview of the situation in the Chernobyl-contaminated areas has yielded detailed understanding of the magnitude and varieties of problems and issues that would arise in any large-scale contamination situation.

Countermeasures in follow-up to a nuclear accident can be numerous. Gathering reindeer is the most commonly applied countermeasure to obtain lower contamination levels in reindeer meat.

Skuterud-NRPA and Reindeer Husbandry Administration, Norway

## Nuclear emergency and recovery management

Following the INEX 2 series of exercises, which were completed in 2001, and the INEX 2000 exercise, the CRPPH Working Party on Nuclear Emergency Matters (WPNEM) summarised a series of urgent response lessons and experience for national response organisations to assess and implement as appropriate within their own contexts. The next phase of a nuclear emergency – consequence and recovery management – is currently under study. For this, the INEX 3 table-top exercise was developed, based on a serious radiological contamination scenario which may or may not be accidental in nature. The exercise begins with the contamination in place, but not yet fully characterised. The broad objectives of the exercise focus on agricultural countermeasures and food restrictions; decision making on soft countermeasures, such as travel, trade and tourism; recovery management; and public information. Exercise preparation and evaluation documents were developed and made available to national exercise co-ordinators. A total of 17 countries organised their national exercises during 2005. The international INEX 3 evaluation workshop, to be held in May 2006, will provide the opportunity to collectively assess the results, share experiences and lessons learnt, and identify opportunities for further improvements in emergency management systems and rehabilitation strategies.

## Occupational exposure at nuclear power plants

Occupational exposure at nuclear power plants continues to be an important issue for the members of the CRPPH. The sharing of lessons and experience, as well as the collection, analysis and exchange of occupational exposure data continues to be addressed by the NEA joint project: the Information System on Occupational Exposure (ISOE). In support of CRPPH efforts to facilitate improvement of members' operational radiological protection capabilities, the ISOE continued to collect, evaluate and disseminate occupational exposure data and trends, and to share operational experience through its information exchange network and international ALARA symposia. Further details on the ISOE are provided on page 35.

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# Nuclear Science

## Nuclear Science Committee (NSC)

*The aim of the NEA nuclear science programme is to help member countries identify, pool, develop and disseminate basic scientific and technical knowledge used to ensure safe and reliable operation of current nuclear systems, as well as to develop next-generation technologies. The main areas covered are reactor physics, fuel behaviour, fuel cycle physics and chemistry, criticality safety and radiation shielding.*

## Highlights

- A workshop on Advanced Reactors with Innovative Fuels (ARWIF-2005) was organised in Oak Ridge, Tennessee, USA on 16-18 February 2005.
- The Third Information Exchange Meeting on Nuclear Production of Hydrogen was held on 5-7 October 2005 in Oarai, Japan.
- A report on an evaluation of proposed integral critical experiments with low-moderated mixed-oxide (MOX) fuel was issued in June 2005.
- Two status reports dealing with the transmutation of nuclear waste were issued in the autumn of 2005: one on fuels and materials, and one on accelerator and spallation target technologies for accelerator-driven system (ADS) applications.

The principal areas covered by the NEA nuclear science programme are reactor physics, fuel cycle physics and chemistry, criticality safety and radiation shielding. The main objective of the programme is to validate the models and data used in member countries for predicting the behaviour and performance of different nuclear systems by comparing calculated and experimental results in international benchmark exercises. In addition, the nuclear science programme sponsors specialist meetings and workshops and the production of state-of-the-art reports as necessary.

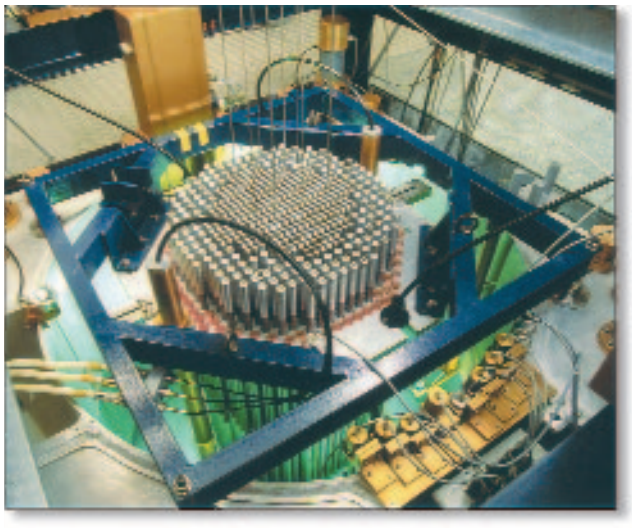
### Reactor physics and fuel behaviour

The NEA reactor physics programme covers both current and advanced reactor systems. Activities related to current reactor systems include a benchmark on control rod ejection in a pressurised water reactor (PWR) loaded with mixed-oxide (MOX) fuel, and a study of kinetic parameters and reactivity effects based on experimental data from the CROCUS zero-power research reactor in Switzerland. The use of MOX fuels with weapon-grade plutonium in current reactors is being studied in a reactor physics benchmark exercise based on data from the VENUS critical facility in Belgium. The behaviour of this fuel type is also being investigated in two benchmarks: one on a comparison of hollow and solid MOX pellets, based on experimental data from the Halden reactor in Norway, and another based on a ramped MOX fuel rod from the PRIMO (PWR Reference Irradiation of MOX Fuels) measurement campaign by *Belgonucléaire* and SCK•CEN in Belgium.

Specific efforts are also being devoted to the study of coupled light water reactor (LWR) transients and core-plant interactions. Three benchmarks are currently in progress in this field: one on a boiling water reactor (BWR) turbine trip transient, one on a VVER-1000 coolant transient, and another devoted to a BWR full-size bundle test, based on experimental data from Japan.

Among the activities dedicated to advanced reactor systems are a benchmark on a high-temperature reactor (HTR) fuelled with reactor-grade plutonium, and a study of a coupled neutronics/thermal-hydaulics transient in a pebble bed modular reactor (PBMR).

View of the CROCUS zero-power research reactor in Switzerland.



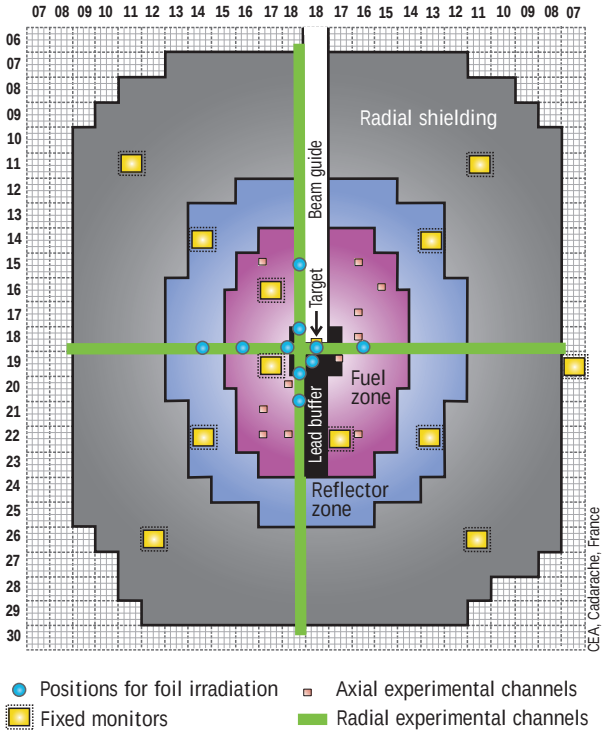
*École polytechnique fédérale de Lausanne, Switzerland*

## Fuel cycle physics and chemistry

The nuclear science programme also covers areas of more direct bearing on strategic issues, including a study of the technical information needed to fully apprehend the transition from current fuel cycles to long-term sustainable fuel cycles, and a study on fuel separation criteria to optimise the use of future nuclear waste repositories and to establish a methodology for evaluating the impact of existing repository projects on various current and advanced fuel cycle scenarios.

Reports from the recently reorganised Working Party on Partitioning and Transmutation have been published or are being finalised. These reports cover national programmes in partitioning, fuels and materials for transmutation, and accelerator and spallation target technologies for ADS applications. A report on a benchmark study of a fast, sub-critical core linked to an external neutron source – the MUSE *(Multiplication avec source externe)* experiment at Cadarache, France – is planned to be published in early 2007, as will a handbook on lead-bismuth eutectic technology.

Core loading of the MUSE 4 configuration.




## Nuclear criticality safety

The fabrication of MOX fuel has been identified as an area in which there are specific needs for additional integral benchmark data. An expert group has reviewed the situation and published a report documenting the evaluation of different experimental proposals and providing recommendations on which experimental programme(s) should be pursued.

In addition, the nuclear criticality programme covers studies of minimum critical reference values for uranium and plutonium, as well as benchmark reports related to the reduction in reactivity of burned nuclear fuel due to the change in composition during irradiation (burn-up credit); criticality accident analyses; and convergence problems in the calculation of the source term for spent fuel casks, spent fuel storage pools and fuel processing systems.

## Radiation shielding and reactor dosimetry

A benchmark exercise has been launched to study the spatial energy distributions of neutrons and photons scattered in the air (skyshine) near a reactor. The benchmark is based on data from an experiment carried out in the Kazakhstan steppe using two research reactors near Semipalatinsk.

In the area of dosimetry, the NEA has launched a benchmark based on reaction rate and fission chamber data measured in the VENUS-2 reactor at Mol, Belgium. The NEA has also actively contributed to the definition and selection of computational problems to be addressed within the framework of the EC-sponsored CONRAD activity, devoted to studying the use of complex computer codes in dosimetry calculations and to assessing uncertainties associated with the numerical results.

## R&D facilities in nuclear science

An expert group has been established to review the needs of research and test facilities in nuclear science. The study is a follow-up to the report on *Research and Development Needs for Current and Future Nuclear Energy Systems* published in 2003.

The expert group will seek to anticipate future needs by reviewing and exchanging information on the status of integral data and the availability of research and test facilities for future R&D in the field of nuclear science. The final products of this study will be a database on existing facilities and a status report identifying future needs of nuclear science research facilities. The group will also make recommendations concerning international collaboration.

## Knowledge preservation

The importance of preserving information and data from well-documented experiments and making them available to the nuclear community in a comprehensive and structured format for use in computer model validation exercises is recognised in all NEA member countries. The NEA nuclear science programme is well-advanced in this sense and has established databases in the areas of reactor physics (IRPhE), fuel behaviour (IFPE) and radiation shielding (SINBAD). The NEA is also co-ordinating the effort to compile data into the International Handbook of Evaluated Criticality Safety Benchmark Experiments (ICSBEP).

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# Data Bank

*The Data Bank operates as an international centre of reference for its member countries with respect to basic nuclear tools, such as computer codes and nuclear data, used for the analysis and prediction of phenomena in the nuclear field. It provides a direct service to its users by developing, improving and validating these tools and making them available as requested.*

## Highlights

- A new version of the Joint Evaluated Fission and Fusion data library (JEFF-3.1) was released in June 2005.
- Four new reviews of chemical thermodynamic data were published in 2005. The new reviews contain inorganic data of nickel, selenium and zirconium, as well as compounds of uranium, americium, technetium, neptunium, plutonium, nickel, selenium and zirconium with simple organic ligands.
- New state-of-the-art computer codes for radiation transport using Monte Carlo methods were acquired from Japan and Spain.
- New editions of databases with evaluated experimental data for radiation shielding and dosimetry (SINBAD) and for fuel behaviour (IFPE) applications were released.

### Computer program services

The NEA Data Bank plays a central role in the collection, validation and dissemination of computer codes used by scientists in member countries. The collection of codes covers many different areas, from reactor design, kinetics, safety and shielding to material behaviour and nuclear waste applications.

In 2005, the Data Bank acquired 52 new or new versions of computer codes. Of these 52 programs, 15 were received from non-OECD countries through the special co-operative agreement in place between the NEA Data Bank and the International Atomic Energy Agency (IAEA).

The Data Bank answered requests for 1 836 programs in 2005, of which 158 were sent to non-OECD countries. This is slightly less than in recent years, mainly due to the fact that the renewal of the Data Bank exchange agreement with the US Department of Energy (DOE) was delayed and temporarily reduced the number of US codes available for distribution. The agreement should be in place in 2006. Requests for data from integral experiments in support of computer code validation were in high demand: 2 212 sets of experiments were distributed.

Special efforts have been devoted to sensitivity and uncertainty analysis studies, and a number of papers describing advances made have been presented at conferences and workshops. A covariance data library is being finalised containing cross-section uncertainties for different application areas. The data library will be made available in 2006.

### Computer program training courses

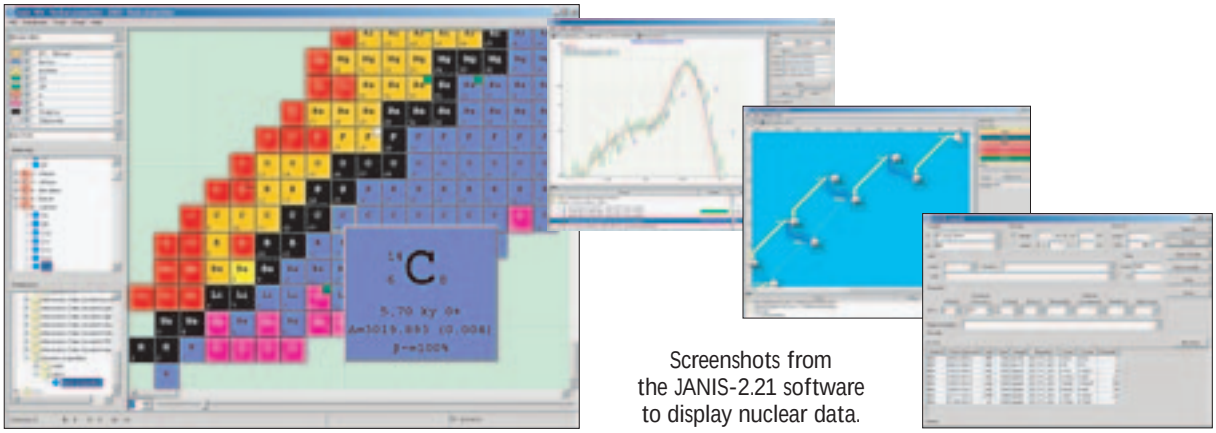
As part of the computer program services, the Data Bank also organises training courses on the utilisation of the most popular computer programs. The following courses were organised or co-sponsored in 2005:

- NJOY Workshop and User Group Meeting, NEA headquarters, 2 May;
- Sixth PENELOPE Electron-Photon Transport Modelling training course, Barcelona, Spain, 4-7 July;
- Seminar and Training on Scaling, Uncertainty and 3D Coupled Code Calculations in Nuclear Technology, held in co-operation with the University of Zagreb and the University of Pisa, 20 June-8 July;
- Workshop on Advances in Monte Carlo Criticality Calculations and on the Monte Carlo Code TRIPOLI-4, Avignon, France, 11 September.

### Preservation of information from integral experiments

The Data Bank continues to compile integral experimental data under the supervision of the Nuclear Science Committee. Well-documented information and data from reactor physics, fuel behaviour, radiation shielding and criticality safety integral experiments are collected, verified and made available to scientists.

Two editions of the IFPE (fuel performance experiments) database were issued in March and June 2005. One revision of SINBAD (shielding and dosimetry experiments) and one revision of ICSBEP (criticality safety experiments) were issued in July and September 2005 respectively. A new edition of the IRPhE (international reactor physics experiments) is scheduled for March 2006.



Screenshots from the JANIS-2.21 software to display nuclear data.

## Nuclear data services

The Data Bank maintains large databases containing bibliographic (CINDA), experimental (EXFOR) and evaluated (EVA) nuclear data and makes these databases available to scientists in member countries. The databases are maintained in close co-operation with other nuclear data centres and cover most types of data needed in nuclear energy applications. In 2005, the Data Bank updated more than 2 200 entries in the CINDA database, and prepared roughly 1 200 new entries covering bibliographic neutron and charged-particle data for inclusion in the new CINDA database. Information and data from 55 neutron-induced and over 100 new charged-particle-induced experiments were added to the EXFOR database.

The Data Bank provides direct online web access to its databases containing nuclear data. The number of retrievals from the NEA website averages about 1 200 per month for bibliographic and experimental data, and about the same number for evaluated data libraries.

A new version of nuclear data display software, JANIS-2.21, was released in October 2005. The program is free of charge and can be downloaded or launched using "JAVA Web Start" from the JANIS home page at http://www.nea.fr/janis, where the complete manual can also be found. JANIS is now integrated as the plotting tool for experimental and evaluated data on the NEA website. JANIS users access the NEA online databases over 15 000 times per month.

## The JEFF project

A new version of the Joint Evaluated Fission and Fusion data library (JEFF-3.1) was released in June 2005. The release covers a general purpose file, containing incident neutron data for 381 materials and thermal scattering data for 9 materials, as well as special purpose files, such as radioactive decay data files, a fission yield file, an activation file and a file containing incident proton data.

The Data Bank has started to develop processed libraries based on JEFF-3.1 to assist scientists wishing to use the JEFF-3.1 general purpose library in application calculations. Both group cross-section and Monte Carlo libraries will be available in 2006.

## International nuclear data evaluation co-operation

The NEA Working Party on International Nuclear Data Evaluation Co-operation (WPEC) was established to provide a framework for co-operative activities between the participating projects in Japan (JENDL), the United States (ENDF), Western Europe (JEFF) and non-OECD member countries (Russia, BROND; China, CENDL; and the international FENDL compendium). In 2005, the Working Party issued reports on measurement and validation of activation cross-sections and on an assessment of fission product evaluations. A number of new activities were also started, including a review of covariance data in the fast neutron region, improvement of data for decay heat calculations and studies on nuclear data needs for advanced reactor systems.

A High Priority Request List (HPRL) for nuclear data is also maintained. The purpose of the list is to provide a guide for those planning measurements and developing nuclear theory and data evaluation programmes. An entirely new list is under development and will be reviewed on a regular basis by external referees.

## The Thermochemical Database (TDB) Project

The Data Bank continues to develop its database of recommended chemical thermodynamic data for the safety assessment of radioactive waste repositories. This work is performed under the scientific guidance of the NEA Radioactive Waste Management Committee. The details of this programme can be found in the section "Joint Projects and Other Co-operative Projects" (page 30).

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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 in member countries and selected non-member countries. It supports the modernisation and strengthening of national and international nuclear liability regimes. In addition, under its supervision the NEA compiles, analyses and disseminates information on nuclear law through a regular publications programme and organises the International School of Nuclear Law educational programme.*

## Highlights

- Member countries which are party to the Paris and Brussels Supplementary Conventions worked actively to implement into their national legislation the provisions of the Protocols to amend those conventions which were adopted in 2004, and to finalise the two *Exposés des Motifs* for those conventions.
- The NLC continued its detailed studies of member countries' legislative regimes covering liability, financial security and compensation in respect of damage caused by (i) a terrorist act on a nuclear installation or during the transport of nuclear substances; (ii) radioactive sources, including compensation policies and practices of insurers and other financial guarantors; and (iii) an incident at a nuclear fusion installation or during the transport of nuclear substances.
- The fifth session of the International School of Nuclear Law was organised at the University of Montpellier 1.
- A Second International Workshop on the Indemnification of Nuclear Damage, organised by the NEA and the Slovak Nuclear Regulatory Authority was held in May, in Bratislava, Slovak Republic.

Member countries which adopted the Protocols to amend the Paris and Brussels Supplementary Conventions in 2004 worked actively during 2005 to implement the provisions of those protocols into their national legislation. The provisions require nuclear operators to make more money available to compensate more victims for more types of damage than ever before. They also ensure that where compensation amounts under the revised Paris Convention are insufficient, a significant amount of additional funding will be provided by the Contracting Parties themselves. In total, €1.5 billion of compensation will be available to compensate victims of a nuclear incident under the revised liability regime.

The Nuclear Law Committee continued its detailed study of existing national regimes covering civil liability, financial security and compensation for damage caused by radioactive sources, including equipment containing radioactive sources, and of current insurance policies and practices in providing financial security in respect of civil liability. The issue is relevant since neither the IAEA Code of Conduct on the Safety and Security of Radioactive Sources nor the Council Directive (Euratom) on the Control of High Activity Sealed Sources and Orphan Sources addresses these matters; nor do the Paris or Vienna Conventions apply to radioisotopes outside a nuclear installation that have been prepared for use in industrial, commercial, agricultural, medical, scientific or educational applications. The Committee concluded that, due to the wide variety of national regimes in place and the low level of risk involved, it was not necessary to attempt to harmonise legislative requirements and practices amongst member countries at this time.

The NLC also continued its study on the ability of nuclear operators to obtain insurance coverage or other financial security for third party liability and material damage resulting from nuclear incidents caused by terrorist acts. This information is expected to lead to a better appreciation of the nuclear insurance market as it currently exists in member countries. As regards material damage and related types of protection, operators can now buy limited amounts of terrorism coverage, subject to additional premiums, but availability of legally required third party liability coverage depends on: (i) the insurers' perception of the terrorism risk; (ii) the capacity of the national insurance market and its willingness to assume terrorist risks; and (iii) the legally imposed amount of operator liability. Where terrorism risks are fully covered, it is usually because the operator's liability amount is relatively modest. Increases in those amounts, due to amendments to the nuclear liability conventions for example, are likely to result in a shortage of terrorism insurance capacity. The Committee will continue to seek information, particularly on excluded risks and other forms of financial security, in the hope of finding ways to overcome difficulties in this area.

The Committee also undertook an initial examination of whether nuclear fusion installations should be included within the scope of application of the Paris Convention, particularly in light of the International Thermonuclear Experimental Reactor (ITER) project which involves several NEA member countries. While the radiological risks associated with such reactors is generally deemed to be relatively low compared to those associated with fission reactors, the NLC agreed that the matter should be studied in more detail to clarify and evaluate the level of risk associated with the construction and operation of such installations, and to take into account sociological factors such as the public's perception of that risk.

The Second International Workshop on the Indemnification of Nuclear Damage took place on 18-20 May 2005 in Bratislava, Slovak Republic. The workshop was co-organised by the NEA and the Slovak Republic Nuclear Regulatory Authority, and attracted 108 participants from 27 countries. Its purpose was to assess the third party liability and compensation mechanisms that would be implemented by participating countries in the event of a nuclear accident taking place within or near their borders. To accommodate this objective, two fictitious accident scenarios were developed: one involving a fire in a nuclear installation located in the Slovak Republic and the other a fire on board a ship transporting enriched uranium hexafluoride along the Danube River. The first scenario was designed to involve the greatest possible number of countries, with the second being restricted to countries with a geographical proximity to the Danube. Both scenarios aimed to evaluate the compensation mechanisms which would be implemented in countries where resulting nuclear damage had occurred. The issues that attracted the most discussion were claims handling issues, the definition of nuclear damage and the proper functioning of the Joint Protocol linking the Paris and Vienna Conventions. There was general consensus that international workshops such as this contribute significantly towards harmonisation amongst like-minded countries.

## Information on nuclear law

Issues No. 75 and 76 of the *Nuclear Law Bulletin* were published in June and December 2005, along with their respective Supplements reproducing the unofficial consolidated texts of the Paris and Brussels Supplementary Conventions as amended in 2004 and recent radiation protection legislation adopted in Estonia. This periodical provides up-to-date information on 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 for those in government, regulatory, academic, industry and international circles who work closely with nuclear law. Back issues of the Bulletin and other nuclear law information resources are available on the NEA website at www.nea.fr/html/law/.

## Educational programme

The fifth session of the International School of Nuclear Law (ISNL) was held at the University of Montpellier 1, France, in August-September 2005. The ISNL is jointly managed by the NEA and the University of Montpellier 1, and its objective is to provide high-quality education in nuclear law to law students

2005 issues of the *Nuclear Law Bulletin*.

and legal professionals through a two-week intensive course. A total of 58 participants from 29 countries attended the 2005 programme, held entirely in English.

The University Diploma *(Diplôme d'Université – D.U.)* in International Nuclear Law, established in 2003, attracts an increasing number of candidates each year. ISNL participants may apply for this diploma which is delivered upon successful completion of written examinations and satisfactory performance during the course. The University has also organised official recognition of the Diploma through ECTS credits (European Credit Transfer and Accumulation System). This system, introduced in 1989 within the framework of Erasmus and now part of the Socrates programme, facilitates the recognition of study periods spent in European universities.

Further information on the 2006 session, scheduled to take place from 21 August to 1 September 2006 is available on the NEA website at www.nea.fr/html/law/isnl/index.html. Application forms are also available from www.nea.fr/html/law/isnl/Appform2006.pdf.

The first session of the World Nuclear University (WNU) Summer Institute took place from 9 July to 20 August 2005 at the US Department of Energy's Idaho National Laboratory. The nuclear law module of this course was organised by the ISNL Secretariat. This six-week training programme covering a broad spectrum of nuclear energy issues was attended by 77 participants from 34 countries.

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# Joint Projects and Other Co-operative Projects

## NUCLEAR SAFETY RESEARCH

### The Halden Reactor Project

The Halden Reactor Project has been in operation for 47 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 development and analyses, carried out at the Halden establishment in Norway, and is supported by approximately 100 organisations in 20 countries.

Halden, Norway

Entrance to the Halden reactor, Norway.

The 2005 programme of work in the fuel area included the continuation of the in-pile loss-of-coolant accident (LOCA) test programme aimed at assessing high burn-up fuel behaviour under accident conditions. A test using high burn-up fuel was carried out, but did not perform as expected and will need to be repeated early in 2006. Properties of $UO_2$, gadolinia and MOX fuels in a variety of conditions relevant to operation and licensing were investigated. Corrosion and creep behaviour of various alloys were studied. The experimental programme on the effect of water chemistry variants on fuel and reactor internals material continues to be of great interest. Tests to investigate the cracking behaviour of reactor internals material in BWRs and PWRs continued, with the aim of characterising the effect of hydrogen addition to the coolant water. The programme on human factors focused on tests and data analyses carried out in the Halden man-machine laboratory. The work on human factors also encompasses new designs and evaluations of human-system interfaces and control rooms. This involves *inter alia* the use of the Halden Virtual Reality Facility. Progress has been made in the area of human reliability assessment, aiming to provide data suitable for probabilistic safety assessments. The work on cable ageing has yielded a promising technique for online cable assessment.

An Enlarged Halden Programme Group Meeting (bringing together both programme representatives and participating country experts) was held in October 2005, with almost 300 participants attending. The main results of the joint programme were reported on that occasion. A number of international workshops were also organised, mainly with the purpose of discussing new programme items and goals.

The Halden Reactor Project operates by way of three-year renewable mandates. The project's signatory organisations confirmed their strong support of the Halden activities for the 2006-2008 period during a meeting held at NEA headquarters in December 2005.

### 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 refabricated to suitable length. The project began in 2000 and will run for eight years. The experimental work is being carried out at the Institute for Radiological Protection and Nuclear Safety (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. Organisations in 12 countries, including regulators, industry and research organisations, participate in the project.

The examination and analyses of the tests that have been carried out so far were completed in 2005. The planning of future tests continued, with the aim of developing a consistent set of objectives and identifying suitable fuel specimens. Further progress was made on the refurbishment of the Cabri test facility and the preparation of the water loop installation.

Two meetings of the Technical Advisory Group (TAG) took place in 2005, during which the programme results and plans for future activities were reviewed. Related analyses were also presented and discussed in a Cabri seminar held in conjunction with a TAG meeting. The TAG also addressed technical issues related to the water loop design. One meeting of the project Steering Committee was held in 2005: the extension of the Cabri Umbrella Agreement to 2010 was finalised, and considerable progress was made in relation to the future participation

of Japan in the project. The French *Commissariat à l'énergie atomique* became a new participant in the project in 2005.

## The MASCA Project

The first phase of the Material Scaling (MASCA) Project investigated the consequences of a severe accident involving core melt. It started in mid-2000 and was completed in July 2003. The second phase of the project started thereafter, upon request of the member countries and recommendation of the CSNI. The programme, to last three years, is supported by organisations in 17 countries. It is based on experiments that are mainly carried out at the Kurchatov Institute in the Russian Federation, and that make use of a variety of facilities in which corium compositions prototypical of power reactors can be tested.

The tests in the first phase of the programme were primarily associated with scaling effects and coupling between thermal-hydraulic and chemical behaviour of the melt. The tests of the second phase seek to provide experimental information on the phase equilibrium for the different corium mixture compositions that can occur in water reactors. This determines the configuration of materials in the case of stratified pools, and thus the thermal loads on the vessel. In order to extend the application of MASCA results to reactor cases, the influence of an oxidising atmosphere and the impact of non-uniform temperatures (presence of crusts or solid debris) will be addressed in addition to scaling effects. The programme is also intended to generate data on relevant physical properties of mixtures and alloys that are important for the development of qualified mechanistic models.

Two meetings of the project steering bodies, supported by the NEA, were held in 2005. During these meetings, the results obtained to date and plans for future tests were reviewed. Discussions were also held to assess the possible need for a new programme at the Kurchatov Institute facilities after completion of the MASCA programme in June 2006. These discussions are expected to be completed during 2006.

## The MCCI Project

The Melt Coolability and Concrete Interaction (MCCI) Project is managed by the US Nuclear Regulatory Commission (NRC), carried out at the Argonne National Laboratory (USA), and has participants from 13 countries. It was started early in 2002 and was completed at the end of 2005. It addressed 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 provided experimental data of relevance to the type of severe accident mentioned above and to resolve two important accident management issues. The first one concerned 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 concerned 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.

The experiments on water ingress mechanisms showed that cooling of the melt by water is reduced at increasing concrete content, i.e. cooling by water flooding is more effective in the early phase of the melt-concrete interaction. The effect of concrete type, i.e. siliceous and limestone types (used respectively in Europe and the United States), was also addressed. Material properties such as porosity and permeability were derived. After a first melt-concrete interaction test, which produced unexpected results (i.e. a strong asymmetry in concrete ablation), two new tests were carried out in 2004 and 2005. The tests were successful and provided excellent data on axial and radial concrete ablation. They also pointed out appreciable differences in ablation rate for siliceous and limestone concrete, although this aspect requires confirmation. Analytical exercises were organised among participants as blind predictions of the test results, which were very valuable in order to understand code capabilities and shortcomings. The strength of the solid upper crust, a parameter that is of great interest for modelling and understanding MCCI at plant scale, was also determined during these experiments.

Two Programme Review Group meetings and two Management Board meetings were held in 2005, both supported by the NEA. On these occasions the scope of a possible extension of the project was discussed, leading to the formulation of a new programme proposal that was brought to the CSNI in December 2005. On that occasion, the decision was taken to extend the MCCI work programme for approximately three years.

## The PKL Project

This project started in 2004 and consists of experiments carried out in the *Primär Kreislauf* (PKL) thermal-hydraulic facility, which is operated by Framatome ANP in its establishment at Erlangen, Germany. Organisations from 14 countries participate.

The PKL experiments focus on the following PWR issues that are currently receiving great attention within the international reactor safety community:

- boron dilution events after small-break, loss-of-coolant accidents (LOCAs);
- loss of residual heat removal during mid-loop operation with a closed reactor coolant system in context with boron dilution;

- loss of residual heat removal during mid-loop operation with an open reactor coolant system;
- an additional test to be defined in agreement with the project partners according to the state of open issues such as:
  - boron precipitation during large-break LOCAs, or
  - boron dilution after steam generator tube rupture.

Two tests were carried out in 2005. Their preparation and the first test outcome were extensively discussed at the two meetings of the project steering bodies that took place during the year. A workshop covering an analytical exercise with code predictions related to the PKL tests was also conducted in 2005. The project is set to continue until the end of 2006.

## The PSB-VVER Project

The objective of the PSB-VVER Project is to provide experimental data of relevance to the validation of safety codes in the field of VVER-1000 thermal-hydraulics. The project, in which seven countries participate, started in 2003 and will be completed at the end of 2006. It consists of five PSB-VVER experiments addressing:

- scaling effects;
- natural circulation;
- small, cold leg break LOCAs;
- primary to secondary leaks;
- 100% double-ended, cold leg break (indicative, actual size to be agreed upon).

Extensive pre- and post-test analyses are to accompany the experimental programme throughout the experimental series. The possibility of setting up sets of international standard problems – either limited to project participants or with broader attendance – will also be considered in light of the resources that this effort requires.

Four project tests have been successfully carried out and reported upon thus far. The features of the final test were discussed and revised by members. This test will simulate thermal-hydraulic conditions arising after a large-break LOCA in a VVER-1000 reactor, and will be the first one run under these very demanding conditions. Two meetings of the project's Programme Review Group were held in 2005 with NEA support.

## The ROSA Project

The ROSA Project was launched in 2005 to resolve issues in thermal-hydraulics analyses relevant to LWR safety, and makes use of the ROSA (Rig-of-safety assessment) large-scale test facility of the Japan Atomic Energy Agency (JAEA, formerly JAERI). It intends to focus on the validation of simulation models and methods for complex phenomena that may occur during safety transients. The project is supported by safety organisations, research laboratories and industry from 13 countries and is set to run from April 2005 to December 2009. The overall objectives of the ROSA Project are:

- To provide an integral and separate-effect experimental database to validate code predictive capability and accuracy of models. Phenomena coupled with multi-dimensional mixing, stratification, parallel flows, oscillatory flows and non-condensable gas flows are to be studied in particular.
- To clarify the predictability of codes currently used for thermal-hydraulic safety analyses as well as of advanced codes presently under development, thus creating a group among member countries who share the need to maintain or improve technical competence in thermal-hydraulics for nuclear reactor safety evaluations.

The project consists of the following six types of ROSA large-scale experiments:

- temperature stratification and coolant mixing during emergency coolant injection;
- unstable and disruptive phenomena such as water hammer;
- natural circulation under high core power conditions;
- natural circulation with superheated steam;
- primary cooling through steam generator secondary depressurisation;
- two open tests defined by participants (one on pressure vessel upper-head break LOCA and another on pressure vessel bottom break LOCA, combined with accident management measures with symptom-oriented operator actions).

The first two tests were carried out as scheduled in 2005. Two meetings of the project steering bodies were held.

ROSA gamma-ray densitometer: from top to bottom view of the 9th, 8th, 7th and 6th floors.

JAEA, Japan

## The SCIP Project

The Studsvik Cladding Integrity Project (SCIP) started in July 2004 and aims to utilise the hot cell facilities and expertise available at the Swedish Studsvik establishment in order to assess material properties and to determine conditions that can lead to fuel failures. The project has the following general objectives:

- to improve the general understanding of cladding integrity at high burn-up;
- to study both BWR and PWR/VVER fuel cladding integrity;
- to complement two large international projects (Cabri and ALPS), which focus on fuel behaviour in design basis accidents (notably RIA), where some of the mechanisms are similar to those that may occur during normal operational transients or anticipated transients;

- to achieve results of general applicability (i.e. not restricted to a particular fuel design, fabrication specification or operating condition), so that they can consequently be used in solving a wider spectrum of problems and be applied to different cases;
- to achieve experimental efficiency through the judicious use of a combination of experimental and theoretical techniques and approaches.

Although the primary concern of this project is the integrity of LWR cladding during reactor operation, a number of closely related areas of relevance to water reactors in general may also be addressed. In addition, some of the results will be able to be used in relation to cladding behaviour of discharged fuel during handling, transport and storage.

Organisations from ten member countries participate in the project. As recommended by the CSNI, comprehensive industry participation was sought in the project establishment phase. Two meetings of the project steering bodies were held with NEA support in November 2005.

### The SETH Project

The SESAR Thermal-hydraulics (SETH) Project, which is supported by 14 NEA member countries, began in 2001 with a four-year mandate. 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 carried out at Framatome's *Primär Kreislauf* (PKL) in Germany, which were completed in 2003, investigated boron dilution accidents that can arise from a small-break, loss-of-coolant accident (LOCA) during mid-loop operation (shutdown conditions) in PWRs. The final report of the PKL tests was completed in 2004.

The experiments being 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. After an extensive preparation phase, the experimental series started in 2004 and continued in 2005. Due to the complexity of the PANDA experiments, some delays were encountered. The Project Board therefore decided to extend the programme's time frame to mid-2006.

Measurement of local gas concentrations inside PANDA vessels and components (mass spectrometer) at the PANDA experimental facility in Switzerland.

Paul Scherrer Institute, Switzerland

## NUCLEAR SAFETY DATABASES

### The COMPSIS Project

The Computer-based Systems Important to Safety (COMPSIS) Project was undertaken in 2005 by ten member countries with an initial mandate of three years. To the extent that analogue control systems are being replaced by software-based control systems in nuclear power plants worldwide, and that the failure modes of both hardware and software in these new systems are rare, there is a considerable advantage in bringing the experience of several countries together. By doing so, it is hoped to contribute to the improvement of safety management and to the quality of software risk analysis for software-based equipment.

Work during the first year of the project has concentrated on the development of the COMPSIS data collection guidelines, quality assurance and data exchange interface. Two meetings of the COMPSIS steering body were held in 2005 with NEA support.

### The FIRE Project

The Fire Incidents Records Exchange (FIRE) Project started in 2002 and its mandate was renewed at the end of 2005 for a further three-year period. The main purpose of the project is to collect and analyse data related to fire events in nuclear environments, on an international scale. The specific 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.

After having established the project quality guidelines and the quality-assurance procedure, data acquisition has proceeded according to plans. In addition, in 2005 Canada and the Netherlands joined the project, bringing the number of

countries that participate to 11. Two meetings of the project steering body were held during the year.

### 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 April 2005-March 2008 has come into force. Eleven countries participate.

The ICDE Project comprises complete, partial and incipient common-cause failure events. The project currently 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, control rod drive mechanisms, reactor protection system circuit breakers, batteries and transmitters. These components have been selected because several probabilistic safety assessments have identified them as major risk contributors in the case of common cause failures.

Qualitative insights from data will help reduce the number of failure events that are risk contributors. Reports have been produced for pumps, diesel generators, motor-operated valves, safety and relief valves, check valves and batteries. Data exchange for switchgear and breakers, reactor level measurement and control rod drive component exchange is ongoing. Two meetings of the project steering body were held in 2005 with NEA support.

### The OPDE Project

The Piping Failure Data Exchange (OPDE) Project started in 2002. The first phase of the project period was successfully completed in mid-2005. The project was then renewed for another three-year period until mid-2008. Currently, 12 countries participate. The project 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 in the main safety systems. 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. Steam generator tubes are excluded from the OPDE project scope. Specific items may be added or deleted upon decision of the Project Review Group. Two meetings of this body were held in 2005 with NEA support.

## RADIOACTIVE WASTE MANAGEMENT

### The Co-operative Programme on Decommissioning (CPD)

The Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD) is a joint research project which has been operating under Article 5 of the NEA Statute since its inception in 1985. A revised Agreement between participants came into force on 1st January 2004 for a period of five years. Currently, 20 organisations from 11 NEA member countries and one non-member economy participate in the CPD, providing experience from 41 decommissioning projects (26 reactors and 15 fuel cycle facilities). Altogether 49 decommissioning projects have benefited from the information exchange framework provided by the CPD. The information exchange includes biannual meetings of the Technical Advisory Group (TAG), during which the site of one of the participating projects is visited, and where positive and less positive examples of decommissioning experience are openly exchanged for the benefit of all. In 2005, TAG meetings were held in Tsuruga, Japan, and in Cadarache, France.

Cross-membership of some of the programme's Management Board in the RWMC Working Party on Decommissioning and Dismantling (WPDD) ensures that insight gained within the CPD can also benefit the work of the NEA standing technical committees. In this context, the CPD collected information amongst its members on the state of the art in measuring contamination levels of materials designated to be released from regulatory control. The CPD provided this information to the RWMC decommissioning group for review and publication in order to make its experience available to all NEA member countries.

UKAEA, United Kingdom

Decommissioning activities in the United Kingdom.

## 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. To enable an evaluation of the respective merits and limitations of different thermodynamic sorption models, the project was implemented in the form of a comparative modelling exercise based on selected datasets for radionuclide sorption by both simple and complex materials. These were organised into seven test cases that were prepared and distributed to participating organisations. A Technical Direction Team evaluated the existing database, developed test cases for sorption modelling, and carried out the subsequent analysis and interpretation of modelling outcomes. Eighteen funding organisations from thirteen countries joined phase II of the Sorption Project, and in total, twenty modelling teams participated in the exercise, making it possible to base the conclusions of the project on a broad range of experience and expertise.

The findings of the project have been published as an NEA report addressing an audience of radioactive waste management organisations and regulators, as well as modellers and experimentalists who are involved in performance assessment. The report summarises the main results and identifies the strengths and drawbacks of various typical approaches. The results show that:

- the conceptual and methodological tools needed for characterising, interpreting and justifying the equilibrium distribution coefficients (Kd values) provided for performance assessment needs, are largely available;
- with regard to complex materials, the main need is for good quality and more complete sets of pertinent sorption data.

Phase II of the Sorption Project was completed with a final workshop in Paris in October 2005. The workshop provided an overview of the main project results, with emphasis on the merits and limitations of thermodynamic sorption models (TSMs) and recommendations on their use.

## The Thermochemical Database (TDB) Project

The Thermochemical Database (TDB) project aims at meeting the specialised modelling requirements for safety assessments of radioactive waste disposal sites. Chemical thermodynamic data are collected and critically evaluated by expert review teams and the results are published in a book series edited by the Data Bank. The French *Commissariat à l'énergie atomique* recently joined the TDB project, bringing the number of TDB participants to 17 organisations in 12 member countries.

Four new reviews were published in 2005, bringing the total number of volumes in the TDB series to nine. The new reviews contain inorganic chemical thermodynamic data of nickel, selenium and zirconium, as well as organic compounds and complexes of uranium, neptunium, plutonium, americium, selenium, nickel, technetium and zirconium with oxalate, citrate, EDTA and iso-saccharinate ligands.

Work also continued on the reviews of thorium, tin and iron. The first two reviews are scheduled for peer review in 2006 and the latter in early 2007. A state-of-the-art report on chemical thermodynamics of solid solutions was prepared in 2005. A final version, containing precise scientific guidelines on the subject, is envisaged for publication in 2007.

# RADIOLOGICAL PROTECTION

## The Information System on Occupational Exposure (ISOE)

Since its creation in 1992, the Information System on Occupational Exposure (ISOE) has been facilitating the exchange of data, analysis, lessons and experience in occupational radiological protection at nuclear power plants worldwide. Jointly sponsored by the IAEA, the ISOE programme includes 478 reactor units (403 operating and 75 in cold-shutdown or some stage of decommissioning) operated by 71 utilities in 29 countries. ISOE databases cover 91% of all nuclear power reactors (442) in commercial operation throughout the world. In addition, the regulatory authorities of 25 countries participate actively in ISOE. Utilities and authorities continue to join the ISOE programme, notably the new units that have recently come on line in Korea and Japan, as well as several recent participants from the United States.

The database and information exchange mechanism used initially was the floppy disk, which then evolved to the CD. With the increasing use and flexibility of the web, it was recommended in 2003 that the ISOE programme should migrate its data exchange/assessment processes, as well as its information and experience sharing to the web. Following a pilot study in 2004, and assessment by the ISOE Working Group on Data Assessment, it was agreed that the ISOE databases should be transferred to a web-compatible database system, in order to create a natural network for the online exchange of information and experience. During 2005, the data viewing and analysis component was successfully transferred to the web as part of the new ISOE network information portal. The databases will continue to be maintained on CD for those with specific national requirements or without access to the web.

In substantive terms, the ISOE programme continued to concentrate on the exchange of data, analysis, good practice and experience in the area of occupational exposure reduction at nuclear power plants. The four regional ISOE Technical Centres continued to support their regional members though specialised data analyses and benchmarking visits. ISOE information and experience exchange continued through the international and regional ISOE ALARA symposia, including the first Asian ALARA Symposium in Japan. Finally, a new initiative was launched in 2005 to improve the usefulness and accessibility of the ISOE programme, with a goal of it becoming a primary source of information when topics of occupational radiological protection are discussed. This will be facilitated through the proactive identification of user needs and the ongoing migration of resources to the unified, web-based ISOE network portal.

PAKS Nuclear Power Plant Co., Hungary

# General Information

# Information and Communications

*Nuclear energy decision making and stakeholder participation need to be based on understanding. The NEA 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.*

## Highlights

- The Agency produced 66 publications in 2005, of which 31 were put on sale and 35 were distributed free of charge.
- A tour of the COGEMA spent nuclear fuel reprocessing plant at La Hague was organised for OECD ambassadors and energy advisors.
- NEA information and publications stands were organised at 12 international conferences.
- The NEA co-sponsored 23 international conferences during 2005; the international conference at ministerial level on Nuclear Power for the 21st Century was organised by the IAEA in co-operation with the OECD and the NEA.

The NEA is an intergovernmental agency specialised in studying the scientific, technical and economic aspects of nuclear energy. It strives to provide high-quality, factual information in a timely manner to member countries, as a complement to national energy analyses. Through a varied information and communications programme, this information is also made available to other interested parties wishing to learn about nuclear energy's multiple aspects and the results of the Agency's work. 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 large selection of publications and reports.

### Public affairs and relations with the press

Various activities were undertaken in 2005 to promote awareness and understanding of the scientific, technical and economic aspects of the nuclear option. In July, a tour of the COGEMA spent nuclear fuel reprocessing plant at La Hague was organised for the ambassadors and energy advisors of OECD member countries working in Paris. This follows on from the visit organised for the same group in 2004 to the Nogent nuclear power plant. The NEA also co-operated with OECD staff at headquarters in preparing the session on Nuclear Energy: A Serious Option?, held during the OECD Forum in May on Fuelling the Future: Security, Stability, Development.

In terms of relations with the press, a press briefing was held in March in collaboration with the International Energy Agency (IEA) on the occasion of the release of a new report on *Projected Costs of Generating Electricity*. The NEA Director-General, Luis Echávarri, also presented the results of the study in various fora, including the European Parliament. In conjunction with the Nuclear Power for the 21st Century conference, he participated in two press conferences and granted numerous interviews. These activities contributed to the event being reported in media around the world. In June, a press conference was organised in co-operation with the French Nuclear Safety Authority (ASN) and the US Nuclear Regulatory Commission at the NEA Safety and Regulation Forum on Multilateral Co-operation in Nuclear Safety Research and Regulation, which commemorated 40 years of multilateral exchanges under NEA auspices in the field of nuclear safety and regulation.

Several articles were published in the specialist press by members of the NEA Secretariat during 2005. Of particular note was the article by NEA Director-General L. Echávarri on *L'énergie nucléaire au 21ème siècle* in the French publication *La revue de l'énergie*.

The "Press Room" on the NEA website (www.nea.fr/html/general/press/) provides an important information service for journalists and interested members of the public. In addition to the Agency's press releases, regularly updated press kits provide introductory information on major nuclear issues. This section of the website attracted about 10% of all visits to the NEA website during 2005.

### Publications

During the course of 2005, the Agency produced 66 publications, of which 31 were put on sale and 35 were distributed free of charge. The list of these publications is provided on page 54. Best sellers included the radioactive waste management workshop proceedings on *Dealing with Interests, Values and Knowledge in Managing Risk and Projected Costs of Generating Electricity: 2005 Update*. All free reports published by the NEA are reproduced in full on the NEA website. The most

highly accessed report in 2005 was *Chernobyl: Assessment of Radiological and Health Impacts – 2002 Update* (downloaded over 57 000 times), followed by *Nuclear Competence Building: Summary Report* (downloaded over 50 000 times, English and French versions combined). In addition to standard distribution of free publications (some 50 000 copies), several hundred individual requests were received. Roughly 7 000 reports were shipped to information and publications stands around the world.

In order to keep NEA correspondents and other interested professionals abreast of key developments in the Agency's programme of work, *NEA News* continues to be published twice a year in both English and French. *NEA News* provides feature articles on the latest developments in the nuclear energy field and how they relate to NEA work under way, advance findings and updates on NEA studies and joint projects, news briefs, and information about NEA publications and forthcoming events. Starting in January 2006, *NEA News* will be available free of charge, including on the NEA website at www.nea.fr/html/pub.

## Internet-based communication

The NEA website continues to form a key part of the Agency's information programme and has proved effective in raising the profile of the Agency's work. It provides background information on the full range of work being undertaken at the Agency, updates on the status of ongoing activities and joint projects, and access to the main findings and conclusions of the majority of the Agency's published reports. It also caters to a more generalist audience by providing basic facts and figures about nuclear energy, and a press room for journalists. At the end of 2005 the site's graphical interface was updated, information presented on the home page was restructured to improve clarity and ease of navigation, and several technical adjustments were made to improve the speed with which pages can be downloaded.

The "Delegates' area" on the NEA website remains an important source of information 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 7 000 official documents are available in the Delegates' area, roughly 400 of which were added for 2005.

Individual subscriptions to the Agency's monthly electronic bulletin continued to grow during 2005, topping 6 700 subscribers by year-end. Distributed free of charge, the bulletin includes monthly updates on important NEA activities and newly released reports. Subscription requests can be made at *www.nea.fr/html/signon.html*.

## NEA visibility in international fora

The NEA Secretariat provided expert presence at a wide range of international conferences and seminars in 2005. In parallel, senior staff were invited to make a number of important keynote speeches. Particularly noteworthy were the NEA Director-General's interventions at ICONE 13, in Beijing, China in May, at the informal meeting of the European Parliament Committee on Industry, Research and Energy in Strasbourg, France in September, and at the European Nuclear Assembly in Versailles, France in December. The opening address by the OECD Secretary-General at the international conference at ministerial level on Nuclear Energy for the 21st Century also merits special mention.

*Ministère délégué à l'Industrie, France*

During the Nuclear Energy for the 21st Century conference in Paris, France.

NEA information and publications stands were organised at 12 international conferences in 2005. These included:

- PIME (February 2005, Paris, France);
- Second International Meeting on Clays in Natural and Engineered Barriers for Radioactive Waste Confinement (March 2005, Tours, France);
- Nuclear Energy for the 21st Century (March 2005, Paris, France);
- SRF 2005 Multilateral Co-operation in Nuclear Safety Research and Regulation (June 2005, Paris, France);
- M&C 2005 – International Topical Meeting on Mathematics and Computation, Supercomputing, Reactor Physics and Nuclear and Biological Applications (September 2005, Avignon, France);
- 2005 NCSD Topical Meeting Integrating Criticality Safety into the Resurgence of Nuclear Power (September 2005, Knoxville, TN, USA);
- NUCNET – 15th Anniversary Symposium (September 2005, Prague, Czech Republic);
- International Conference on the Safety of Radioactive Waste Disposal (October 2005, Tokyo, Japan);
- Global 2005 – Nuclear Energy Systems for Future Generation and Global Sustainability (October 2005, Tsukuba, Japan);
- ISOE Annual Meeting (October 2005, Tokyo, Japan);
- ANS Nuclear Technology Expo 2005 – Talk About Nuclear Differently: A Good Story Untold (November 2005, Washington, DC, USA);
- ENC 2005 – Nuclear Power for the 21st Century: From Basic Research to High-tech Industry (December 2005, Versailles, France).

The NEA also co-sponsored 23 international conferences. In March 2005, the international conference at ministerial level on Nuclear Power for the 21st Century was hosted by the French government, and organised by the IAEA in co-operation with the OECD and the NEA. Some 65 countries were represented at the conference, which included presentations by more than 30 ministers. The conference demonstrated a renewed interest among policy makers for the nuclear option in terms of its capacity to enhance security of energy supply, to reduce environmental impacts of energy production and use, and to provide electricity to consumers at affordable costs.

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# Nuclear Energy and Civil Society

## Radioactive waste management

### *FSC workshop in Spain*

The integration of waste management programmes into wider socio-political considerations is a major challenge for all waste management programmes. Through its Forum on Stakeholder Confidence (FSC), the RWMC provides member countries with the opportunity to exchange information in this area as well as to exchange views with relevant stakeholders. The FSC continues to organise workshops in a national context to provide a basis for helping the national stakeholder dialogue programmes and to gain insight into both country-specific and general aspects and influences of the political, cultural and socio-economic framework. The workshops also provide participants neutral ground for examining controversial issues. FSC workshops in national context have been conducted in Finland (2001), Canada (2002), Belgium (2003) and Germany (2004).

The fifth FSC workshop in national context was held in 2005 in Hospitalet, Spain. Three Spanish organisations – the association of Spanish nuclear-affected municipalities (AMAC), the Spanish waste management agency ENRESA and the national safety authority CSN – had worked together on a project called "Cowam Spain" to develop a methodology for arriving at facility-siting proposals broadly accepted by society. Workshop participants discussed this new methodology with those of the Cowam Spain project and with Spanish stakeholders in order to offer the results of their reflection to national politicians and administration. These discussions were particularly helpful to the Spanish participants as they provided valuable feedback from the international community and from different points of view. The Cowam-Spain methodology will be applied to the currently proposed national interim storage facility for spent fuel in Spain. The next FSC workshop in national context is planned to take place in Hungary in November 2006.

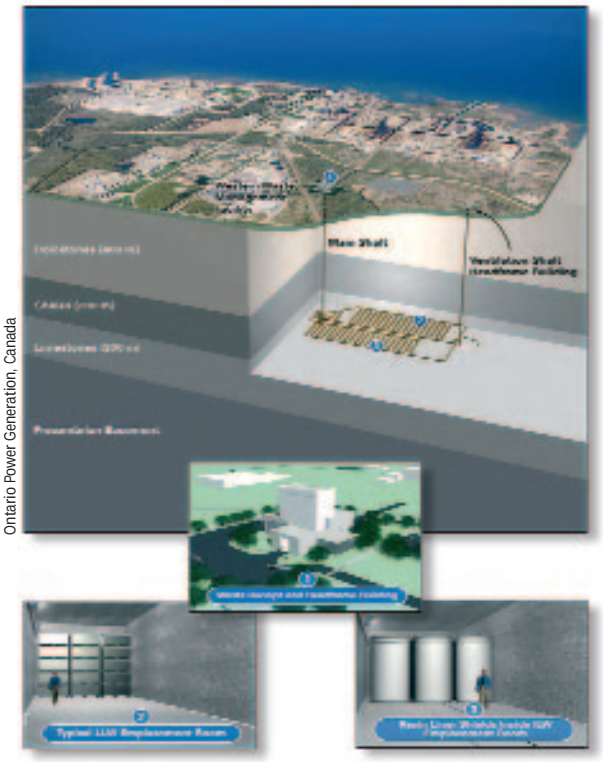
### *FSC "value added" project*

In radioactive waste management (RWM), the greatest challenge may be to create a local, operating facility that can survive over the generations – in both a technical sense and a societal sense. Alongside scientific knowledge and technical competency, and resources for implementing an agreed approach, there must be a continued willingness to live with and maintain the facility. As part of this, a sustainable relationship between the host community and the installation should be established.

It is in this context that the FSC has undertaken a study of the added value of waste storage or repository projects. The concept is distinct from that of compensation. Socio-economic development packages are recognised to be important, as is the management of social and economic impacts, and work is under way in these areas. However, there has been little international exploration of what the FSC calls added cultural value and amenity. Added cultural value to RWM facilities and sites may be described as falling into three broad categories:

- design and architectural aspects, amenities, and markers for coming generations ("hardware" aspects);
- "related projects" such as science centres, time-travel museums, and associated research facilities (also "hardware" but extending beyond the facility and the site themselves);
- community identity, image, and profile, as well as messages for coming generations ("soft" aspects that may be developed and enhanced).

All three categories can be legitimate areas for work and investment by communities and implementers. The FSC has therefore proposed, as a service to communities and to national RWM programmes, to facilitate this discussion. As a first step, a desk study and interviews were undertaken in 2005.



Ontario Power Generation, Canada

Ontario Power Generation's proposed deep geologic repository for low- and intermedidate-level waste at the Bruce nuclear site, Tiverton, Ontario, Canada.

### *FSC project on organisational changes*

Institutions with responsibilities for radioactive waste management must be able to accommodate organisational changes in order to carry out the long-term projects for which they are responsible. Institutions capable of achieving and maintaining stakeholder confidence will need focused efforts in the three main areas of organisational aspects, mission and behaviour.

For the purpose of better understanding recent cultural and structural changes taking place within RWM organisations, the FSC launched a process including a questionnaire survey, the preparation of a desk study, a workshop (and/or topical session) and the publication of the main lessons learnt.

The questionnaire survey was carried out with FSC delegates, aimed at eliciting views of FSC members about recent changes taking place in their organisations. Responses were received from most FSC organisations (17 organisations in 11 countries). Key problem areas identified for further investigation include looking at: how the survey results relate to findings in other areas of organisational research, and to what extent do various factors – such as cultural context, political and social environment, legal and policy changes, and local aspects – influence organisational change in general, and RWM organisations in particular.

Beyond the desk study summarising the questionnaire results, it was suggested that these questions should be addressed in a specific workshop or topical session. Organisational scientists specialised in research on these topics will be invited to share their knowledge with FSC delegates.

## Stakeholder involvement in radiological protection

The recognition of the need for, and usefulness of, stakeholder involvement in decision making has enlarged the focus of radiological protection in recent years. The CRPPH has for many years focused a significant part of its programme of work on stakeholder involvement, primarily through the series of workshops held in 1998, 2001 and 2003 in Villigen, Switzerland. A key result of these workshops suggests that when stakeholders are involved in radiological risk assessment and management, and science is brought to the service of "inclusive" decision-making processes, the resulting decisions can be of higher quality and greater sustainability than had stakeholders and radiological protection scientists and professionals not worked together towards a solution.

The rehabilitation of contaminated lands and facilities often involves significant stakeholder concerns. Work to rebuild the lives of those living in the areas affected by the Chernobyl accident is a prime example of this, and with 2006 marking 20 years since the accident, the CRPPH has revisited this case. While clearly not all of this experience is applicable to other circumstances in other countries, much can be gained by studying its stakeholder involvement aspects. Particular areas of interest include the interaction of stakeholders with radiological protection specialists, and the development of practical radiological protection approaches (a radiological protection culture) for all those living in a contaminated environment. A broad overview of the situation in the Chernobyl-contaminated areas has yielded detailed understanding of the magnitude and varieties of problems and issues that would arise in any large-scale contamination situation. This work, performed during 2005, will be documented in an NEA report to be published in mid-2006.

In addition, in order to share the knowledge developed by the Committee, and to remain up-to-date with ongoing work in this area, the CRPPH participated in the 2005 annual meeting of the Japanese Health Physics Society (JHPS), which included a specific topical session on stakeholder involvement. Following this meeting, the JHPS and the NEA jointly organised a symposium at Tokyo University in July on Stakeholder Involvement in Radiation Protection. All presentations made at the symposium were documented in the proceedings.

Finally, following the International Radiological Protection Association session on stakeholder involvement in May 2004, the Spanish Society for Radiological Protection (SERP) consulted the French and the UK Societies to explore opportunities for organising a follow-up international workshop aiming at promoting stakeholder engagement among radiation protection professionals. The three Societies agreed to hold three workshops on this important issue in 2005 (in Spain), 2006 (in France) and 2007 (in the United Kingdom). The first of these meetings, Processes and Tools for Stakeholder Engagement in Radiological Protection, took place in Salamanca, Spain, in November 2005, and included active participation on behalf of the CRPPH and the NEA Secretariat.

## Nuclear regulators and the public

Information officers from regulatory bodies meet once a year under the auspices of the Working Group on Public Communication (WGPC) to exchange information and experience related to communication with the public and to carry out related studies. The two main topics discussed in 2005 were the challenges associated with public communication during abnormal situations and the publicity given to regulatory decisions. For further information regarding the activities of the WGPC, see page 17.

## Society and nuclear energy policy

The second phase of the NDC project on society and nuclear energy was completed with the publication on the NEA website of a report compiling and analysing 13 case studies from 7 member countries. The case studies describe experiences in communication with stakeholders on nuclear energy projects and issues, and provide policy makers with insights into the challenges involved and examples of best practice. The report complements the 2002 publication entitled *Society and nuclear energy: Towards a better understanding*.

# NEA Publications Produced in 2005

## General Interest


**Annual Report 2004**
*ISBN 92-64-01053-X* *Free: paper or web versions.*

**NEA News, Vol. 23 Nos. 1 and 2**
*ISSN 1605-9581* *Yearly subscription: € 49, US$ 56, £ 31, ¥ 6 600.*

**Strategic Plan of the Nuclear Energy Agency – 2005-2009 (The)**
Summary
*ISBN 92-64-01057-2* *Free: paper or web.*

## Nuclear Development and the Fuel Cycle

**Actinide and Fission Product Partitioning and Transmutation**
Eighth Information Exchange Meeting, Las Vegas, Nevada, United States, 9-11 November 2004
*ISBN 92-64-01071-8* *Free: paper or web.*

**Beneficial Uses and Production of Isotopes**
2004 Update
*ISBN 92-64-00880-2* *Price: € 24, US$ 29, £ 16, ¥ 3 200.*

**Nuclear Energy Data – 2005**
*ISBN 92-64-01100-5* *Price: € 24, US$ 29, £ 16, ¥ 3 200.*

**Projected Costs of Generating Electricity**
2005 Update
*ISBN 92-64-00826-8* *Price: € 70, US$ 91, £ 47, ¥ 9 400.*

## Nuclear Safety and Regulation

**CSNI Technical Opinion Papers – Nos. 7-8**
Living PSA and its Use in the Nuclear Safety Decision-making Process;
Development and Use of Risk Monitors at Nuclear Power Plants
*ISBN 92-64-01047-5* *Free: paper or web.*

**Joint CSNI / CNRA Strategic Plan and Mandates – 2005-2009**
*ISBN 92-64-01060-2* *Free: paper or web.*

**Review of the Role, Activities and Working Methods of the CNRA**
Committee on Nuclear Regulatory Activities (CNRA)
*ISBN 92-64-01062-9* *Free: paper or web.*

**Review of the Role, Activities and Working Methods of the CSNI**
Committee on the Safety of Nuclear Installations (CSNI)
*ISBN 92-64-01072-6* *Free: paper or web.*

**Safety of the Nuclear Fuel Cycle (The)**
*ISBN 92-64-01421-7* *Price: € 70, US$ 88, £ 48, ¥ 9 600.*

**Nuclear Regulatory Decision Making**
*ISBN 92-64-01051-3* *Free: paper or web.*

## Radioactive Waste Management

**Achieving the Goals of the Decommissioning Safety Case**
A Status Report
*ISBN 92-64-01068-8* *Free: paper or web.*

**Clay Club Catalogue of Characteristics of Argillaceous Rocks**
*ISBN 92-64-01067-X* *Free: paper or web.*

**Engineered Barrier Systems (EBS) in the Context of the Entire Safety Case: Process Issues**
Workshop Proceedings, Las Vegas, United States, 14-17 September 2004
*ISBN 92-64-01313-X* *Price: € 40, US$ 50, £ 27, ¥ 5 500.*

**Geological Repositories: Political and Technical Progress**
Workshop Proceedings, Stockholm, Sweden, 8-10 December 2003
*ISBN 92-64-00830-6* *Price: € 55, US$ 72, £ 37, ¥ 7 400.*

**International Peer Reviews for Radioactive Waste Management**
General Information and Guidelines
*ISBN 92-64-01077-7* *Free: paper or web.*

**Management of Uncertainty in Safety Cases and the Role of Risk**
Workshop Proceedings, Stockholm, Sweden, 2-4 February 2004
*ISBN 92-64-00878-0* *Price: € 50, US$ 65, £ 34, ¥ 6 700.*

**NEA Sorption Project Phase II**
Interpretation and Prediction of Radionuclide Sorption onto Substrates Relevant for Radioactive Waste Disposal Using Thermodynamic Sorption Models
*ISBN 92-64-01206-0* *Price: € 70, US$ 88, £ 48, ¥ 9 600.*

**Radioactive Waste Management Programmes in OECD / NEA Member Countries**
*ISBN 92-64-01210-9* *Price: € 45, US$ 56, £ 31, ¥ 6 200.*

**Regulatory Function and Radioactive Waste Management (The)**
International Overview
*ISBN 92-64-01075-0* *Free: paper or web.*

**Stability and Buffering Capacity of the Geosphere for Long-term Isolation of Radioactive Waste**
Application to Argillaceous Media
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Seminar Proceedings, Aix-en-Provence, France, 9-11 March 2004
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**Shielding Aspects of Accelerators, Targets and Irradiation Facilities – SATIF 7**
Workshop Proceedings, Lisbon, Portugal, 17-18 May 2004
*ISBN 92-64-01042-4* *Price: € 70, US$ 91, £ 47, ¥ 9 400.*

**Utilisation and Reliability of High Power Proton Accelerators**
Workshop Proceedings, Daejeon, Republic of Korea, 16-19 May 2004
*ISBN 92-64-01380-6* *Price: € 120, US$ 150, £ 82, ¥ 16 400.*

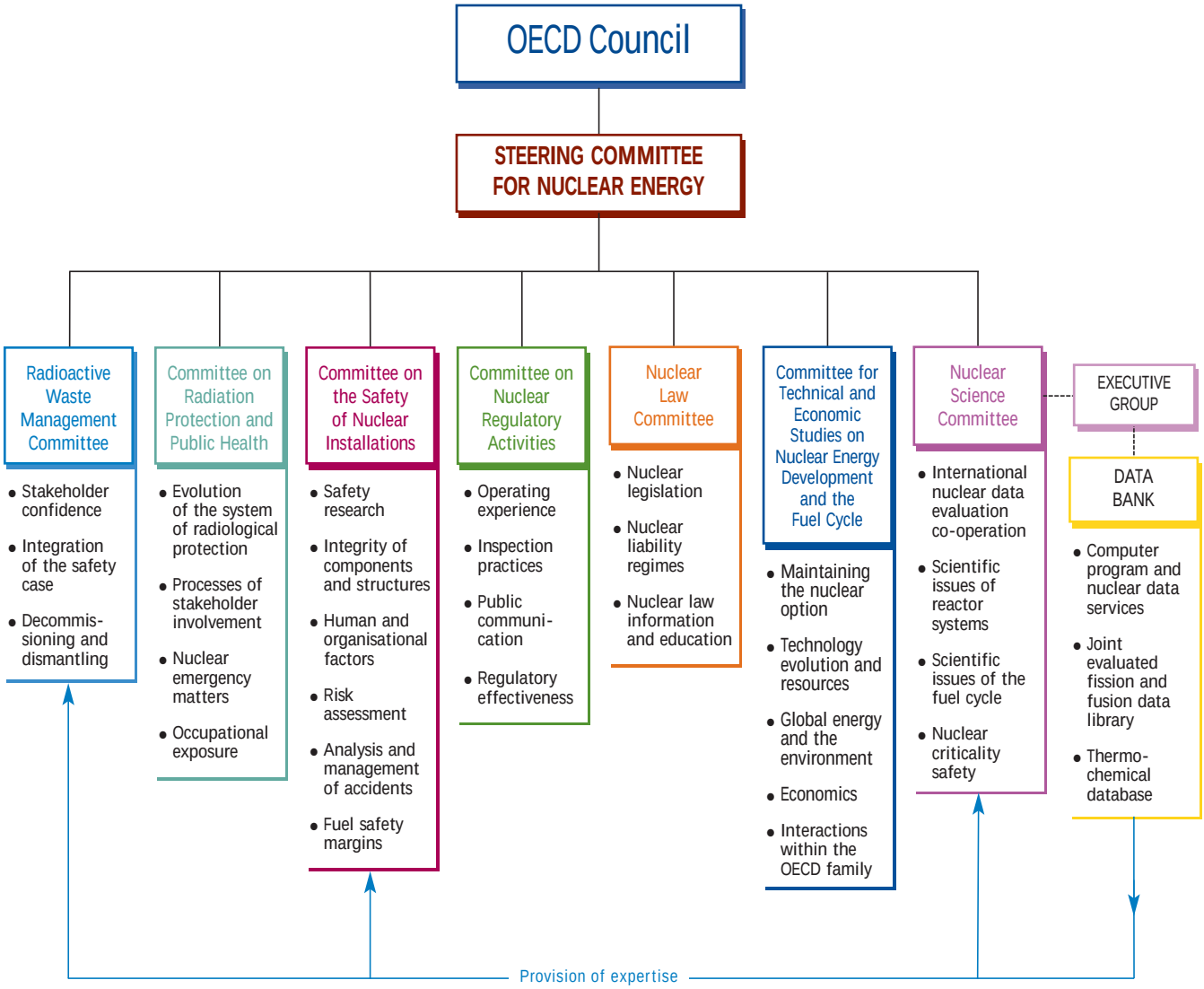
## Nuclear Law

**Nuclear Law Bulletin No. 75 (June 2005) and No. 76 (December 2005)**
*ISSN 0304-341X* *Price: € 90, US$ 103, £ 58, ¥ 12 200.*

**Supplement to the Nuclear Law Bulletin No. 75 (June 2005)**
Unofficial Consolidated Texts of the Paris and Brussels Supplementary Conventions as Amended
*ISBN 92-64-01214-1* *Price: € 24, US$ 29, £ 16, ¥ 3 200.*

**Supplement to the Nuclear Law Bulletin No. 76 (December 2005)**
Estonia – 2004 Radiation Act
*ISBN 92-64-03674-1* *Price: € 24, US$ 29, £ 16, ¥ 3 300.*

# Organisation Charts of the NEA



The Nuclear Energy Agency (NEA) is a semi-autonomous body of the Organisation for Economic Co-operation and Development. OECD member countries wishing to participate in the activities of the Agency must make a formal request to join. Of the 30 OECD member countries, 28 are members of the NEA:

| | | | |
|---|---|---|---|
| Australia | France | Japan | Slovak Republic |
| Austria | Germany | Luxembourg | Spain |
| Belgium | Greece | Mexico | Sweden |
| Canada | Hungary | Netherlands | Switzerland |
| Czech Republic | Iceland | Norway | Turkey |
| Denmark | Ireland | Portugal | United Kingdom |
| Finland | Italy | Republic of Korea | United States |

The NEA is governed by the Steering Committee for Nuclear Energy. This committee is primarily made up of senior officials from national atomic energy authorities and associated ministries. It oversees and shapes the work of the Agency to ensure its responsiveness to member countries' needs, notably in establishing the biennial programmes of work and budgets. It approves the mandates of the seven standing technical committees.

The current members of the Bureau of the Steering Committee for Nuclear Energy are:

Mr. Jussi MANNINEN (Finland), Chair

Ms. Sylvana GUINDON (Canada), Vice-Chair

Dr. Walter SANDTNER (Germany), Vice-Chair

Mr. Kenji SEYAMA (Japan), Vice-Chair

Dr. József RÓNAKY (Hungary), Vice-Chair

The standing technical committees are primarily composed of member country experts and technical specialists. These committees constitute a unique feature and important strength of the NEA, providing flexibility for adapting to new issues and helping to achieve consensus rapidly. Their main areas of work are listed in the chart.

The Steering Committee for Nuclear Energy and the Agency's seven standing technical committees are serviced by the NEA Secretariat, composed in 2005 of 69 professional and support staff from 18 countries. Professional staff are often specialists from national administrations and research institutes, bringing their experience to the Agency for two to five years on average.

# NEA Secretariat Structure in 2005

Director-General
**Luis Echávarri**

Deputy Director-General
**Gail Marcus**

Safety and Regulation
**Takanori Tanaka**
*Deputy Director*

Science and Development
**Thierry Dujardin**
*Deputy Director*

Central Secretariat, External Relations, Public Affairs
**Karen Daifuku**
*Head*

Legal Affairs
**Julia Schwartz**
*Head*

Management Support Unit
**John Hembury**
*Head*

Radiation Protection and Radioactive Waste Management
**Hans Riotte**
*Head of Division*

Nuclear Safety
**Javier Reig**
*Head of Division*

Nuclear Development
**Stan Gordelier**
*Head of Division*

Nuclear Science and Data Bank
**Claes Nordborg**
*Head of Section*

# Main Workshops and Seminars Held in 2005

### January

26-28 Licensees' Nuclear Safety Management and the Effectiveness of Inspections, Tokyo, Japan

### February

16-18 Advanced Reactors With Innovative Fuels (ARWIF-2005), Oak Ridge, Tennessee, USA

### May

18-20 Second International Workshop on the Indemnification of Nuclear Damage, Bratislava, Slovak Republic

23-26 Fire Probabilistic Safety Assessment, Puerto Vallarta, Mexico

24 Security of Energy Supply for Electricity Generation, Paris, France

### June

14-15 NEA Safety and Regulation Forum on Multilateral Co-operation in Nuclear Safety Research and Regulation, Paris, France

### July

2 Stakeholder Involvement in Radiation Protection, Tokyo, Japan

### August

24-26 Integration of Engineered Barrier Systems (EBS) in the Safety Case – The Role of Modelling, La Coruña, Spain

### September

20-22 Linkage of Geoscientific Arguments and Evidence in Supporting the Safety Case, Toronto, Canada

### October

3-5 Better Nuclear Plant Maintenance: Improving Human and Organisational Performance, Ottawa, Ontario, Canada

5-7 Nuclear Production of Hydrogen, Oarai, Japan

### November

7-9 Evaluation of Uncertainties in Relation to Severe Accidents and Level-2 Probabilistic Safety Analysis, Cadarache, France

21-23 Workshop of the NEA Forum on Stakeholder Confidence (FSC) – Co-ordination of Decision Making in Spain, Hospitalet, Spain

## ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where the governments of 30 democracies work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The Commission of the European Communities takes part in the work of the OECD.

OECD Publishing disseminates widely the results of the Organisation's statistics gathering and research on economic, social and environmental issues, as well as the conventions, guidelines and standards agreed by its members.

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## 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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