NEA

Annual Report

2008

NUCLEAR ENERGY AGENCY

Organisation for Economic Co-operation and Development

The NEA in Brief

Governing body:
the Steering Committee for Nuclear Energy

28	members countries (22 in the Data Bank)
50	years of international service
7	standing technical committees
21	international joint projects funded by participants
65	professional and support staff (NEA and the Data Bank combined)
500	national experts participating in NEA committees
3 600	experts participating annually, on average, in policy and technical meetings organised at OECD headquarters
€ 10.4	million budget for the NEA in 2008, supplemented by voluntary contributions
€ 3.0	million budget for the Data Bank in 2008, supplemented by voluntary contributions
51	publications produced in 2008

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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Message from the Director-General

In 2008, the OECD Nuclear Energy Agency (NEA) celebrated its 50th anniversary of international co-operation in the field of nuclear energy. We have all come a very long way since Fermi's reactor. The number of countries using nuclear power has increased significantly, from a very restricted handful in the 1950s to 30 countries at present, and new entrants in perspective. The industry has evolved, grown and benefited from decades of experience. The NEA has accompanied this evolution in the nuclear sector every step of the way, helping its member countries to ensure the safe, economical and environmentally friendly use of nuclear energy for peaceful purposes.

The contribution of the NEA to international co-operation and research in the field and the considerable value of its work to member countries were clearly reflected at the NEA 50th Anniversary High-level Session organised in October 2008. Over 350 policy makers and nuclear energy specialists attended the high-level session chaired by the OECD Secretary-General, Mr. Ángel Gurría, and co-chaired by Mr. Richard J.K. Stratford, Chair of the OECD Steering Committee for Nuclear Energy. Dr. Mohamed ElBaradei, Nobel Peace Prize laureate and IAEA Director-General, was the keynote speaker. Ministers and other high-level officials emphasized the essential role played by the Agency over the years and praised the professionalism and high quality of its work (a selection of the views expressed can be found on pages 10-11). In summary, member countries have come to know that they can count on the NEA to provide independent, leading-edge analyses in the most cost-effective way, providing substantial added value for the investments made.

On the eve of what is set to become a major renewal of nuclear energy development, the role of the NEA is all the more crucial. According to the projections made in the Agency's first-ever *Nuclear Energy Outlook*, largely corroborated by estimates from other major sources, the world's fleet of nuclear power reactors will expand by as little as 55% and as much as 375% between now and 2050. In the context of such an expansion, but also increasing concerns about climate change, security of supply and the costs of energy supply, in markets facing increasing competition and pressure for resources, the work of the Nuclear Energy Agency is key. It offers a forum for member countries to pool their resources and to obtain the best economic, scientific and legal analyses in support of their energy policy decision making. It also fosters the sharing of best practice and experience so that nuclear facilities around the world are among the safest and least polluting energy solutions available for base-load electricity production at affordable prices.

The NEA is proud to have provided valuable service to its member countries for the past 50 years, and looks forward to continuing to do so in the very dynamic environment of the years ahead.

Luis E. Echávarri
NEA Director-General

Nuclear Power in 2008

Nuclear energy development

At the end of 2008, a total of 345 reactors were connected to the grid in OECD countries, constituting about 83% of the world's total nuclear electricity generating capacity and about 22% of the total electricity supply in the OECD area. During 2008, no new reactors were connected to OECD country grids, one was shut down (the Bohunice-2 reactor in the Slovak Republic was closed on 31 December 2008 as a condition to the country's accession to the European Union) and the first concrete was poured for two reactors under construction in the Republic of Korea.

Nuclear energy policies vary widely in OECD countries, and range from official moratoria or phase-out policies (e.g. Austria, Belgium, Germany and Spain) to clear commitments to maintain nuclear power as a significant component of the energy mix (e.g. France, Japan and the Republic of Korea). Nuclear power's ability to enhance security of energy supply and to provide competitively priced, base-load electricity that is essentially free of greenhouse gas emissions led, in 2008, to several developments to either replace soon-to-be-retired capacity or to increase nuclear generating capacity in several OECD countries:

- In Canada, the Government of Ontario launched a competitive procurement process to select a preferred supplier of two new reactors. Bruce Power launched an environmental assessment (EA) of a plan to build two reactors at the Nanticoke site in Ontario, and work on the company's EA of a proposal to add four reactors to the existing Bruce site continued. Hydro-Quebec announced that it would refurbish the province's sole reactor (Gentilly-2) to extend the reactor's operating life to near 2040. A feasibility study in Saskatchewan concluded that 1 000 MWe of nuclear generating capacity could contribute to the province's energy mix by 2020.
- In Finland, the national government approved a new climate and energy strategy that gives priority to the construction of electricity generating capacity with low carbon emissions, but limits new nuclear capacity to that required for domestic purposes only. By November 2008, environmental impact assessment reports of plans for three new reactor construction projects had been submitted. Construction of the Olkiluoto-3 European pressurised water reactor (EPR) continues, but the completion date has been pushed back to 2012.
- In France, construction of the Flamanville-3 EPR in the Basse-Normandie region continues and the President of France announced Penly as the site for a new EPR construction project.
- In Italy, the newly elected national government announced an energy plan that includes a return to nuclear energy, and introduced legislation to overturn the existing moratorium.
- In the Republic of Korea, the national government announced a new "National Energy Basic Plan" calling for an increase in nuclear generating capacity to about 60% of the country's total electricity generation by 2030; to do so requires the commissioning of 10-12 new nuclear power plants in addition to the 8 units that are already planned or under construction.
- In the Slovak Republic, a project was launched to complete the construction of two reactors at the Mochovce power plant, halted in 1992. The Czech power company CEZ was selected to form a partnership to build an additional nuclear power source at the existing Bohunice site.
- In Switzerland, the Atel energy group submitted plans to the government to build a new nuclear power plant near the existing Goesgen station, and it was confirmed that the Axpo Group and BKW FMB Energy would be submitting applications to build two new reactors at the existing sites of Beznau and Muhleberg.
- In Turkey, the national government called for bids to build the country's first nuclear power plant (total capacity of

2008 Nuclear Data Summary (as of 31 December 2008)

	Operational reactors	Installed capacity (GWe net)	Uranium requirements (tonnes U)	Nuclear share of electricity production (%)
Belgium	7	5.8	1 030	53.8
Canada	20	12.7	1 900	14.5
Czech Republic	6	3.6	637	32.4
Finland	4	2.7	460	29.9
France	59	63.3	8 150	76.2
Germany*	17	20.4	3 400	23.2
Hungary	4	1.9	422	37.7
Japan*	55	47.5	5 792	25.6
Mexico	2	1.4	161	4.0
Netherlands	1	0.5	60	4.0 *
Republic of Korea*	20	17.0	3 200	35.2
Slovak Republic	4	1.7	380	54.9 *
Spain	8	7.5	1 513	18.3
Sweden	10	9.2	1 574	42.0
Switzerland*	5	3.2	318	39.9
United Kingdom	19	11.0	951	13.2
United States	104	100.6	16 424	19.7
Total (OECD)	345	310.0	46 372	21.6 *

* 2007 data. Operational = connected to grid.

about 4 000 MWe) and is evaluating the sole bid received from Atomstroyexport of the Russian Federation.

- In the United Kingdom, the national government continued to express support for the construction of new reactors by private industry. Électricité de France made a (successful as of 9 January 2009) bid to acquire British Energy, committing to build four new nuclear reactors in the United Kingdom.
- In the United States, the Department of Energy announced that it had received loan guarantee applications from 17 utilities, reflecting intentions to build a total of 21 new nuclear reactors at 17 different facilities. The Nuclear Regulatory Commission (NRC) received 17 Combined Construction and Operating License (COL) applications for a total of up to 26 potential new reactors, and approved 10 power uprates amounting to an addition of 726 MWe of capacity to the US fleet.

As governments continue to develop these and other nuclear energy initiatives, the ongoing global financial crisis threatens to at least delay some of them due to credit shortages and concern about potential financial risks.

In non-OECD countries, no new units were commissioned in 2008, but the construction of eight reactors (six in China and two in the Russian Federation) was initiated in support of plans for a robust expansion of nuclear electricity generating capacity in these two countries. India and South Africa have also expressed similar ambitions. The completion of a nuclear safeguards agreement with the International Atomic Energy Agency and a decision by the Nuclear Suppliers Group to approve nuclear trade with India brought the country closer to realising these plans. In contrast, South Africa postponed the selection of a successful bidder in its tender to build new nuclear generating capacity, citing concerns about the magnitude of the investment. Elsewhere, Bulgaria and Romania formed joint venture partnerships to increase nuclear generating capacity in their countries, and consideration to either increase existing capacity or introduce nuclear energy continues in a number of other non-OECD countries, including Argentina, Brazil, Indonesia, Jordan, Kazakhstan, Lithuania, some Persian Gulf States and Vietnam.

Uranium production, conversion and enrichment

Preliminary data indicate that in 2008 uranium was produced in seven OECD countries, three of which (France, Germany and Hungary) contributed only small amounts as part of mine remediation activities. Australia (19%), Canada (20%) and the United States (3%) together accounted for a significant share of world production. Production in OECD countries amounted to approximately 19 350 tonnes of uranium (tU) in 2008 (a decrease of almost 4% from 2007) accounting for roughly 40% of uranium requirements in the OECD area. Remaining requirements were met by imports and secondary sources (material derived from dismantling warheads, excess commercial inventories and reprocessed uranium).

Beginning in 2001, the spot price of uranium began to rise from historic lows of about USD 18/kgU to levels not seen since the 1980s, reaching a peak of USD 354/kgU in June 2007. By early 2008, the spot price had declined to USD 235/kgU and continued a general decline throughout the year, retreating to about USD 138/kgU in December 2008. The price decline in the latter half of 2008 is thought to be at least in part the result of the global financial crisis as some investors were forced to sell uranium holdings in order to raise capital. However, despite the recent decline, uranium spot prices remain several times higher than prices in the 1990s owing to increased demand combined with reduced inventories. In response to higher prices, uranium exploration and mine development activity has increased substantially. However, the unfolding global financial crisis has already caused some uranium mine development projects to be delayed.

During 2008, uranium conversion facilities continued to operate in Canada, France, the United Kingdom and the United States, while construction of additional capacity continued in France. Cameco and Kazatomprom announced the creation of a joint venture partnership and the initiation of the first stage of a feasibility study to assess plans to build a 12 000 tonnes/year conversion facility in Kazakhstan. In late 2008, Cameco announced that it had suspended production at its plant in Canada until mid-2009 owing to a contract dispute with its sole supplier of hydrofluoric acid.

In terms of uranium enrichment, construction moved ahead on schedule at two new centrifuge plants using URENCO technology: AREVA's Georges Besse II facility in France, where development was accelerated in 2008, and Louisiana Energy Services' National Enrichment Facility (NEF) in the United States, where a second phase of development is due to double capacity by 2015. Elsewhere in the United States, the US Enrichment Corporation continued development of its new plant using the American centrifuge design; AREVA filed an application with the NRC to build and operate a centrifuge facility in Idaho using URENCO technology; and GE-Hitachi Global Laser Enrichment development continued as an NRC licence for the construction of a test loop facility was obtained and Cameco purchased a 24% stake in the company. In 2008, China signed an agreement with the Russian Federation to increase capacity of its domestic centrifuge enrichment facilities.

Nuclear safety and regulation

In 2008, the safety performance of nuclear power plants in OECD countries remained at a very high level, as in previous years. The main elements supporting this achievement are a mature industry, a robust regulatory system and a strong foundation of research. The number of nuclear power plants reaching their initial design life is increasing and licence renewal continues to be an approach adopted by many OECD countries. The NEA continues to support regulatory authorities in their review of the adequacy of plant ageing management methods.

At the same time, several countries are licensing new reactors and OECD countries are promoting several initiatives, including the establishment of multinational programmes, to improve the efficiency of the design review of new nuclear power plants, and to share experience related to the regulation of new reactors. The initiatives seek to enhance nuclear safety worldwide, by promoting convergence on safety practices and by combining the expertise of participating regulatory authorities, while improving and expediting the safety review of new designs.

Overall, the general consensus remains that safety assessment and 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. Nuclear regulatory authorities and nuclear safety research institutions also continue to review operating experience feedback and to implement appropriate and timely corrective action programmes.

Radioactive waste management

With the US Department of Energy's application for a construction licence, the world's most substantial geological repository project for high-level, heat-generating radioactive waste and spent nuclear fuel at Yucca Mountain, Nevada, entered a decisive new phase. The licensing authority, the NRC, has a three-year period, starting in September 2008 and with a possible one-year extension set by the US Congress, to decide whether to grant a construction authorisation for the repository. It is expected that multiple hearings regarding the Yucca Mountain application will be organised by the NRC's Atomic Safety and Licensing Board as part of the licensing procedure. The start of the review was marked by the release of a new radiation standard for Yucca Mountain by the Environmental Protection Agency (EPA) that also established a dose limit for the time period beyond 10 000 and up to 1 million years to be consistent with recommendations of the National Academy of Sciences (NAS).

In spite of this very positive development, the planned schedule for a construction licence for the repository still faces some uncertainties due to possible funding problems and legal challenges for the licensing review. In addition, policy decisions on the future development of nuclear energy in the United States and the required repository capacity may lead to project delays.

The procedures and decisions to identify appropriate sites for radioactive waste disposal continue to be high priorities for national programmes. At a procedural level, the waste agencies in Canada and in the United Kingdom launched public consultation processes. The Canadian effort aims to design a process for identifying and selecting an informed and willing community to host a deep geological repository. The UK consultation will establish a framework for public and stakeholder engagement in geological disposal. The UK Government also issued a white paper inviting local communities to express interest in discussions on hosting a geological repository.

Several other programmes took important steps towards siting disposal facilities. The Swiss national waste agency Nagra announced three geographical areas in which further investigation into geological disposal of high-level waste will be focused, and three additional areas which may be suitable to host geological repositories for low- and intermediate-level waste. The selection of these areas was based so far solely on scientific-technical criteria; a final site decision is expected in about ten years and will involve the local population, municipalities and cantons in a transparent procedure.

In France, the French national radioactive waste agency Andra issued a call in June for volunteer communities to identify suitable candidate sites for the implementation of a disposal facility for graphite and radium-bearing waste stemming from graphite-moderated, gas-cooled reactors and from the rehabilitation of industrial sites contaminated with radium. Andra will select a short list of two or three sites for further studies. The final objective is to select a suitable site by the end of 2010, with a view to submitting the application for the implementation licence of the disposal facility by the end of 2013 and to commissioning the actual facility in 2019.

Radiological protection

With the approval of the new International Commission on Radiological Protection (ICRP) general recommendations (ICRP publication 103), the radiological protection community is now turning towards its implementation. It should be noted that recommendations on public and worker dose limits have not changed, and that the three fundamental ICRP principles (justification of exposure-causing activities and of protective actions; optimisation of protection; and limitation of exposures) also remain. The key change in the new recommendations is, however, its emphasis on the optimisation of protection in all exposure situations, be they planned, emergency or existing situations. This new focus stresses the importance of the prevailing circumstances of the exposure situation, and of the process followed in order to identify and to implement the protective actions. It also stresses the judgemental nature of radiological protection decision making, and the need for transparency in optimisation and decision processes. In general, this new approach reflects an extension of the successful use of ALARA (as low as reasonably achievable) in reducing exposures from planned situations to the public and workers, to also address exposures caused by nuclear or radiological emergencies (such as at a nuclear power plant or industrial facility) and in existing situations (for example exposure from radon in dwellings or from post-accident, long-term residual contamination).

The new approach promotes flexibility in designing and implementing radiological protection, but at the same time somewhat complicates decisions in that numerical standards, either national or international, may be taken more as a starting point for discussions rather than as predetermined end points. Implementation of a "modern" approach to radiological protection is now being developed in the form of new international Basic Safety Standards (BSS) to replace the 1996 version issued by the International Atomic Energy Agency (IAEA) and co-sponsored by the OECD Nuclear Energy Agency (NEA), the International Labour Organisation (ILO), the World Health Organisation (WHO), the Pan-American Health Organisation (PAHO) and the Food and Agriculture Organisation (FAO). The new version seeks to expand the standards, and hopes to include the European Commission (EC) and the UN Environment Programme (UNEP) as co-sponsors. Significant progress was made on the draft text for the new BSS during 2008, moving towards incorporating the new philosophy of the ICRP, experience from the implementation of the 1996 BSS, and bringing the document more in line with the current IAEA Safety Series documents and structure. However, several key issues remain to be resolved before the new BSS can be approved by IAEA member states, and subsequently by the constituencies of the other co-sponsoring organisations. First, the identification of what are truly the "basic" requirements is under way, as is the discussion of how detailed the expression of necessary requirements should be. The detail with which the new

BSS follows the new ICRP recommendations is also under discussion. These issues reflect the complexity posed by the previously mentioned trend of flexibility that comes with the new focus on judgemental optimisation of protection.

Another trend that emerged strongly in 2008 was renewed regulatory focus on radiological protection in the areas of medical exposures and domestic exposure to radon. Average annual medical exposure has, for the first time in several countries, exceeded average annual exposure to natural radiation. This trend, broadly resulting from significant increases in the use of CT scans and other radiological imaging techniques, has been accompanied by discoveries of medical over-exposure cases in some countries that suggest a need to improve the optimisation of radiological protection. However, while the radiological protection community tends to view these increases with some concern, the medical community tends to consider them as generally beneficial in terms of the medically valuable information provided by the images obtained. As such, the regulatory challenge is to define, with both the medical and radiological protection communities, a path forward to ensure public protection. As regards domestic radon, the renewed focus is not due to increases in exposures, but rather due to new epidemiological studies that suggest a statistically significant incidence of lung cancers at radon concentrations that are lower than most international, and some national, recommended action levels. While the risk of radon-induced lung cancer estimated in these studies is consistent with previous understanding, the level at which statistically significant effects are being noted, in smokers and non-smokers, has pushed the regulatory community to reconsider its approach to protection.

Nuclear science

The trends observed in recent years in the area of nuclear science continue to prevail. For example, the development of advanced nuclear fission reactors depends to a large extent on the availability of advanced structural materials, as well as suitable nuclear fuel, which have to withstand severe conditions, such as high temperatures, intense neutron irradiation and, in some cases, strongly corrosive environments. Since experimental studies of irradiation effects in materials are very expensive, requiring dedicated, long-term experiments in research reactors, it is important to develop a sound theoretical approach to help understand material behaviour on a long-term basis. Important efforts are therefore being pursued to develop numerical tools to model, for example, irradiation effects in structural materials and fuels.

Another important issue in the development of advanced reactor systems is the availability of well-documented experimental information to help assess new concepts. To this end, a number of efforts to preserve information from previously performed experiments in a suitable and easily accessible form have been undertaken, covering many different subject areas, such as reactor physics, nuclear criticality, fuel behaviour and radiation shielding.

Methodologies have been established and/or are being developed in many countries to quantify computational biases and their associated uncertainties when performing benchmark exercises to validate different reactor parameters. To assist this process, nuclear data library producers are making efforts to include uncertainty information in their data libraries, especially for the minor actinides, which are less well known and of importance when considering transmuting these elements in fast reactors or accelerator-driven systems (ADS). These efforts to propagate uncertainty information throughout the calculations are driven by a need to obtain a better estimation of safety margins, for example, as a better understanding of and confidence in these margins could have a significant economic impact.

Nuclear law

Harmonising legislation governing the peaceful uses of nuclear energy and minimising legal impediments to the safe use of nuclear energy will lead to better understanding, appreciation and confidence among countries in the use of this technology. One of the primary aims of the legal community in this regard is to ensure 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 continue working to implement the provisions of these protocols in their national legislation. Several of these countries are searching for solutions to overcome nuclear operators' inability to obtain private insurance coverage for certain third party liability risks that they are legally obliged to assume under these conventions. By ratifying the 1997 Convention on Supplementary Compensation for Nuclear Damage (CSC), the United States became a contracting party to one of the international nuclear liability conventions. Several other countries that have not yet joined the international nuclear liability regime prepared new national legislation that is based on its principles, such as Canada and Japan. The European Commission assessed the impact of different nuclear liability regimes in Europe to determine whether a uniform EU regime on nuclear third party liability is both feasible and desirable. Currently 13 EU member countries (Belgium, Denmark, Finland, France, Germany, Greece, Italy, the Netherlands, Portugal, Slovenia, Spain, Sweden and the United Kingdom) are party to the 1960 Paris Convention, 9 EU member countries (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania and the Slovak Republic) are party to the 1963 Vienna Convention, with one of them (Latvia) also being party to the 1997 Vienna Convention, whereas 5 EU member countries (Austria, Cyprus, Ireland, Luxembourg and Malta) as well as the European Community itself do not belong to any convention.

Many countries that are considering launching a nuclear power programme have begun preparing a legal and regulatory framework. In this regard, Turkey has adopted key legislation on the construction and operation of nuclear power plants and updated the existing set of national nuclear safety regulations.

Other key issues in the development of nuclear law concern the impact of international conventions outside the nuclear field on nuclear activities; ensuring that small training and research reactors as well as nuclear installations that are being decommissioned are not subject to an overly burdensome liability and compensation regime; identifying legal and economic factors that may impact nuclear emergency decision making; and assisting selected countries in adopting domestic nuclear legislation based upon internationally accepted principles.

The NEA 50th Anniversary

The NEA celebrated its 50th anniversary on 16 October 2008 in the presence of over 350 policy makers and nuclear energy specialists at a high-level session on nuclear energy chaired by the OECD Secretary-General, Mr. Ángel Gurría, and co-chaired by Mr. Richard J.K. Stratford, Chair of the OECD Steering Committee for Nuclear Energy. This event was an occasion to showcase the main accomplishments of the Agency over its 50-year history. It also provided an opportunity to envisage the future, both in terms of the development of nuclear energy and the challenges that lay ahead for the Agency. Secretary-General Gurría underlined the need for member countries to work together to build common understandings, shared visions and globally accepted concepts and measures that allow us to have a clearer picture of nuclear energy's advantages and drawbacks, but also to make nuclear energy more reliable. He added that the role of the NEA in supporting the scientific and technical development of promising nuclear reactor and fuel cycle technologies, and in favouring a safe, environmentally friendly and economical use of nuclear energy, has become strategic.

In his keynote address, the IAEA Director-General, Dr. Mohamed ElBaradei, stated that the work of the IAEA and the NEA is complementary in nuclear safety, energy and related fields. Both agencies have been successful in ensuring co-ordination and avoiding unnecessary duplication. The IAEA can also act as a multiplier by sharing OECD knowledge with the IAEA membership. There are many examples of effective areas of co-operation, including on nuclear data and the transfer of knowledge, technology development and not least, safety.

The NEA Director-General, Mr. Luis Echávarri, provided a brief overview of the Agency's 50 years: from the beginnings of international co-operation in nuclear energy, to vast and rapid development of nuclear power plants and facilities, through the "winter years" where it was mostly only a question of "keeping the option open" and now a spring revival. He noted that throughout this time, the Agency has proved to be a flexible organisation, always capable of adapting to the challenges of the day. He commended the dedication of NEA staff, which has been fundamental to the NEA's success. He also stressed that without the contributions of the member countries that provide their best experts in the NEA standing technical committees and expert groups, the Agency would not be what it is today.

In the ministerial segment, distinguished speakers emphasized the recent changes in the nuclear energy sector as well as prospects for nuclear growth, and expressed continued support for the Agency's work. It was followed by a round table on the challenges of new nuclear build, bringing together CEOs from nuclear vendors and senior nuclear regulators. The common message was the need to establish and/or strengthen partnerships between the major stakeholders, government, regulators, vendors and utilities, as such synergies are an essential key to success.

What they are saying about the NEA:

Dr. Mohamed ElBaradei, *Director-General, International Atomic Energy Agency*

"...I am confident that co-operation between the IAEA and the NEA will remain excellent and will continue to grow in the next 50 years."

Spain: Mr. Miguel Sebastián Gascón, *Minister for Industry, Tourism and Trade*

"...the NEA provides a worthy stock of technical and economic studies on practically all nuclear energy related issues... as a centre of excellence, NEA plays a key role in benchmarking, facilitating the exchange of experience, technical expertise and scientific knowledge."

Italy: Mr. Claudio Scajola, *Minister for Economic Development*

"The Nuclear Energy Agency plays a fundamental and irreplaceable role in promoting collaboration among our countries."

Slovak Republic: Mr. Ľubomír Jahnátek, *Minister of Economy*

"The expertise available at the Nuclear Energy Agency is considered by the relevant Slovak authorities to be an essential part of our international co-operation, and an essential measure of consensus building that supports the national decision-making process. ...the future of the Agency should be marked by continued high professionalism, independence and accountability which will lead to effective, impartial and highly professional results in its activities."

France: Mr. Pierre-Franck Chevet, *Director-General for Energy and Climate, Ministry for Ecology, Energy, Sustainable Development and Town and Country Planning (Regional Development)*

"For its part, France is pleased to host on its territory the OECD Nuclear Energy Agency whose quality of work is recognised worldwide..."

United States: Mr. Dennis R. Spurgeon, *Assistant Secretary for Nuclear Energy*

"The NEA now plays a key role in the global expansion of nuclear power."

Japan: Dr. Shunichi Tanaka, *Vice-Chairman, Atomic Energy Commission*

"Japan expects the NEA to further enhance and develop its efforts that are indispensable for realising the sustainable utilisation of nuclear power, through specialised technological deliberations at its various committees and through improving and developing its Data Bank services."

Czech Republic: Mr. Tomáš Hüner, *Vice-Minister for Industry and Trade*

"The Czech Republic thinks very highly of the contributions of the OECD Nuclear Energy Agency and considers it an honour to be a member."

Mr. Nobuo Tanaka, *Executive Director, International Energy Agency (IEA)*

"Though the world may look very different to what it did in 1958 when the NEA was created, rising global energy demand, increased prices and growing pressure to address climate change make the mission of the NEA as important today as when the Agency was created by the Organisation for European Economic Co-operation fifty years ago."

Mr. Richard J.K. Stratford, *Chair, OECD Steering Committee for Nuclear Energy*

"If the NEA did not exist today, countries with nuclear power would be looking for ways to create something like it. [...] With the right support, the Agency can help ensure that the 'expansion phase' of nuclear energy in the years ahead is the safest, most reliable and most successful phase in nuclear energy's history."

The NEA website contains a full record of the anniversary event including speeches and video recordings: www.nea.fr/html/general/50th/index.html.

The NEA's 50th anniversary commemorative brochure, a 45-page historical review of the Agency, is also available on the NEA website at www.nea.fr/html/general/reports/nea6365-50th-historical.pdf.

The NEA *Nuclear Energy Outlook*

As part of its 50th anniversary celebrations, the NEA launched its first *Nuclear Energy Outlook* (NEO). It responds to the changing dynamics and renewed interest in nuclear energy and arrives at a moment when energy security, climate change and the cost of energy have become priorities in both short-term and long-term energy policies.

Using the most current data and statistics available, the 460-page NEO provides projections up to 2050 to consider growth scenarios and potential implications on the future use of nuclear energy. It also offers unique analyses and recommendations on the possible challenges that lie ahead.

Topics covered by the NEO include:

- nuclear power's current status and projected trends;
- environmental impacts;
- uranium resources and security of supply;
- costs;
- safety and regulation;
- radioactive waste management and decommissioning;
- non-proliferation and security;
- legal frameworks;
- infrastructure;
- stakeholder engagement;
- advanced reactors and advanced fuel cycles.

The NEO, which represents a major Agency-wide effort, has been published in English, French and Japanese.

NEO Executive Summaries can be downloaded free of charge in Chinese, English, French, German, Hungarian, Italian, Japanese, Korean, Russian and Spanish from the NEA website at www.nea.fr/neo/index.html. Paper copies are also being provided on request (roughly 4 500 thus far) to support enhanced knowledge and understanding of the nuclear energy option.

Technical Programmes

European Communities

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 renewed interest in nuclear technology and sustained government interest in ensuring long-term security of energy supply, reducing greenhouse gas emissions and fostering sustainable development of energy production.

Highlights

- A study on *Market Competition in the Nuclear Industry* was published. The study examines competition in the major nuclear industry sectors, how this has changed, and how it may evolve with a significant upturn in demand.
- A publication on the *Timing of High-level Waste Disposal* was issued. It identifies key factors influencing national strategies and impacting their implementation.
- The 22nd edition of *Uranium: Resources, Production and Demand* was published in June. It shows that there are sufficient resources to fuel nuclear power plants for roughly a century and potentially more, and that recent price increases have led to a significantly greater exploration for additional reserves. A key issue is to bring identified resources into timely production.

Nuclear policy issues

Nuclear energy continues to attract keen interest from policy makers seeking to enhance security of energy supply, reduce fossil fuel dependency and produce sufficient amounts of electricity at competitive costs without emitting carbon-dioxide at plant level. These and other issues were treated comprehensively in the Agency's first-ever *Nuclear Energy Outlook* (NEO) that was released on the 50th anniversary of the NEA in October 2008 (see page 11 for further details).

Security of supply is a cornerstone of energy policy and has become more prominent as tensions increase in the oil and gas markets. The role of nuclear energy in enhancing national security of supply has been recognised by several OECD governments, but little analytical work is available on methods to quantitatively assess its contribution. The objective of the NDC study on this topic is to identify relevant quantitative approaches for measuring nuclear energy's contribution to security of supply and to provide decision makers with information to support electricity generation choices. An expert group, including representatives from NEA member countries, the International Energy Agency (IEA), the International Atomic Energy Agency (IAEA), Foratom and the European Commission, has conducted the analysis and the final report is due to be published in 2009.

Given the renewed interest in recycling, the NDC undertook a study to examine transition scenarios from thermal to fast neutron reactors. The study was completed in late 2008 and the final report is to be published in 2009. To the extent that the once-through fuel cycle inevitably leads to an increase in the number of waste disposal sites required and to the inefficient use of uranium resources, such a transition is desirable. The study concludes *inter alia* that the successful implementation of a transition scenario requires long-term planning and stable energy policies, and that the technology choice should not rely solely on an analysis of the final end state, but also on the economic and socio-political aspects of the transition period. Moreover, since a transition cannot be achieved without adequate human resources, knowledge management cannot be overlooked, as well as consideration of proliferation-resistance and physical protection issues.

As radioactive waste disposal is frequently regarded as being uniquely difficult and one of the major drawbacks to nuclear energy production, the NDC launched the Radioactive Waste in Perspective project in 2006 to provide policy makers with a realistic perspective of the issue. An expert group with representatives from 12 countries, supported by the OECD Environment Directorate, has developed such a perspective by reviewing disposal methodologies used for a wide spectrum of solid hazardous wastes, including radioactive waste from civilian sources and wastes from power production (including gaseous effluents from coal-fired plants). The final report is expected to be published in 2009.

The study on the timing of high-level waste (HLW) disposal was completed in 2007 and its final report published in 2008. The study identifies key factors influencing the timing of HLW disposal and examines how social, technical, environmental and economic aspects impact national strategies. It underlines the importance of informing all stakeholders and involving them in the decision-making process for successfully implementing the strategies, and the need for clear, long-term commitment and support from governments towards the design and timely implementation of a national policy for waste disposal.

In order to ensure that nuclear energy issues are addressed on a level playing field with alternatives, the NEA continued its collaboration with other parts of the OECD, and in particular with the IEA. NEA staff members participated in the IEA in-depth energy policy reviews of the European Union, the Netherlands and Spain. NEA involvement brings expertise on

Shares of uranium resources and production

	Resources (%)*	Production (%)**	Production (tU)**
Australia	22.7	19	8 470
Canada	7.7	20	9 000
United States	6.2	3	1 500
Namibia	5.0	10	4 350
Niger	5.0	7	3 150
South Africa	8.0	1	500
Kazakhstan	14.9	19	8 520
Russian Federation	10.0	9	3 840
Uzbekistan	2.0	5	2 300
Ukraine	3.6	2	850
Others	14.9	5	1 750
Total	100.0	100	44 230

* Identified resources recoverable at less than USD 130/kgU (2007 data).
** 2008 estimates.

nuclear energy to the teams conducting the reviews, thus ensuring that they are as comprehensive as possible.

Economics

Recognising the growing importance of competitiveness in liberalised electricity markets, the NDC created a Working Party on Nuclear Energy Economics (WPNE). This new standing group of experts is to provide guidance to the NDC on key economic issues that could be investigated in an international perspective for the benefit of member countries. The WPNE has focused recent efforts on making arrangements for the next electricity generating costs (EGC) study, which will be the seventh in the series. An expert group, to be established in co-operation with the IEA, will aim to complete the study by the end of 2009.

The *Market Competition in the Nuclear Industry* study, published in 2008, uses ten market characteristics as broad indicators of competitiveness (including market shares of the participants), and spans the supply of goods, materials and services required for the design, engineering and construction of new nuclear plants, for the maintenance and upgrading of existing plants, and for the fuel cycle as a whole. The study concludes that, although enrichment and fuel fabrication are the most concentrated market sectors, there is no single company with an overwhelming dominance. Reprocessing, although over-concentrated, is a small, less developed market. Further details are provided in the study which recommends that efforts should be made by governments to maintain and, where possible increase, the level of competition in all nuclear market sectors.

A study on the financing of nuclear power plants was undertaken to identify key issues to be addressed by governments wishing to facilitate such financing. Three meetings of the expert group (composed of government and industry experts from seven member countries, the European Commission, the IAEA, the IEA and the World Nuclear Association) were held in 2008. The group's final report is expected to be published in 2009.

Data and resource assessment

In the context of anticipated growth in nuclear generating capacity, questions have been raised regarding the capacity of the natural resource base to support such growth. As a result, a project was initiated in 2006 to define raw material limitations which could arise from a hypothetical ten-fold expansion of global nuclear generating capacity. Such growth would increase the demand not only for nuclear fuel, but also for a number of natural resources required to support nuclear power plant construction, operation, decommissioning and the disposal (or reprocessing) of used nuclear fuel. The expert group formed for this study is currently finalising results, with a report due to be published in 2009. Preliminary findings indicate that uranium is the only raw material that could be in short supply, but that market forces should provide the means to produce sufficient uranium for the early stages of rapid growth. However, over time the amount of uranium required to fuel such a large fleet of reactors would likely require a transition to fast breeder reactors.

Detailed information on uranium resource data was provided by the Joint NEA/IAEA Uranium Group in its 2007 update of *Uranium: Resources, Production and Demand*, the "Red Book". Published in June 2008, the 2007 Red Book notes that recent increases in the spot market price for uranium have stimulated significant exploration and mine development activities, and have led to the identification of additional resources. It concludes that sufficient uranium resources exist for 100 years of consumption at current rates and that existing and planned production capability can produce sufficient uranium to meet even high case requirements to 2030. However, the long lead times needed to bring resources into production (often ten years or more) means that the potential remains for uranium supply shortfalls and continued upward pressure on prices, in particular if mine developments do not proceed as planned.

The annual 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 2008 edition offers projections to 2030 and country reports highlighting key events in the nuclear energy field.

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Nuclear Safety and Regulation

Highlights

- The CNRA established a working group on new reactors in response to the new projects under way or planned in several member countries. The working group will constitute an international forum for exchanging information and experience, and for ensuring improvements in nuclear safety through more effective and efficient regulation.
- In 2008, the CNRA and the CSNI organised several workshops, most notable were those on regulatory inspection practices; experiments and computational fluid dynamics (CFD) code application to nuclear reactor safety; lessons learnt from containment sump clogging; risk-informed, in-service inspection methodologies (RISMET); probabilistic seismic hazard assessment methodologies and applications; risk-informed piping integrity management; ageing management of thick-walled concrete structures; and justifying the suitability of nuclear licensee organisational structure, resources and competencies.

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, inspection practices and the regulation of new reactors.

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.

The Working Group on Operating Experience (WGOE) has focused its activities on follow-up by each member country of lessons learnt from important events. At the last meeting, three events were selected and the working group members reviewed their actions in response to these events. They also provided information on additional regulatory practices and methodologies being applied in the assessment and use of operating experience in order to define and to assess corrective measures in response to operational events.

The working group completed two reports, one on Safety Analysis of Fire Operating Experience, and another on National Operating Experience Feedback Programmes. Both reports were approved by the CNRA for publication.

Regulation of new reactors

A new Working Group on the Regulation of New Reactors (WGRNR) was established. The group has been mandated to address regulatory activities in the areas of siting, licensing and oversight of new commercial nuclear power reactors (Generation III+ and Generation IV).

Given that the sharing of information about the licensing process, construction experience and inspection practices will be helpful to all countries, a construction experience database is being developed. The aim is to collect inspection findings during the construction of new nuclear power plants as well as during major modifications of existing plants, and to share the lessons learnt.

An activity was also initiated on the regulation of site selection and preparation aimed at reviewing the various practices used by regulators in the regulation of nuclear power plant siting. A survey was issued covering different aspects of the regulation of nuclear sites, including seismicity issues, security issues, multi-unit questions and regulator practices on sites where mixed activities are taking place (e.g. operating units, new construction, decommissioning, etc.).

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.

An international workshop on inspection-related activities was held in June in Finland. Nuclear inspectors met with experts to discuss methods to improve inspection programmes and to address the training and qualification of inspectors, the integration of inspection findings and the inspection of new plants under construction. The proceedings were approved by the CNRA and are being finalised for

publication. The group also completed a report on inspection of fire protection programmes.

Nuclear regulators and public communication

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. The mandate of the Working Group on Public Communication of Nuclear Regulatory Organisations (WGPC) includes the preparation of reports addressing developments, tools, procedures and achievements in the area of nuclear regulatory communication with the public and stakeholders.

The group's main activity in 2008 consisted of issuing a report on the main outcomes of the three workshops held from 2000 to 2007, and of establishing an operating plan for its activities in the coming years. Future reports from the WGPC will address: the transparency of regulatory activities, local public information, the use of public perception surveys and communication in emergency situations.

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 accidents and their management, ageing and structural integrity, fuel safety, contributors to risk and human factors. The committee also facilitates the establishment of international joint research projects when useful.

Analysis and management of accidents

The activities of the Working Group on Analysis and Management of Accidents (WGAMA) have primarily focused on the thermal-hydraulics of the reactor coolant system; in-vessel behaviour of degraded cores; containment behaviour and protection; computational fluid dynamics (CFD); and fission product release, transport, deposition and retention. According to CSNI recommendations, in the future additional efforts will be made in other areas, notably as related to new and advanced reactors.

During 2008, further progress was made on the uncertainty and sensitivity evaluation of best-estimate methods (BEMUSE). Following an assessment based on calculations from an integral test, work continued on an analysis of a commercial nuclear power plant.

Activities in the area of CFD two-phase applications were completed in 2008. A pilot project to keep the CFD code assessment database up-to-date using a web-based portal started in 2008. The second workshop on validation and benchmarking of CFD codes for application to nuclear reactor safety was held in September, focusing on new experimental techniques and two-phase CFD applications.

Work continued on in-vessel behaviour of degraded cores; a report on predicting in-vessel accident progression (covering beyond-design-basis accident code capabilities) was completed. A state-of-the-art report on in-containment behaviour of aerosols was completed and is being published.

An activity on core exit temperature (CET) effectiveness in accident management was started. Discussions of the task group focused on a review of the design basis of CET application to accident management procedures in different countries and a review of relevant experimental results.

Regarding the transfer of knowledge to young engineers and scientists, two courses were organised in 2008: one on severe accidents, held in co-operation with the Severe Accident Research Network (SARNET) in Hungary in April, and one in the area of thermal-hydraulics, held in Italy in May.

During 2008, the CSNI requested that an experts meeting be held to discuss the technical content of a new project on fuel overheating of spent fuel assemblies in storage ponds, subsequent to water loss. The discussion was very fruitful and led to the establishment of a new joint project to be carried out by the USNRC at the Sandia National Laboratory in the United States, with 12 countries participating.

Ageing and structural integrity of reactor components

The main topics investigated in this area by the Working Group on Integrity of Components and Structures (IAGE) include the integrity of metal components, the integrity of concrete structures and the seismic behaviour of structures and components. The concept of risk-informed, in-service inspection (RI-ISI) has been successfully implemented in several NEA countries and is now, along with non-destructive testing qualification, providing improved in-service inspection, reducing both plant risks and inspection personnel's exposure to radiation.

Current activities in this area include a benchmark on risk-informed, in-service inspection methodologies (RISMET). During 2008, the final meeting of the RISMET project took place during which the main results and conclusions of the study were discussed. A synthesis report on the ageing of nuclear power plant concrete containment structures was issued. Work was also carried out on finalising the report on

the second phase of the Probabilistic Structural Integrity of a PWR Reactor Pressure Vessel Benchmark (PROSIR).

In addition, a workshop was held in April in France on recent findings and developments in probabilistic seismic hazard assessment methodologies and applications. To discuss the final results of RISMET and the applications and uses of the Piping Failure Data Exchange (OPDE) database, a workshop was organised in conjunction with the EC Joint Research Centre (JRC) in June in Spain on risk-informed piping integrity management. A workshop was also organised in October in the Czech Republic to review the state of the art on ageing management of thick-walled concrete structures, including in-service inspection, maintenance and repair as well as instrumentation, methods and safety assessment in view of long-term plant operation.

JNES, Japan

View of a pipe failure.

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.

Current tasks include establishing a framework for human reliability data exchange; analysing the status and experience with the technical basis and use of probabilistic risk criteria for nuclear power plants in member countries; preparing a low-power and shutdown PSA information base; and analysing and preparing recommendations on methods and information sources for quantitative evaluation of digital system reliability.

The activity related to human reliability analysis was completed. The group completed work on PSA of off-site external hazards other than earthquakes, where the focus was on off-site external events, including floods. PSA in several member countries indicates that external, off-site events such as extreme weather conditions or high temperatures may be important risk contributors, depending on the specifics of plant design and location.

Following a CSNI request, the group is also carrying out discussions on current experience with reliability modelling and qualifications of digital systems in the context of PSA applications. A technical meeting was held in Paris in October.

Fuel safety

The Working Group on Fuel Safety (WGFS) addresses 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. The main focus of the group remains on reviewing data from reactivity-induced accident (RIA) and loss-of-coolant accident (LOCA) experiments, and assessing how these data affect fuel safety criteria, in particular at increasing burn-up.

The WGFS is continuing its work to update the 1986 CSNI state-of-the-art report on RIA and LOCA, although this time the two issues will be separated into two reports. The final draft of the report on LOCAs was approved by the CSNI.

The adequacy of existing fuel performance codes for the simulation of high burn-up fuel behaviour under accident conditions was assessed by benchmarking against an irradiated LOCA test performed at the Halden reactor. It was decided to continue the benchmarking with two additional Halden LOCA tests, in co-operation with the Halden Reactor Project, to address in particular the effects from ballooning and related fuel blockage. The benchmarking results were provided at the WGFS meeting in September. Most presentations indicated that further refinements would be made in order to enhance the prediction accuracy of the various codes.

Human and organisational factors

The Working Group on Human and Organisational Factors (WGHOF) constitutes a unique international forum for addressing safety management, human and organisational factors, and human performance in nuclear facilities. Two technical opinion papers were finalised and one workshop was held in 2008.

A technical opinion paper about human performance issues in the safety of nuclear power plant maintenance, to be published early in 2009, states that human errors during maintenance and periodic tests are significant contributors to plant events. The key steps in securing reliable and effective maintenance are the development of an effective planning process, and the formalisation of the communication processes, in particular when contractors are used.

Another technical opinion paper also due to be published early in 2009 identifies a set of research topics that will enhance the state of knowledge related to human and organisational factors. Eight research topics (among them the role of automation and personnel, organisational factors and safety culture) were defined. The paper recommends that the international community, including regulators, vendors, research institutes and other interested parties, pursue a collaborative and co-ordinated approach to addressing these important research areas.

A workshop on justifying the suitability of nuclear licensee organisational structure, resources and competencies was organised in co-operation with the Swedish Radiation Safety Authority and the EC Joint Research Centre's Institute for Energy in September in Sweden. The objective was to identify and to compare methods and approaches that can be used to demonstrate that licensees have suitable organisational

Comanche Peak NPP, United States

Safety management
and the human factor.

structures, resources and competencies to manage safety throughout the facility's life cycle.

Fuel cycle safety

The Working Group on Fuel Cycle Safety (WGFCS) 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.

The joint NEA/IAEA Fuel Incident Notification and Analysis System (FINAS) is the only international system providing regulators and government bodies with information about lessons learnt from safety-significant events at fuel cycle facilities. The introduction of the new, web-based FINAS has suffered some delays, but was operational at the end of 2008. Steps still need to be taken to update facility information and to finalise revised coding and updating of a number of older reports.

The group is also addressing the management of ageing fuel cycle facilities. The main objective is to review the potential impact of ageing on the safety, regulation and operability of reprocessing and fuel fabrication facilities.

Integrated assessment of safety margins

Factors such as 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. The Task Group on Safety Margin Applications and Assessment (SM2A) began testing methodology finalised in 2007 by evaluating the change in safety margins which would result from implementing the newly proposed USNRC rules on performing LOCA analyses. Overall, it is intended that the methodology will be able to be used to quantify the change in margins due to combinations of plant modifications, as well as in support of setting safety limits for advanced reactor designs. A base case, with a hypothetical 10% power uprate applied to a commercial NPP, was considered.

Defence in depth of electrical systems and grid interaction

The July 2006 Forsmark-1 event identified a number of design deficiencies related to electrical power supply to systems and components important to safety in nuclear power plants. In follow-up, the Task Group on Defence in Depth of Electrical Systems and Grid Interaction (DIDELSYS) was established with its mandate developed in line with the findings of a workshop on lessons learnt from the event.

The general objectives of the task group were to evaluate the robustness of existing safety-related electrical systems in nuclear power plants; the basic principles used to develop a robust safety-related electrical system in terms of critical design features, redundancy, diversity, and the use of proven technologies; methodologies used to demonstrate the robustness of safety-related electrical systems considering the definition of input transients, analytical approaches, defence-in-depth issues, simulation techniques, the use of computer codes, and the definition of safety margins; and the various modes of interaction between nuclear power plants and the electrical grid, and the command and control interface between operators of the electrical grid and nuclear power plants.

The task group is currently drafting the final technical report that will provide information on the state of the art regarding the robustness of safety-related electrical systems (SRES), taking into account their interaction with other electrical equipment, the use of new technologies and the problems encountered when the modernisation of existing plants is undertaken. It will also provide guidelines for improving communication and co-ordination among the grid operator, the nuclear safety authorities and the licensees.

Research facilities for existing and advanced reactors

Following several years of work on the subject, a CSNI Collective Statement on Support Facilities for Existing and Advanced Reactors was published. The statement places particular emphasis on CSNI experience in acting as an efficient co-ordinator of international reactor safety research projects involving both regulators and the industry, and on preparing for the next generation of reactors. Based on that, the CSNI established a task group to assess research needs in the medium term. The objectives, scope and schedule have been defined for the Task Group on Advanced Reactor Experimental Facilities (TAREF), which will focus on gas reactors and sodium fast reactors in a first phase.

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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, and on the decommissioning of obsolete nuclear facilities.

Highlights

- An RWMC collective statement on *Moving Forward with Geological Disposal of Radioactive Waste* was published.
- A workshop was organised in France on approaches and challenges for the use of geological information in safety cases.
- The Working Party on Decommissioning and Dismantling (WPDD) started a study on decommissioning cost elements, estimation practices and reporting requirements.
- A project on retrievability and reversibility in long-lived waste disposal was initiated.

Waste management policy and regulatory issues

An RWMC collective statement on *Moving Forward with Geological Disposal of Radioactive Waste* was published. The statement notes that national strategies for geological disposal should address not only the technical means to construct a facility, but also the framework to allow decision makers and the concerned public the time and means to understand and to evaluate the basis for the various decisions proposed. An important conclusion is that delaying work on geological disposal – i.e. by adopting a "wait-and-see strategy" – would require increasingly more demanding care for the waste and its storage facilities. Sufficient information now exists for taking the first steps and adopting a plan commensurate with the current generation's responsibility. Moving forward with implementation of geological disposal is desirable from both the ethics and safety points of view.

The collective statement also recognises that issues related to retrievability and reversibility (R&R) are prominent in a number of countries. Following on from a 2001 NEA report on this subject, a new initiative was started in 2008 to survey current views, issues and practices associated with R&R and to provide information that would be useful to national debates and programmes. A first workshop was held in Toronto, Canada, in September. More meetings and workshops are to take place culminating in an international conference in France in December 2010.

The RWMC Regulators' Forum (RF) continues to investigate issues connected with establishing long-term safety regulation for geological disposal. In 2008, final preparations were made for a workshop to be hosted by the Government of Japan in Tokyo, in January 2009, on the questions of transparent, proportionate and deliverable regulation. Regulators, implementers, R&D specialists, policy makers and social scientists were expected to attend.

Safety case for geological disposal

Through its Integration Group for the Safety Case (IGSC), the RWMC continues to define trends and best practices in developing and presenting safety cases. During 2008, the IGSC compiled and analysed international experience on safety case development. The results will be brought together in a state-of-the-art report that identifies areas of consensus as well as emerging trends and remaining challenges for safety case development.

A workshop was organised in France in April on approaches and challenges for the use of geological information in safety cases. The workshop explored the connections among site characterisation, safety assessment and repository design, and demonstrated the importance, in supporting a safety case, of having a coherent and comprehensive conceptual model of the geosphere. This was the third and final workshop of the Approaches and Methods for Integrating Geologic Information in the Safety Case (AMIGO) project. Outcomes and key messages from the project will be compiled in a forthcoming report.

As national programmes move towards licensing, there is a growing need to reconcile the demands not only for long-term safety of disposal facilities, but also for their engineering feasibility and operational safety. The IGSC

Posiva Oy, Finland

Part of the geological disposal facility under construction in Finland.

is exploring the links and trade-offs among the various technical requirements.

In 2008, the IGSC also initiated several new activities. Foremost among these are a desk study to review advances in safety assessment methods and a workshop to be held in 2009 on the role and performance of cementitious materials in geological repositories.

Forum on Stakeholder Confidence

The RWMC Forum on Stakeholder Confidence (FSC) continues to foster reflection on stakeholder dialogue as well as the improvement of decision-making processes for radioactive waste management. At the FSC annual meeting, three topical sessions were organised outlining experience related to links between research, development and demonstration (RD&D) and stakeholder confidence, reviewing the legal and policy framework for involving stakeholders, and addressing the symbolic dimension of some concepts promoted within waste management (for further details see page 40).

Preparations were also started for the FSC workshop to be held on the French national context in April 2009, in the region where a repository for high-level radioactive waste may be sited. Reversibility is one of the topics on the agenda.

Important efforts were made by the FSC in 2008 to produce plain-language flyers to be used for outreach and training. A general flyer describing the FSC as well as three thematic flyers – on principles for decision making, on the practice of stepwise decision making, and on ways to foster a durable relationship between a facility and its host community – are available online.

Decommissioning

The RWMC Working Party on Decommissioning and Dismantling (WPDD) undertook an activity to analyse lessons learnt from decommissioning and their impact on the construction of new nuclear plants. First findings based on practice and expectations by designers, utilities and regulators were discussed at a topical session. Completion of the study's report and preparation of a short policy document on the same issue in collaboration with the IAEA is expected during 2009.

To address issues relating to methodologies for estimating decommissioning costs, the WPDD established the Decommissioning Cost Estimation Group (DCEG). The first meeting of the DCEG in May included a topical session on dealing with risk and uncertainties in decommissioning cost estimates. The group also started a study on decommissioning cost elements, estimation practices and reporting requirements to be finalised in 2009. Findings suggest that different cost assessment methodologies will need to be used as the project advances, and should be continuously updated using cost data from actual decommissioning projects. An important conclusion so far is that scope changes and scope growth may have the greatest impact on cost estimates, and should be incorporated immediately if estimates are to be a viable benchmarking resource.

Finally, two WPDD reports were published in relation to regulatory practice. On *Regulating the Decommissioning of Nuclear Facilities*, the WPDD concludes that regulatory requirements should be commensurate with the level of residual hazard in plants being decommissioned and that internal authorisation systems, whereby safety committees established by the licensee provide a first line of oversight, may have a role to play. On the *Release of Radioactive Materials and Buildings from Regulatory Control*, the WPDD notes that clearance policies are heavily influenced by the costs and availability of disposal pathways for low-level waste and that, although clearance levels are established by national legislation, a good level of international harmonisation exists, especially for key radionuclides.

The *Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects* (CPD) has accepted four additional participating projects, from Canada, Italy, Japan and the United Kingdom – thus further expanding its information base. The work of the two currently operating specialised task groups – on the use of robotics in decommissioning and on techniques for the decontamination and dismantling of concrete – has progressed considerably and will be completed in 2009. (See page 35 for further details on this programme.)

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.

The Clay Club co-sponsored an international meeting on Fault Zones: Structure, Mechanics and Fluid Flow along with the Geological Society of London, the Geological Society of America and a number of other scientific organisations. The Clay Club's participation in this meeting was the fruition of ongoing efforts to improve information exchange regarding research and understanding of clays outside the radioactive waste field, notably in the petroleum industry and the broader academic community. Progress in modelling fault growth, shown in the meeting, may be of real interest for geological disposal.

The Clay Club is also continuing its investigation of processes that lead to self-sealing of fractures in clays, which could have important implications for the performance of deep geological repository systems because of the possibility to reduce or eliminate preferential pathways. A full technical report will be drafted and reviewed in the year to come to interpret recent important laboratory results and field tests in the context of geological disposal.

Work continued on the Thermochemical Database (TDB) Project, which entered phase IV covering the years 2008-2012. This NEA-sponsored joint project is described on page 36.

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Radiological Protection

Committee on Radiation Protection and Public Health (CRPPH)

The objective of the CRPPH is to facilitate the understanding and implementation of a system of radiological protection that will address regulator and practitioner needs, and that more appropriately positions scientific radiological protection considerations within the broader context of social judgement and risk governance.

Highlights

- In-depth discussions of how science and social values are taken into account in the formation of policy and regulatory judgements took place at a workshop in Finland in January.
- The CRPPH participated actively in the development of draft text for the new international Basic Safety Standards, which are being developed under the auspices of the IAEA and co-sponsored by the NEA and several other international organisations.
- In follow-up to the INEX-3 emergency exercise, reports on recovery, countermeasures and decision making were drafted.
- Under the auspices of the Information System on Occupational Exposure (ISOE), a report on modern approaches to work management in the nuclear power industry was completed.

Evolution of the international system of radiological protection

Following active CRPPH participation in providing input to the International Commission on Radiological Protection (ICRP) for the completion of its new general recommendations (Publication 103), during 2008 the committee reviewed three draft "building block" documents explaining the ICRP's new philosophy in specific applications. The documents included new ICRP recommendations on emergency preparedness and management, post-emergency rehabilitation and radiological protection of the environment. Assessing and commenting on these documents has assisted the CRPPH membership in better understanding the details of the new ICRP recommendations. In particular, it has provided significant insight into how the new recommendations should be implemented.

This developing knowledge has been particularly useful in the preparation of new draft text for the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS). The NEA, as a co-sponsoring organisation, has very actively contributed to this work, with 50 experts from 20 countries participating in 20 drafting meetings during 2007 and 2008 as part of the preparation and finalisation of Revision 1.0. In addition, over 100 experts from 25 NEA member countries have participated in the assessment of the first full draft of the revised BSS. The CRPPH will continue to lead the NEA's efforts in this work, which should result in a new international BSS in the near future.

Radiological protection science and policy judgement

One of the most significant aspects of the new ICRP recommendations is their focus on the importance of optimisation in the application of radiological protection. This focus places significant emphasis on the judgemental aspects of decision making, strongly suggesting the need to be clear and transparent with respect to what judgements are being made and on what basis.

In January, the CRPPH, in co-operation with the Finnish Radiation and Nuclear Safety Authority (STUK) held the 1st Workshop on Science and Values in Radiological Protection to investigate how societal values, scientific knowledge and uncertainties are combined when making decisions regarding the optimisation of protection. Key aspects of emerging radiological protection science (e.g. non-targeted effects, individual sensitivity and circulatory diseases) were discussed among researchers, regulators and civil-society stakeholders. The result of this workshop showed the value of this type of dialogue, and resulted in the CRPPH approving the organisation of the 2nd Workshop on Science and Values in Radiological Protection, to be held in France at the end of 2009. The second workshop will focus on value-judgement aspects of decisions.

Radiological protection and public health

A CRPPH expert group has been exploring how radiological protection decision making might be affected if taken more from a public health perspective. Four case studies have been used to identify possible effects, and to explore how the national organisations responsible are addressing them. The cases being studied are: radon; justification of medical exposure; public health judgement in decision making based on new scientific evidence; and management of individual differences. The results of these case studies will be published in 2009 and will serve as key input to the second science and values workshop.

Stakeholders and radiological protection

CRPPH work in this area has shown that the involvement of stakeholders in decision-making processes can significantly improve the quality and sustainability of radiological protection decisions, and in some cases is the only approach that can successfully be used to reach an acceptable decision. While stakeholder involvement is now broadly accepted, the CRPPH has been exploring how governmental radiological protection organisations have reacted to these challenges and have adapted. A short report on this subject will be published in 2009 based on the work of an expert group.

The CRPPH also began planning a workshop to explore stakeholder involvement aspects of post-emergency consequence management. This work is partly based on the results of the 3rd International Nuclear Emergency Exercise (INEX-3), which identified stakeholder participation as a key element in the later phases of post-accident consequence management. This new workshop will focus on how governments and emergency response organisations might better incorporate stakeholders into the management of emergency consequences, and on the exchange of experience in this area. The workshop will be supported by a case study focusing on response organisations and how they have structurally and procedurally evolved to best incorporate stakeholder input into their decision-making processes.

Operational radiological protection from a policy perspective

An area of increasing interest concerns radiological protection needs in the context of possible significant new build over the next 10 to 20 years. A CRPPH expert group is looking into possible radiological protection criteria for new build, the implication of new ICRP recommendations on operational radiological protection, and experience related to operational radiological protection. The expert group is addressing these questions in three, separate case studies. The first, on radiological protection criteria for new build, examines not only the types of criteria that regulatory bodies could use to assess new license applications, but also suggests areas where good practice has demonstrated significant dose-management effectiveness. The second case study, addressing the implications of new ICRP recommendations, is focusing in particular on the use of dose constraints and reference levels in operation. The third case study will investigate operational issues affecting radiological protection policy, for example regulatory assessment of optimisation programmes. Industry input will be sought to ensure that practical operational experience is taken into account. The CRPPH also continued its work on the concept of best available techniques (BAT), what this would mean in the context of possible new build, and what types of criteria regulatory authorities could use when assessing applications claiming to use BAT.

Radiological protection of the environment

The CRPPH organised a session on this important topic of interest at the Bergen International Conference on Radioecology and Environmental Radioactivity in 2008. The session concluded that, in general, NEA member country governments rely on their environmental impact assessment approaches to determine what actions are needed for environmental protection. However, the tools being developed, by the ICRP and others, for impact assessment may usefully aid in these determinations. The CRPPH agreed to continue to monitor developments and to investigate under what circumstances the ICRP position according to which, if man is protected then the environment will also be protected, might be challenged.

ORISE, United States

Recording radiation measurements with an *in situ* gamma ray spectroscopy (ISGRS).

Nuclear emergency and recovery management

Decision-making processes as part of consequence management were investigated in the 3rd International Nuclear Emergency Exercise series (INEX-3). Based on the outcomes of the post-exercise evaluation workshop, the CRPPH Working Party on Nuclear Emergency Matters (WPNEM) created expert groups to address key needs in consequence management in the areas of post-emergency countermeasures, good practices in decision making and possible implications of nuclear indemnification. Reports from these activities will be finalised in early 2009. The INEX-4 exercise is planned to take place in the 2010 time frame and to focus on the transition to recovery.

Occupational exposure at nuclear plants

Occupational exposure at nuclear power plants continues to be an important issue for the CRPPH. The sharing of operational 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, ISOE completed a report on modern approaches to work management to optimise radiological protection in the nuclear power industry, updating a landmark 1997 publication on this topic. Further details on the ISOE programme are provided on page 36.

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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 report on *Nuclear Fuel Cycle Transition Scenario Studies* was completed for publication.
- The 4th NEA workshop on Advanced Reactors with Innovative Fuels (ARWIF-2008) was held in Tsuruga and in Fukui, Japan on 20-22 February.
- The 10th NEA Information Exchange Meeting on Actinide and Fission Product Partitioning & Transmutation was held in Mito, Japan on 6-10 October.
- A report on a benchmark study on the impact of PWR axial burn-up asymmetry on fuel assemblies was issued.

The NEA nuclear science programme is to a large extent devoted to international comparison exercises or benchmark studies to validate computational methods and data used to predict the behaviour and performance of different nuclear systems. In addition, the nuclear science programme sponsors expert meetings and workshops and co-ordinates the preparation of state-of-the-art reports as necessary.

Fuel cycle physics and chemistry

A report on *Nuclear Fuel Cycle Transition Scenario Studies*, including country-dependant scenarios and key technologies to be identified to implement future scenarios, was completed and sent to print at the end of 2008. The associated benchmark studies of scenario codes and of a European and a global fuel cycle transition scenario continue.

A new activity devoted to progress in separation chemistry, including minor actinide separation and future R&D perspectives, was started in 2008. The main objective of this work is to assess technical maturity and needs for separation processes according to three recycling methods: aqueous, pyro and fluoride. It is also envisaged to evaluate separation requirements in different fuel cycle scenarios and to suggest possible future steps.

New activities on scientific and technical issues associated with the development of innovative fuels and structural materials have also been started, as well as studies on homogeneous versus heterogeneous recycling of transuranics in fast reactors, and the potential benefits of advanced fuel cycles using partitioning and transmutation.

CEA, France

View of the Atalante CBP hot cell.

Reactor physics

A study of coupled neutronics/thermal-hydraulics transients in a pebble bed modular reactor (PBMR) has been completed and will be published in 2009. A new benchmark, based on experimental data from the Russian VVER-1000 Kalinin-3 reactor, was started in 2008 in support of advanced simulation of coupled neutronics/thermal-hydraulics.

A benchmark based on PWR sub-channel and bundle tests performed by the Nuclear Power Engineering Corporation (NUPEC) of Japan has started. The benchmark will be devoted to simulations of PWR thermal-hydraulic conditions, including steady states and transients, such as power increase, flow reduction, depressurisation and temperature increase. It follows on from a similar, recently completed benchmark based on BWR fine-mesh full-bundle tests, also performed by NUPEC.

The reactor physics programme comprises a number of studies related to the use of mixed-oxide (MOX) fuel in reactors including, for example, results from fuel performance benchmark studies based on experimental data from the OECD Halden Reactor Project and the PRIMO programme at the SCK•CEN BR3 reactor. The results were presented at the Physor-2008 conference.

The preparatory work for the publication of a state-of-the-art report on minor actinide burning in thermal reactors was started, with plans to complete the report in 2009.

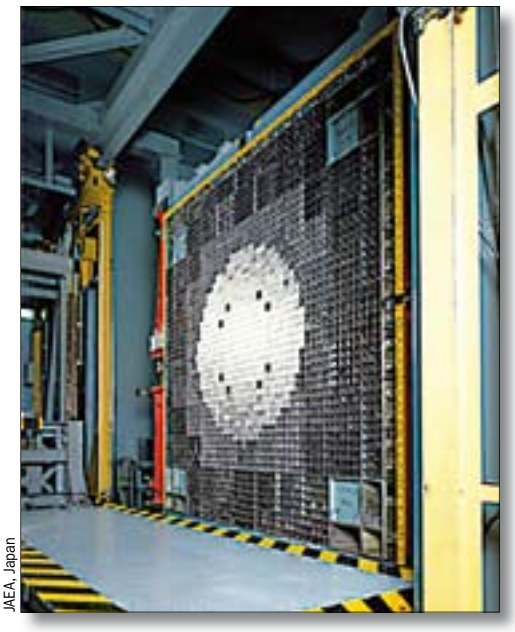
Material science

The content and organisation of NEA work in the area of material science was further defined in 2008. It was decided to address two issues: to revisit the displacement per atom (DPA) radiation damage definition and to review benchmark methods used by comparing the outcome of various codes with experimental results.

In addition, the programme will include the assessment of the possibilities and limits of numerical methods applied to multiscale modelling of materials for nuclear energy, and the means to link the different scales. A critical review will also be carried out on development and potential bottlenecks in the fields of fuels and structural materials.

Nuclear criticality safety

A state-of-the-art-report on assay data for spent nuclear fuel is under development. Special emphasis will be given to the development and validation of methods to estimate the uncertainties caused by the lack of experimental data. The related NEA database for spent nuclear fuel, SFCOMPO, has been updated with new data from Japan, Spain, Sweden, the United Kingdom and the United States. Data from VVER reactors will be collected and entered in the database.



JAEA, Japan

JAEA Fast Critical Assembly (FCA) for mock-up reactor core experiments.

A study of uncertainty analyses for criticality safety assessment has been undertaken. The aim is to validate criticality analysis codes and to provide recommendations on the use and development of robust methodologies to determine biases and uncertainties when using these codes.

The September 2008 issue of the *International Criticality Safety Benchmark Evaluation Project* (ICSBEP) handbook contained evaluations of 485 experimental series, representing 4 207 critical or sub-critical experiments and 24 criticality-alarm/shielding configurations. It also includes four fundamental physics measurement evaluations relevant to criticality safety applications.

Radiation shielding and reactor dosimetry

The final meeting of the scientists involved in the benchmark exercise on the accuracy of solutions of 3-dimensional transport codes and methods over a wide range of parameters was held in September 2008 in connection with the Physor-2008 conference. The results will be summarised in a report to be published in 2009. A special issue of *Progress in Nuclear Energy* will cover the different solutions and compare the methods in greater detail.

The drafting of a handbook on accelerator shielding was started with the goal of having it published in the course of 2010.

R&D facilities in nuclear science

The study on needs for research and test facilities in the area of nuclear science was completed and the report was sent to print at the end of 2008. A database, containing information about existing R&D facilities, was also developed in addition to the report. The database, which was partly released to the public in the beginning of 2008 on the NEA website (www.nea.fr/rtfdb/), contains information on approximately 775 scientific research facilities.

Knowledge preservation

The NEA science programme also comprises the preservation of information from important and well-documented experiments in selected nuclear application areas. The activity is performed in close collaboration with the NEA Data Bank. Data from integral experiments have been collected in the areas of reactor physics (IRPhE), fuel behaviour (IFPE), radiation shielding (SINBAD) and criticality safety (ICSBEP). All the collected data are made available through the NEA Data Bank to the nuclear community in a comprehensive and structured format for use in benchmark validation exercises.

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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 acquiring, developing, improving and validating these tools and making them available upon request.

Highlights

- The third edition of the *International Handbook of Evaluated Reactor Physics Benchmark Experiments* was published on DVD in March. This version includes new experiments for 17 reactors and 4 fundamental evaluations.
- A book on *Analytical Benchmarks for Nuclear Engineering Applications: Case Studies in Neutron Transport Theory* was published, reconfirming the importance of the analytical methods in transport calculations.
- A revised JEFF neutron data library, JEFF-3.1.1, was finalised in December 2008 for release in January 2009.
- A report on *Uncertainty and Target Accuracy Assessment for Innovative Systems Using Recent Covariance Data Evaluations*, containing explicit recommendations for nuclear data improvements, was published.
- Updates to the data display program JANIS-3 (3.0.1) included new capabilities for users' prepared data plotting. It is available on the NEA website at www.nea.fr/janis.
- The NEA Data Bank electronic newsletter was launched in March; since then four issues were distributed to about 1 300 users.

Computer program services

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

During 2008, a total of 80 new or revised versions of computer codes were acquired, and 50 were verified, tested and master-filed. The special co-operative agreement in place between the NEA Data Bank and the International Atomic Energy Agency (IAEA) has enabled the NEA Data Bank to receive about 10 computer codes from non-OECD countries. Twenty new or revised sets of integral experiment compilations (such as SINBAD, IFPE and IRPhE) were acquired and integrated during the same period.

The Data Bank answered requests for over 2 000 programs in 2008, of which 115 were sent to non-OECD countries. With regard to integral data experiments in support of computer code validation, slightly under 4 000 sets were distributed, of which about 800 were sent to authorised users in the non-OECD area.

Knowledge transfer and preservation

As part of the Data Bank services, ten training courses on the utilisation of the most popular computer programs were organised. The areas covered were: computational radiation physics, radiation transport using Monte Carlo codes and sensitivity/uncertainty analysis, analytical benchmarks, experimental data analysis and coupled neutronics/thermal-hydraulics. Over 200 participants attended in all.

The Data Bank's knowledge preservation activities include the development of the following databases in co-operation with the NEA Nuclear Science Committee: IFPE (fuel performance experiments with data for 1 500 fuel rods), SINBAD (about 100 shielding and dosimetry experiments) and IRPhE (International Handbook of Evaluated Reactor Physics Benchmark Experiments, 38 experimental series from 25 facilities). In co-operation with the NEA nuclear safety division, relevant experimental data from international joint projects are maintained and distributed (for example, from the steam explosion database). A large number of copies of these databases were distributed upon request. Many reports relative to NEA work have been indexed and integrated into the IAEA International Nuclear Information System (INIS) for easy and structured access.

In the field of radiation transport and reactor physics, additional "legacy" books of continuing interest and

importance were released to the Data Bank after publishers reverted the copyrights to the authors. These include *Analytical Benchmarks for Nuclear Engineering Applications* and a series of books on reactor shielding. The Data Bank is now authorised to distribute them in electronic format at no cost to requesters, and in particular to students.

Nuclear data services

The Data Bank maintains large databases containing bibliographic (CINDA), experimental (EXFOR) and evaluated (EVA) nuclear data, and makes these databases available online to scientists and engineers in member countries. In 2008, several evaluated special-purpose nuclear data libraries were added to the EVA database, such as the JENDL libraries JENDL/AC-2008 (neutron-induced reactions for 79 actinides), JENDL/HE-2007 (neutron- and proton-induced reaction data up to 3 GeV for 106 nuclides), JENDL/PD-2004 (photon-induced reaction data up to 140 MeV for 68 nuclides), JENDL/AN-2005 (alpha-induced neutron production cross-sections of 17 nuclides) and the UK Heavy Element Decay Data and Activation Product Decay Data libraries, UKHEDD-2.6 and UKPADD-6.8 respectively. The EVA database contains over 40 evaluated data libraries at present.

The Data Bank contributed over 200 experiments on neutron- and charged-particle-induced data to the EXFOR database, of which 70% relate to charged-particle reactions. An emphasis on the correction of erroneous data in collaboration with the WPEC (see below) has resulted in the updating of about 1 640 data sets.

Updates to the nuclear data display software, JANIS-3, was released in February to respond to users' feedback and needs. The main improvements include corrections in the reading of the ENDF and EXFOR formats, and new functionalities such as the possibility to display the user's own data in the nuclide chart (browser) window of JANIS. The program can be downloaded or launched from the JANIS web page at www.nea.fr/janis.

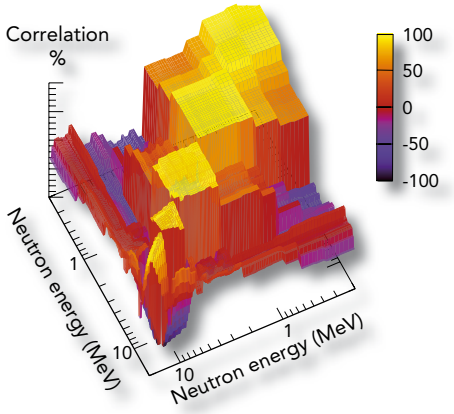
The proceedings of the International Conference on Nuclear Data for Science and Technology, held in Nice, France in April 2007 were published. The next conference in the series will be held in Korea in 2010.

The JEFF Project

The Joint Evaluated Fission and Fusion (JEFF) Project has revised its neutron data library. The new version, JEFF-3.1.1, was finalised in December and is available on the NEA website. Two reports have been finalised regarding the recent revisions and this updated version. They are scheduled to be published early in 2009.

International nuclear data evaluation co-operation

The NEA/NSC Working Party on International Nuclear Data Evaluation Co-operation (WPEC) provides a framework for improving the quality and completeness of evaluated nuclear data libraries available for use in science and technology and for promoting the efficient use of available resources through international collaboration. In 2008, a report was published on *Uncertainty and Target Accuracy Assessment for Innovative Systems Using Recent Covariance Data Evaluations*. The recommendations for nuclear data improvements made in the report have been reviewed and entered into the WPEC High Priority Request List (HPRL) for nuclear data.



Graphical representation of nuclear data uncertainties.

The WPEC has launched two follow-up studies, one on meeting nuclear data needs for advanced reactor systems and another on methods and issues for the combined use of integral experiments and covariance data. Other ongoing studies cover the production and processing of covariance data in different energy regions, a review and quality assurance procedure for the experimental database EXFOR and the review of the uranium-235 capture cross-section in the keV to MeV energy region.

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. Details are provided in the section on Joint Projects and Other Co-operative Projects (see page 36).

In-house computer services

The Data Bank's in-house computer services provide a highly available network, data storage and servers. The web cluster connected by two internet links has served 1.2 million visits in 2008, during which 3 million web pages were browsed and some 2.6 terabytes were downloaded.

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Legal Affairs

Nuclear Law Committee (NLC)

The NLC promotes the development, strengthening and harmonisation of nuclear legislation governing the peaceful uses of nuclear energy in member countries and selected non-member countries. It supports the adoption, implementation and modernisation of national and international nuclear liability regimes. Under its supervision, the NEA analyses and disseminates information on nuclear law through a regular publications programme and conducts annual sessions of the International School of Nuclear Law.

Highlights

- The NLC held its first-ever topical session on legal implications of multilateral approaches to the nuclear fuel cycle, designed to address the legal aspects of initiatives for the security of nuclear fuel supply.
- The Committee explored the challenges facing legislators and regulatory bodies which are trying to balance the needs for both transparency and confidentiality with respect to information concerning nuclear activities.
- The NLC sought to help those countries wishing to ratify the 2004 Protocols to amend the Paris and Brussels Supplementary Conventions to resolve the problem of obtaining sufficient financial security to cover new liability risks being assumed by nuclear operators under those instruments.
- The United States of America ratified the 1997 Convention on Supplementary Compensation for Nuclear Damage (CSC), the first NEA member and major nuclear power generating country to do so.
- Two issues of the *Nuclear Law Bulletin* (NLB) were published containing topical articles on the licensing of new reactors in the United States, EU non-proliferation instruments and policies, environmental law developments in nuclear energy, operator pooling for nuclear third party liability and US-India nuclear co-operation and non-proliferation.
- The eighth session of the International School of Nuclear Law was successfully organised at the University of Montpellier 1.

Development and harmonisation of nuclear legislation

Environmental protection is becoming a growing concern amongst nuclear lawyers and the NLC assessed some of the processes that are used in member countries to ensure adequate environmental protection in the nuclear field, including environmental impact assessments for nuclear installations and public participation in the decision-making process. The NLC explored the challenges facing legislators and regulatory bodies in balancing the needs for transparency and confidentiality: communicating sufficient information on nuclear activities to policy makers and the public to allow for informed decision making, while protecting confidential information that is either commercially valuable or that, if used in a malevolent manner, could pose risks to public health, safety and security.

For the first time during a regular meeting, the NLC held a special topical session addressing the legal implications of multilateral approaches to the nuclear fuel cycle. The session was designed to inform members of the NLC of the most important issues in this field which are currently being considered at the international level. The legal aspects of several specific proposals put forward by NEA member countries and non-member observers were addressed, as was the potential role of the International Atomic Energy Agency (IAEA) in such initiatives.

The impact of legal and economic factors in decision making in nuclear emergency situations was studied by a joint ad hoc working group comprising representatives of the NLC and of the NEA Committee on Radiation Protection and Public Health (CRPPH). The group stressed the importance of exchanging information between the two disciplines, including among communities from different countries. Issues examined by the group included stakeholder involvement in emergency management, the role of insurers, the notions of "nuclear incident" and "nuclear damage", and the institution of compensation claims for nuclear damage.

National and international nuclear liability regimes

NEA member 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. Member countries which are party to the Paris and Brussels Supplementary Conventions on nuclear third party liability continue to work towards implementing the 2004 protocols amending those conventions. Several countries face delays in implementation because private nuclear risk insurers are unable to provide full coverage for certain risks which nuclear operators are obliged to assume under the newly revised conventions, such as the cost of reinstating an impaired environment and extended prescription periods. The NLC has thus sought to help those countries find adequate, alternative financial security. The United States of America was the first NEA member country to deposit its instrument of ratification of the Convention on Supplementary Compensation for Nuclear Damage (CSC), the aim of which is to create a global regime of nuclear liability and compensation to cover nuclear accidents. Three other countries have ratified this instrument (Argentina, Morocco and Romania), but it will only enter into force 90 days after the date on which at least five states with a minimum of 400 000 "units" of installed nuclear capacity (or roughly 400 000 MWth of installed capacity as defined in the convention) have done the same.

Nuclear law publication programme

The June 2008 issue marked the 40th anniversary of the *Nuclear Law Bulletin*. This unique, bilingual periodical provides up-to-date information on national and international developments in legislation, regulations and case law in the nuclear law field and includes articles and studies analysing those developments. It has proven to be an invaluable tool for both professionals and academics. Volumes No. 81 and 82 of the Bulletin were published in June and December respectively. All but the latest three editions are available online at www.nea.fr/html/law/nlb.

Country chapters on the regulatory and institutional framework for nuclear activities in OECD member countries are also available at www.nea.fr/html/law/legislation/welcome.html. Several country profiles were updated in 2008 (Australia, Hungary, Italy, Japan, Luxembourg, Sweden, Turkey and the United States). A new service, "Latest Legislative Developments", was also introduced which tracks recent nuclear legislative news even prior to its publication in the *Nuclear Law Bulletin*; it can be found at www.nea.fr/html/law/legislation/updates.html.

Nuclear law educational programme

The eighth session of the International School of Nuclear Law (ISNL) was held in August/September in co-operation with the University of Montpellier 1, France. Established in 2001, the ISNL aims to provide high-quality education in international nuclear law to students and legal professionals through an intensive training course. It benefits from professional expertise provided by the IAEA and by the European Commission. For the first time this year, a session on the impact of environmental law on nuclear activities was included in the intensive two-week course. The 2009 session is scheduled to be held from 24 August to 4 September. Further information may be obtained at www.nea.fr/html/law/isnl/index.html.

OECD/NEA

Participants at the 2008 session of the ISNL, Montpellier, France.

The fourth Summer Institute of the World Nuclear University (WNU), an intensive six-week programme aimed at building future leadership in nuclear science and technology, took place in Ottawa, Canada in July and August with NEA Legal Affairs and the IAEA's Office of Legal Affairs co-ordinating the nuclear law component. Representatives from NEA Legal Affairs also gave lectures at the WNU-organised week-long courses held in various countries throughout the world on key nuclear energy issues.

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Joint Projects and Other Co-operative Projects

NUCLEAR SAFETY RESEARCH

The Halden Reactor Project

The Halden Reactor Project is operated by the Norwegian Institute for Energy Technology (IFE). It has been in operation since 1958 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 prototype developments and analyses carried out at the Halden establishment in Norway. It is supported by approximately 100 organisations in 18 countries. The Halden Project benefits from stable and well-experienced organisation and a technical infrastructure that has undergone substantial developments throughout the years. The project objectives have been continuously adapted to users' needs.

In 2008, work in the fuel area included continued testing under loss-of-coolant accident (LOCA) conditions, carried out with high burn-up fuel. These are the only LOCA tests that are currently performed in-pile worldwide, and complement the work done at laboratory scale in other institutions, notably in Japan and the United States. The tests carried out have provided valuable insights and have been the basis for benchmarking exercises carried out in the Working Group on Fuel Safety Properties of UO_2, gadolinia and MOX fuels under a variety of conditions relevant to operation and licensing. Long-term irradiations have been carried out with advanced and standard nuclear fuel at high initial rating conditions. Corrosion and creep behaviour of various alloys were studied. The experimental programme on the effect of water chemistry variants on fuel and reactor internals materials has been expanded. Tests to investigate the cracking behaviour of reactor internals materials in BWRs and PWRs continued, with the aim of characterising the effect of water chemistry and material ageing. The work on cable ageing has resulted in a technique that is being used for assessing insulation damage, and in those cases to determine the extent and location of the damage.

The programme on human factors has focused on experiments in the Halden man-machine laboratory, related data analyses, new control station designs, evaluations of human-system interfaces, process and instrumentation optimisation and digital instrumentation and control (I&C). This involves *inter alia* the use of the Halden Virtual Reality Facility. Progress has been made in the area of human reliability assessment (HRA), aiming to provide data suitable for probabilistic safety assessments and to improve validity of HRA methods.

To mark the 50th anniversary of the Halden Reactor Project, the CNRA and the CSNI summer meetings were held in Oslo, in conjunction with the Halden Board of Management. An Enlarged Halden Programme Group meeting (bringing together both programme representatives and participating country experts) was held in May 2008. The main results of the programme were reported on that occasion. Another Programme Group meeting was held in Sweden in October. The Halden Board also met twice in 2008. During the last Board meeting, which was hosted by Électricité de France in Lyon in December, the project's extension for the period 2009-2011 was decided, with all member countries confirming their participation.

The BIP Project

The Behaviour of Iodine Project (BIP), which is supported by 13 member countries, began in 2007. The work consists of separate effect and modelling studies that will augment and complement larger national and international experimental programmes. In addition, it will provide data and interpretation from three Radioiodine Test Facility (RTF) experiments. The proposed project for iodine experiments, to be hosted by Atomic Energy of Canada Limited (AECL), will combine international resources to achieve a consolidated understanding of the behaviour of iodine and other fission products in post-accident nuclear reactor containment buildings. This will be accomplished by:

- addressing technical issues and scientific gaps;
- optimising the use of existing data and test results to support common tools for predicting fission product behaviour.

Specific technical objectives that this programme hopes to achieve are:

- quantification of the relative contributions of homogeneous bulk aqueous phase processes, homogeneous aqueous phase processes in paint pores and heterogeneous processes on surfaces to organic iodine formation;
- the measurement of adsorption/desorption rate constants on containment surfaces as a function of temperature, relative humidity and carrier-gas composition;
- the provision of RTF data to participants, for use in collaborative model development and validation.

Two meeting of the project steering bodies were held in 2008 and were devoted to the presentation of the first test results and to discussing the parameters and boundary conditions to be chosen for the remaining tests.

The Cabri Water Loop Project

The Cabri Water Loop Project, which began in 2000 for an eight-year period, is investigating the ability of high burn-up fuel to withstand the sharp power peaks that can occur in power reactors due to postulated rapid reactivity insertions in the core (RIA accidents). The project participants, from 13 member countries, intend to determine the limits for fuel

failure and the potential consequences of possible ejection of fuel into the coolant environment. Different cladding materials and fuel types are being studied. Project execution involves substantial facility modifications and upgrades, and consists of 12 experiments with fuel retrieved from power reactors and refabricated to suitable length. The experimental work is being carried out at the Institut de radioprotection et de sûreté nucléaire (IRSN) in Cadarache, France, where the Cabri reactor is located. Programme execution can, however, involve laboratories in participating organisations, for instance, in relation to fuel fabrication and characterisation and instrumentation.

Two tests (still using the sodium loop) were carried out with high burn-up fuel having zirconium-niobium cladding material. Fuel that had been in service in Spanish and French reactors, respectively with ZIRLO and M5 cladding, and with burn-up in excess of 70 MWd/kg, was subjected to a ~100 cal/g energy injection during the transients. No fuel failure was registered. Appreciable progress has been made in the design of the water loop test facility and in the production of related components. It will take about three years for the water loop to be in place. The Cabri tests are being complemented by additional reactivity-induced accident (RIA) tests performed in Japan. These tests, which constitute the in-kind contribution from the Japan Atomic Energy Agency (JAEA) for its participation in the Cabri Project, will be carried out at both cold and hot coolant conditions and with both BWR and PWR fuel.

A meeting of the Cabri Technical Advisory Group was held in March. A meeting of the Project Steering Committee was held in December in Paris.

The MCCI-2 Project

The aim of the Melt Coolability and Concrete Interaction (MCCI) Project is to provide experimental data on relevant severe accident phenomena and to resolve two important accident management issues. The first one concerns the verification that the molten debris that has spread on the base of the containment can be stabilised and cooled by water flooding from the top. The second issue concerns the two dimensional, long-term interaction of the molten mass with the concrete structure of the containment, as the kinetics of such interaction is essential for assessing the consequences of a severe accident. The programme utilises the unique expertise and infrastructure that have been developed at Argonne National Laboratory (ANL) for conducting large-scale, high-temperature reactor materials experiments. The US Nuclear Regulatory Commission (NRC) acts as the project Operating Agent.

The first phase of the programme (MCCI-1) was completed in 2005. The experiments on water ingress mechanisms showed that cooling of the melt by water is reduced at increasing concrete content, implying that 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 in the first phase of the programme. Material properties such as porosity and permeability were derived. Tests also showed appreciable differences in ablation rate for siliceous and limestone concrete, which is a relevant finding that requires confirmation. A workshop on the results of MCCI-1 was organised in France in October 2007.

A second three-year programme (MCCI-2) started in 2006. Emphasis is being placed on 2D core-concrete interaction experiments, as they provide the integrated effect of many processes. The MCCI-2 Project involves organisations from 12 member countries. Two meetings of the project steering bodies were held in 2008. On these occasions, the tests results on core-concrete interaction and the test conditions for the molten core cooling test were discussed. The next meeting is planned for April 2009 to review new results and to specify the final integral tests with which the programme will be completed.

The PKL-2 Project

A first PKL project was performed from 2004 to 2007 and consisted of experiments carried out in the Primär Kreislauf (PKL) thermal-hydraulic facility, which is operated by AREVA NP in its establishment at Erlangen, Germany. Organisations from 14 countries participated. These PKL experiments focused on the following PWR issues that have been 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; and loss of residual heat removal during mid-loop operation with an open reactor coolant system.

A second phase of the project, using the same PKL loop together with the PMK loop in Hungary and the ROCOM facility at Dresden-Rossendorf (FZD), started in 2008 with the support of 14 countries. The PKL-2 tests will investigate safety issues relevant for current PWR plants as well as for new PWR design concepts. They will focus on complex heat transfer mechanisms in the steam generators and boron precipitation processes under postulated accident situations.

Two meetings of the steering bodies were held in 2008 during which the test conditions for the first series of tests were discussed.

The PRISME Project

Fire is a significant contributor to overall core damage frequency for both new and old plant designs. Questions of fire probabilistic safety analysis (PSA) that still remain open are the following:

- the propagation of heat and smoke from the room in which the fire is located to other rooms;
- the impact of heat and smoke on safety critical systems;
- the role of the ventilation network in limiting smoke and heat propagation.

The objective of the PRISME Project, which began in 2006 and in which 13 member countries participate, is to answer questions concerning smoke and heat propagation inside a plant by means of experiments tailored for code validation purposes. In particular, the project aims to provide answers regarding the failure time for equipment situated in nearby rooms and the effect of conditions such as room-to-room communi-

IRSN, France

Cable fire testing, before and after the test.

cation and the configuration of the ventilation network. The results obtained for the experimentally studied scenarios will be used as a basis for qualifying fire codes (either simplified zone model codes or computational fluid dynamics codes). After qualification, these codes could be applied for simulating other fire propagation scenarios in various room configurations with a good degree of confidence.

Tests were carried out and reported upon as scheduled in 2008. Two meetings of the project steering bodies were held in April and October. The conditions for the integral test series were addressed, including ways to support the experimental projects with analyses and code assessments. As requested by the project members, the French IRSN also prepared and submitted the plans and conditions for the four tests to be carried out in 2008, which were circulated among participants and subsequently revised according to the input received. These tests will also involve facility modifications to meet specific members' requirements.

The PSB-VVER Project

The objective of the PSB-VVER Project was 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 was initially planned for a four-year period. It was to consist 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.

Extensive pre- and post-test analyses accompanied the experimental programme throughout the experimental series.

Four project tests were successfully carried out and reported upon. The features of the fifth test were discussed and revised by members. This test was to simulate thermal-hydraulic conditions arising after a large-break LOCA in a VVER-1000 reactor, and would have been the first one run under these very demanding conditions. Difficulties encountered by the Operating Agent led to the postponement of the last test. A reduced power (10%) large-break LOCA test was conducted in January 2008 and was the subject of a benchmark exercise. Later in 2008 attempts to perform the full power test were unsuccessful and much more additional time would have been needed to achieve it. Hence, participants agreed to end the project there with the commitment from the Operating Agent that it would nevertheless attempt to carry out the full power test and would provide the results to participants if and when available.

The ROSA Project

The ROSA Project is to address issues in thermal-hydraulics analyses relevant to LWR safety using the ROSA (Rig-of-safety assessment) large-scale test facility of the Japan Atomic Energy Agency (JAEA). In particular, it will 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 in 14 countries, and will be conducted between April 2005 and December 2009. The overall objectives of the ROSA Project are to provide an integral and separate-effect experimental database to validate the code predictive capability and accuracy of models. In particular, phenomena coupled with multi-dimensional mixing, stratification, parallel flows, oscillatory flows and non-condensable gas flows are to be studied.

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;
- open tests: upper-head break and bottom break LOCA.

The programme includes a total of 12 tests, which had all been completed by the end of 2008 except one. Two project meetings were held in 2008. Project members discussed the issues to be addressed in a possible follow-up project, and the technical basis for a new 2009-2012 project period was defined. Based on this, a new project agreement was prepared.

The SCAP Project

The Stress Corrosion Cracking and Cable Ageing Project (SCAP), which is supported by 15 member countries, began in 2006. The International Atomic Energy Agency (IAEA) and the European Commission also participate as observers. The project's main objectives are to:

- establish two complete databases with regard to major ageing phenomena for stress corrosion cracking (SCC) and degradation of cable insulation respectively;
- establish a knowledge base by compiling and evaluating collected data and information systematically;
- perform an assessment of the data and identify the basis for commendable practices which would help regulators and operators to enhance ageing management.

The project is scheduled to last four years and the scopes and structures of the databases have been defined. The project is currently focusing on populating the data and

assessing the data. The assessment report will be published at the end of the project and provide the technical basis for commendable practices in support of regulatory activities in the fields of SCC and cable insulation.

The Management Board held its third meeting in June, approved the programme of work for 2008 and 2009, and decided to hold a workshop at the end of the project.

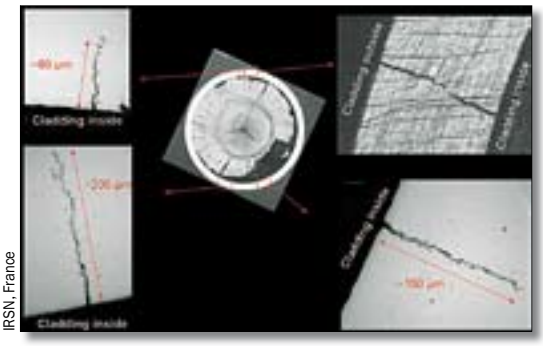
The SCIP Project

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 determine conditions that can lead to fuel failures. The project, in which 11 countries participate, has the main objective of improving the general understanding of cladding reliability at high burn-up through advanced studies on phenomena and processes that can impair fuel integrity during operation in power plants and during handling or storage. The project aims to achieve results of general applicability (i.e. not restricted to a particular fuel design, fabrication specification or operating condition). The results can consequently be used in solving a wider spectrum of problems and applied to different cases. It also aims to achieve experimental efficiency through the judicious use of a combination of experimental and theoretical techniques and approaches.

The SCIP Project has so far focused on the execution of several power ramps and on defining a hot cell programme addressing the various failure mechanisms which will be studied in the project. These are as follows:

- pellet-clad interaction (PCI): stress corrosion cracking initiated at the cladding inner surface under the combined effect of the mechanical loading and chemical environment caused by an increase in the fuel pellet temperature following a power increase;
- hydride embrittlement: time-independent fracture of existing hydrides;
- delayed hydride cracking (DHC): time-dependent crack initiation and propagation through fracture of hydrides that can form ahead of the crack tip.

The programme has been progressing very satisfactorily, producing evidence that is relevant for understanding the factors leading to cladding brittleness and the methods for reproducing in hot cell tests the stress-strain conditions that prevail in fuel power ramps. Two meetings of the project steering bodies took place in 2008. At the December 2008 meeting, all members clearly indicated their interest in continuing the project for a new five-year period. In addition, the project has been enriched with a new LOCA programme promoted by the USNRC on integral LOCA testing.



IRSN, France

Cross-section of ramp-tested BWR cladding showing incipient cracks on the outer and inner cladding surface.

The SERENA Project

The Steam Explosion Resolution for Nuclear Application (SERENA) Project was launched in 2007 with nine member countries participating. Its predecessor programme sought to evaluate the capabilities of the current generation of fuel-coolant interaction (FCI) computer codes in predicting steam-explosion-induced loads in reactor situations, and to identify confirmatory research that would be needed to bring predictability of FCI energetics to required levels for risk management. The programme concluded that in-vessel FCI would not challenge the integrity of the containment whereas this cannot be excluded for ex-vessel FCI. However, the large scatter of the predictions indicated lack of understanding in some areas, which makes it difficult to quantify containment safety margins to ex-vessel steam explosion. The results clearly indicated that uncertainties on the role of void (gas content and distribution) and corium melt properties on initial conditions (pre-mixing) and propagation of the explosion were the key issues to be resolved to reduce the scatter of the predictions to acceptable levels. Past experimental data does not have the required level of details to answer the question.

The present programme has been formulated to resolve the remaining uncertainties by performing a limited number of focused tests with advanced instrumentation reflecting a large spectrum of ex-vessel melt compositions and conditions, as well as the required analytical work to bring the code capabilities to a sufficient level for use in reactor case analyses. The objective of the SERENA experimental programme is threefold:

- to provide experimental data to clarify the explosion behaviour of prototypic corium melts;
- to provide experimental data for validation of explosion models for prototypic materials, including spatial distribution of fuel and void during the pre-mixing and at the time of explosion, and explosion dynamics;
- to provide experimental data for the steam explosion in more reactor-like situations to verify the geometrical extrapolation capabilities of the codes.

These goals will be achieved by using the complementary features of the TROI (Korea Atomic Energy Research Institute) and KROTOS (Commissariat à l'énergie atomique) corium facilities, including analytical activities. The KROTOS facility is more suited for investigating the intrinsic FCI characteristics in one-dimensional geometry. The TROI facility is better suited for testing the FCI behaviour of these materials in reactor-like conditions by having more mass and multi-dimensional, melt-water interaction geometry. The validation of models against KROTOS data and the verification of code capabilities to calculate more reactor-oriented situations simulated in TROI will strengthen confidence in code applicability to reactor FCI scenarios. Two meetings of the steering bodies of this project were held in 2008 and the results of the first two tests were presented. In parallel,

analytical activities were undertaken to prepare and then to assess these tests.

The SETH-2 Project

The SESAR Thermal-hydraulics (SETH) Project, supported by 14 member countries, was conducted from 2001 to 2007. It consisted of thermal-hydraulic experiments in support of accident management, which were carried out at facilities identified by the CSNI as those requiring international collaboration to sponsor their continued operation. The experiments carried out at the Paul Scherrer Institute (PSI) PANDA facility in Switzerland provided 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.

A follow-up to the project, called SETH-2, was launched in 2007 and will make use of the PANDA facility and the MISTRA facility of the French Commissariat à l'énergie atomique (CEA). Nine countries are participating. The project aims to resolve key computational issues for the simulation of thermal-hydraulic conditions in reactor containments and will benefit from the complementarity of the two facilities. Two meetings of the project steering bodies were held in 2008 and were devoted to presenting the first test results and to discussing the parameters and boundary conditions to be chosen for the remaining test.

The THAI Project

The Thermal-hydraulics, aerosols and iodine (THAI) Project, is supported by eight member countries and began in 2007. It consists of thermal-hydraulic experiments aiming at resolving uncertainties related to combustible hydrogen and to the behaviour of fission products, in particular iodine and aerosols. The proposed experiments are designed to fill knowledge gaps by delivering suitable data for the evaluation and simulation of the hydrogen and fission product interactions mentioned above, thus supporting the validation of accident simulation codes and models. The experiments are conducted in the THAI facility, which is operated by Becker Technologies GmbH in Germany. The Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) and AREVA NP GmbH also support the programme.

In the case of hydrogen, uncertainties mainly arise in relation to determining conditions for the occurrence of deflagration flames, and the performance of devices, such as passive autocatalytic recombiners, designed to reduce the concentration of hydrogen gas developed in a hypothetical accident. Some concern also exists regarding the applicability of several previous experiments where helium was used to simulate hydrogen. The relevance to reactor safety is connected with the destructive potential of fast deflagrations.

In the case of fission products, a number of transport processes have not yet been investigated to a level of detail sufficient to establish reliable transport models. Such processes include iodine exchange between turbulent atmospheres and walls, relocation by wash-down (washing the walls with condensate water), airborne chemical reaction of iodine with radiolytic ozone, and aerosol resuspension from a boiling sump. The control of volatile radioactive species is relevant to the potential accident source term and the radioactivity management.

In 2008, two meetings of the project steering bodies were held to discuss the results of the hydrogen combustion tests performed and the parameters for the remaining tests to be undertaken in 2009. Hydrogen distribution tests performed in 2007 were used to support a blind benchmark exercise in 2008, followed by an open one which has enabled a better understanding of the modelling of hydrogen mixing in steam environments. In 2009, a benchmark of a hydrogen combustion test will be conducted in co-operation with the CSNI Working Group on Analysis and Management of Accidents (WGAMA).

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. A new three-year mandate began in January 2008. 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 part of the project has concentrated on the development of the COMPSIS data collection guidelines, quality assurance and data exchange interface. Recently, countries have begun submitting data. Two meetings of the COMPSIS steering body were held in 2008 and a report on the first three years of achievements was issued.

The FIRE Project

The Fire Incidents Records Exchange (FIRE) Project started in 2002 and its current mandate runs until the end of 2009. Twelve countries participate. The main purpose of the project is to collect and to 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;

- record event attributes to enable quantification of fire frequencies and risk analysis.

The structure of the database is now well-defined and arrangements have been made in all participating countries to collect and to validate data. Similar to the OPDE Project, the group is reviewing and collecting past events in addition to events having taken place during the year. The quality-assurance process is in place and has proved to be efficient on the first set of data provided. An updated version of the database, which now contains more than 340 records, is provided to participants every year. Two meetings of the project steering body were held during 2008.

The ICDE Project

The International Common-cause Data Exchange (ICDE) Project collects and analyses operating data related to common-cause failures (CCF) that have the potential to affect several systems, including safety systems. The project has been in operation since 1998, and was extended with a new agreement covering the period April 2008-March 2011. 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 CCF events that are risk contributors, and member countries use the data for their national risk analyses. More activities in the area of quantification are under discussion. Reports have been produced for pumps, diesel generators, motor-operated valves, safety and relief valves, check valves, batteries, switchgear and breakers and reactor-level measurement. Data exchange for heat exchangers and control rod drive component exchange is ongoing.

Two project meetings were held in 2008. The next ICDE steering group meeting will take place in March 2009.

The OPDE Project

The Piping Failure Data Exchange (OPDE) Project started in 2002. A new three-year phase of the project was started in June 2008. Currently, 11 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 scope of the OPDE Project includes all possible events of interest with regard to piping failures in the main safety systems. It also covers 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. An updated version of the database is provided to participants every six months. Two Project Review Group meetings were held in 2008. A joint workshop on Risk-informed Piping Integrity Management was also organised between the OPDE Project and the CSNI Working Group on Integrity of Components and Structures (IAGE) to discuss the applications and uses of the OPDE database.

RADIOACTIVE WASTE MANAGEMENT

The CPD Programme

The NEA Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD) is a joint undertaking which functions within the framework of an agreement between 22 organisations actively executing or planning the decommissioning of nuclear facilities. It has operated under Article 5 of the NEA Statute since its inception in 1985, and a revised Agreement between participants will come into force on 1 January 2009 for a period of five years. The objective of the CPD is to acquire and to share information from operational experience in the decommissioning of nuclear installations that is useful for future projects.

The information exchange also ensures that best international practice is made widely available and encourages the application of safe, environmentally friendly and cost-effective methods in all decommissioning projects. It is based on biannual meetings of the Technical Advisory Group (TAG), during which the site of one of the participating projects is visited, and positive and less positive examples of decommissioning experience are openly exchanged for the benefit of all. Currently 39 projects under active decommissioning (23 reactors and 16 fuel facilities) are included in the information exchange.

Although part of the information exchanged within the CPD is confidential and restricted to programme participants, experience of general interest gained under the programme's auspices is released for broader use. In this context, the CPD is collecting and analysing its experience on remote dismantling techniques and on decontamination and dismantling of concrete structures. The resulting information will be provided to the relevant NEA committees and working groups for their review and consideration for publication as NEA reports. The CPD plans to finalise both draft reports in 2009.

The Sorption-3 Project

Radionuclide sorption is one of the most important processes with regard to the prevention or retardation of radionuclide migration to the biosphere and the overriding objective of the Sorption Project is to demonstrate the potential of thermodynamic sorption models to improve confidence in the representation of radionuclide sorption in the context of radioactive waste disposal. This objective will be met if it can be shown that the major physical-chemical mechanisms underlying the sorption of a radioelement by different types of solid materials are understood, and if it can be demonstrated that it is possible to represent the process-defining parameters with reasonable accuracy as a function of variations in relevant system parameters.

After a first phase of the Sorption Project (1997-1998) investigating the potential of thermodynamic models for improving the presentation of sorption in performance assessments for geological repositories, and a second phase (2000-2004) demonstrating the consistency and applicability of different thermodynamic models, a third phase of the Sorption Project was started in November 2007 with a mandate until April 2010. Organisations involved in geological disposal from 12 countries are participating in this project that comprises the production of a guideline document which addresses thermodynamic sorption model development and the use of such models in building a safety case. It will also include a workshop to discuss the draft document with interested parties. An important objective of the project is to facilitate communication with waste management organisations as well as regulatory authorities.

Since the start of the project a Technical Direction Team has been appointed to undertake the main drafting task, as have other experts to provide specific inputs and to undertake review tasks. By the end of 2008, significant progress had been achieved in drafting the first two chapters of the document.

The TDB-4 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 series edited by the Data Bank. Phase 3 of the TDB Project was completed at the end of January 2008.

A new fourth phase of the TDB Project (TDB-4) was started subsequently, with the remaining tasks of the third phase having been transferred to the new phase. Sixteen organisations from 14 countries are participating in this new phase.

Remaining tasks from Phase 3 include the completion and publication of the reviews of chemical thermodynamic data for inorganic compounds and complexes of iron (Fe) and tin (Sn). The review on thorium was sent to print for publication in January 2009. The fourth phase of the project will comprise complementary studies of inorganic species and compounds of iron, a review of auxiliary data, an update of the selected value database accrued during the first three phases of the project, and a review of inorganic species and compounds of molybdenum (Mo).

RADIOLOGICAL PROTECTION

The ISOE System

Since its creation in 1992, the Information System on Occupational Exposure (ISOE), jointly sponsored with the IAEA, has been facilitating the exchange of data, analysis, lessons and experience in occupational radiological protection (RP) at nuclear power plants worldwide. At the beginning of 2008, the new ISOE Terms and Conditions came into force. As of December 2008, membership in ISOE included 59 participating utilities in 26 countries and the regulatory authorities of 22 countries.

The ISOE programme maintains the world's largest occupational exposure database and a network of utility and regulatory authority RP experts. Four ISOE Technical Centres (Europe, North America, Asia and the IAEA) manage the programme's daily technical operations of analysis and exchange of information and experience. The ISOE occupational exposure database contains information on occupational exposure levels and trends at 470 reactors (396 in operation and 74 in cold-shutdown or some stage of decommissioning) in 29 countries, covering about 91% of the world's operating commercial power reactors. Since its inception, ISOE participants have used this dual system of databases and communications networks to exchange occupational exposure data and information for dose trend analyses, technique comparisons, and cost-benefit and other analyses promoting the application of the as low as reasonably achievable (ALARA) principle in local radiological protection programmes.

In 2008, 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, on improving the quality of its occupational exposure database and on migrating ISOE resources to the ISOE Network website. The four regional ISOE Technical Centres continued to support their regional members through specialised data analyses and benchmarking visits. ISOE information and experience exchange continued through the successful organisation and hosting of the 2008 international ALARA Symposium (in Japan) and regional ALARA symposia (in the United States and Finland).

The ISOE Network web-based information portal (www.isoe-network.net) continued to serve as a "one-stop" website for ISOE information and experience exchange. Development of web-based input modules for occupational exposure data collection were finalised in 2008, and will be implemented on the Network in 2009.

At its annual meeting, the ISOE Management Board approved the publication of a report on *Work Management to Optimise Occupational Radiological Protection in the Nuclear Power Industry*, which takes into account new experience and technology in occupational radiation dose reduction and 15 years of information exchange under the ISOE programme. The Management Board also approved a proposal for improving the data collection, analysis and experience exchange aspects of participating reactors undergoing decommissioning. The ISOE ad hoc expert group for the revision of the International Basic Safety Standards (BSS) provided, through the CRPPH, input into the BSS revision process with respect to good practice in occupational exposure.

General Information

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Information and Communications

Nuclear energy decision making and stakeholder participation need to be based on knowledge and 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

- Numerous activities were carried out in conjunction with the celebration of the NEA's 50th anniversary and the publication of the Agency's first *Nuclear Energy Outlook*.
- Overall, the Agency produced 51 publications in 2008, of which 16 were put on sale and 35 were distributed free of charge.
- Six press releases were issued on a diverse range of topics.
- NEA information and publications stands were organised at five international conferences.

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 these activities are reflected in the Agency's large selection of publications and reports.

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NEA 50th anniversary. Above: A. Gurría, OECD Secretary-General, and M. ElBaradei, IAEA Director-General. Below: partial view of the participants at the special anniversary session.

Public affairs and relations with the press

The Agency responded to a steady volume of media inquiries and organised a number of interviews. Journalists' subjects of interest included nuclear energy in Europe; the UK decision on nuclear power; uranium supply; the nuclear incidents at the Krško nuclear power plant in Slovenia, at the AREVA facilities in Tricastin, France, and at the Vandellós nuclear power plant in Spain; nuclear energy prospects in the Middle East; and the Agency's *Nuclear Energy Outlook* (NEO).

In addition to responding to media inquiries, the Agency issued six press releases during the year. They covered the new phase of the Multinational Design Evaluation Programme (MDEP), the launch of the 2008 edition of the "Red Book" (*Uranium 2007: Resources, Production and Demand)*, the 50th anniversary of the OECD Halden Reactor Project, the publication of *Nuclear Energy Data 2008*, the 50th anniversary of the NEA and the launch of the *Nuclear Energy Outlook* (NEO). The latter two were the object of specific media events (see pages 10-11 for further details).

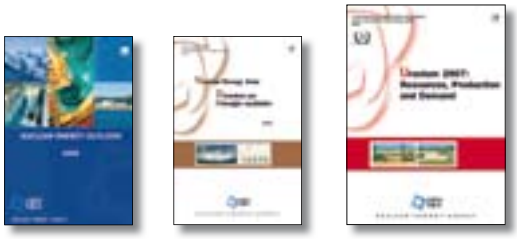
A new service was launched for journalists in 2008, providing online, password-protected access to selected publications on sale via the NEA website. This measure was undertaken to improve the speed of service, cost-effectiveness in terms of distribution and outreach. Journalist

copies of the *Nuclear Energy Outlook* provided through this service were downloaded 583 times.

As in previous years, articles on nuclear energy continued to be authored by members of the NEA secretariat for the trade press.

Publications

In 2008, the Agency produced 51 publications, of which 16 were put on sale and 35 were distributed free of charge. The list of these publications is provided on page 44. Best sellers included the *Nuclear Energy Outlook* (NEO); *Uranium 2007: Resources, Production and Demand*; *Nuclear Energy Data 2008*; and the *Nuclear Law Bulletin*. All free reports published by the NEA are made available in pdf format on the NEA website. Executive summaries of the *Nuclear Energy Outlook* were also provided free of charge on the NEA website in ten languages. These summaries have been downloaded 6 700 times thus far (including 2 700 times in Italian, 1 800 in English and 500 in Japanese). Further details about the *Nuclear Energy Outlook*, which represented a major Agency-wide effort, are available on page 11.



NEA News is the Agency's specialised journal, published in English and French, which strives to keep NEA correspondents and other interested professionals abreast of significant findings and advances in the Agency's programme of work. It provides feature articles on the latest developments in the nuclear energy field, as well as updates on NEA work, news briefs, and information about NEA publications and forthcoming events. In 2008, a special 50th anniversary issue was prepared, including the reproduction in full of the NEO Executive Summary. *NEA News* is available free of charge on the Agency's website at www.nea.fr/html/pub.

Internet-based communication

The NEA website continues to play a crucial role in disseminating the work of the Agency. Website traffic persisted in its steady growth during 2008 with, on average, over 3 200 people using the site's services each day. The areas that attracted the most visitors were the Data Bank, nuclear science, nuclear safety, publications and radiological protection. The most accessed reports in the course of 2008 concerned *Nuclear Energy Today* (39 000 downloads); *Externalities and Energy Policy: The Life Cycle Analysis Approach* (31 000 downloads); *Chernobyl: Assessment of Radiological and Health Impacts* (28 000 downloads); and *Nuclear Electricity Generation: What Are the External Costs?* (25 000 downloads).

The number of individual subscriptions to the Agency's monthly electronic bulletin reached nearly 7 900 subscribers by the end of the year. Distributed free of charge, the bulletin includes monthly updates on important NEA activities and newly released reports. A sign-up form is available at www.nea.fr/html/signon.html.

Online interaction with NEA delegates continues to expand. Most NEA committees and their working groups use some form of electronic communication, such as dedicated download areas, e-mail discussion lists or online collaborative work spaces to support their work; many now use several.

The Delegates' Area on the NEA website also continues to provide an important service for many NEA committees and working groups. This section of the website provides authorised users with OECD official documents, information on forthcoming NEA meetings, contact details for other committee members, as well as access to the presentations and background notes prepared for the Steering Committee policy debates.

NEA visibility in international fora

NEA information and publications stands were organised at five international conferences in 2008. These included:

- OECD Forum 2008 (June, Paris, France);
- International Conference on the Physics of Reactors – PHYSOR'08 (September, Interlaken, Switzerland);
- Decommissioning Challenges: An Industrial Reality? (September-October, Avignon, France);
- 10th Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation (October, Tokai-Mura, Japan);
- UN Framework Convention on Climate Change, 14th Conference of the Parties (December, Poznan, Poland).

Some 1 500 reports were distributed in conjunction with these events. The NEA was also active in co-sponsoring a number of international conferences. Of particular note were the 11th International Conference on Radiation Shielding (ICRS-11) held in April in the United States; the International Conference on Radioecology and Environmental Radioactivity held in June in Norway; the PHYSOR'08 conference held in September in Switzerland; the Decommissioning Challenges: An Industrial Reality? conference held on 28 September-2 October in France; and the TOPSAFE 2008 International Topical Meeting on Safety of Nuclear Installations held in October in Croatia.

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Nuclear Energy and Civil Society

RADIOACTIVE WASTE MANAGEMENT

Forum on Stakeholder Confidence

The RWMC Forum on Stakeholder Confidence (FSC) documented a "Link between Research, Development and Demonstration (RD&D) and Stakeholder Confidence: Use of Analogues for Confidence Building". At a topical session held in June, case studies were presented from Finland, Spain and Switzerland and from joint international endeavours (EC projects NAnet and PAMINA). The presentations gave an overview of how natural analogues have been used by technologists, implementers and regulators in examining the safety case and in communicating with the public about safety. Both natural and anthropogenic (archaeological and contemporaneous) analogues were considered. Significant input was received from members of the RWMC Integration Group for the Safety Case (IGSC). The summary overview, available online in the proceedings [NEA/RWM/FSC(2008)3], offers definitions, recommendations and some novel perspectives in this area.

In another activity, the FSC addressed Tools and Processes for Involving Stakeholders: Law and Policy Issues in Stakeholder Involvement. Stakeholder involvement in environmental decision making is not a luxury, but law. The Aarhus Convention, for example, provides for stakeholder access to information, participation and justice, and there have been successful legal challenges in the nuclear domain on this basis. The FSC reviewed how its member organisations not only conduct formally required consultation, but also foster deeper involvement of stakeholder partners. Discussion focused notably on definitions of the "affected or concerned public", who must be involved in planning and decisions.

The FSC has long been sensitive to the social values that underlie differing stakeholder perceptions and positions. A new cross-cutting activity enhances the awareness of the symbolic weight of some of the key concepts for stakeholders that are dealt with in waste management, such as safety, landscape and community. The FSC addressed these issues with presentations outlining the concepts, proposing related methods for identifying and responding to the symbolic and value-laden aspect underlying decisions, and analysing case examples. Following an FSC session and small group discussion, the group began preparing a review paper which will present the messages heard plus the lessons to be learnt from both FSC and non-FSC literature. It was agreed that new cases may be presented by FSC members in future.

RADIOLOGICAL PROTECTION

The trend in radiological protection towards judgemental optimisation of protection brings with it an increasing importance of the participation of civil society in decision-making processes. The crucial role of stakeholder involvement in the NEA Committee on Radiation Protection and Public Health (CRPPH) programme of work over the years has kept the committee actively engaged in this work. In 2008, the CRPPH continued its focus on the exchange of specific, concrete experience in stakeholder engagement and in this context decided to hold a workshop in 2010 on stakeholder engagement in post-accident consequence management. This work will be supported by an assessment of the results of the INEX-3 international nuclear emergency exercise and a study of the CRPPH Expert Group on Stakeholder Involvement and Organisational Structures (EGSIOS). In addition, the EGSIOS will specifically survey emergency response organisations with regard to stakeholder involvement impacts on their processes and structures for input to the workshop. The INEX-4 exercise will also address the involvement of stakeholders in post-accident consequence management to follow up on issues identified during the INEX-3 exercise.

NUCLEAR REGULATORS AND THE PUBLIC

Information officers from regulatory bodies meet once a year under the auspices of the Working Group on Public Communication of Nuclear Regulatory Organisations (WGPC) to exchange information and experience related to communication with the public and to carry out related studies. The main activity in 2008 consisted in issuing a report on the main outcomes of the three workshops held from 2000 to 2007 and in establishing a programme of work for the coming years. The report, entitled "Achievements and Challenges in Nuclear Regulatory Communication with the Public" is available on the NEA website under reference NEA/CNRA/R(2008)4. Future reports from the WGPC will address: transparency in regulatory activities, local public information, the use of public perception surveys and communication during emergency situations.

T. Foulon, CEA, France

Volcanic glass.

JNES, Japan

NEA workshop on public communication.

Organisational Structure 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 members of the **Bureau of the Steering Committee** for Nuclear Energy are (as at its autumn 2008 meeting):

Mr. Richard STRATFORD (United States), Chair
Mr. Olivier CARON (France), Vice-Chair
Dr. József RÓNAKY (Hungary), Vice-Chair
Dr. Walter SANDTNER (Germany), Vice-Chair
Mr. Takayuki SHIRAO (Japan), 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 on page 42.

The Steering Committee for Nuclear Energy and the Agency's seven standing technical committees are serviced by **the NEA Secretariat**, composed in 2008 of 65 professional and support staff from 17 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.

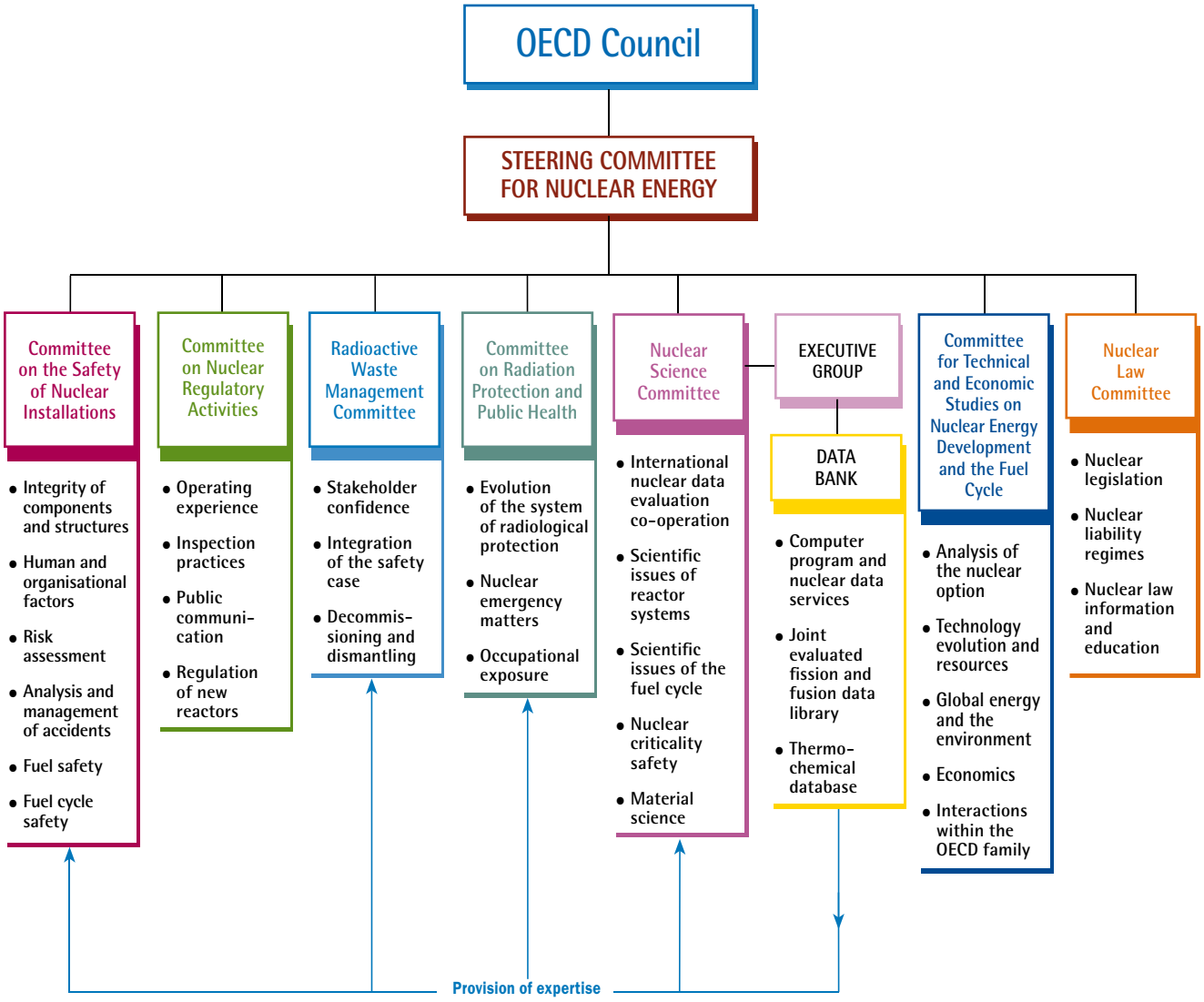
Participation in the work of the Agency by **non-member countries** is an established practice. The Russian Federation holds regular observer status in all the Agency's standing technical committees and their working groups. Slovenia participates as a regular observer in the seven standing technical committees. Selected other countries take part in NEA activities on a more ad hoc basis.

G. Bassignac, © OECD/NEA

OECD Headquarters and conference centre (left and above); NEA offices (right).

B. Baudoin, © OECD/NEA

NEA Committee Structure in 2008



NEA Secretariat Structure in 2008

Luis Echávarri
Director-General

Janice Dunn Lee
Deputy Director-General

Uichiro Yoshimura
Deputy Director
Safety and Regulation
(T. Tanaka until July 2008)

Thierry Dujardin
Deputy Director
Science and Development

Karen Daifuku
Head
Central Secretariat, External Relations and Public Affairs

John Hembury
Head
Management Support Unit

Julia Schwartz
Head
Legal Affairs

Hans Riotte
Head of Division
Radiological Protection and Radioactive Waste Management

Javier Reig
Head of Division
Nuclear Safety

Stan Gordelier
Head of Division
Nuclear Development

Akira Hasegawa
Head
Data Bank

Claes Nordborg
Head of Section
Nuclear Science

NEA Publications Produced in 2008

General Interest

Annual Report 2007
ISBN 978-92-64-99046-3. Free: paper or web.

NEA 50th Anniversary (historical review)
Free: paper or web.

NEA News
Volume 26
ISSN 1605-9581. Free: paper or web.

Nuclear Development and the Fuel Cycle

Market Competition in the Nuclear Industry
ISBN 978-92-64-05406-6. Price: € 39, US$ 60, £ 30, ¥ 6 200.

Nuclear Energy Data 2008
ISBN 978-92-64-04796-9. Price: € 30, US$ 46, £ 21, ¥ 4 100.

Nuclear Energy Outlook 2008
ISBN 978-92-64-05410-3. Price: € 105, US$ 161, £ 81, ¥ 16 800.

Nuclear Energy Outlook 2008 – Executive Summaries
Available in Chinese, English, French, German, Hungarian, Italian, Japanese, Korean, Russian and Spanish.
Free: paper or web.

Timing of High-level Waste Disposal
ISBN 978-92-64-04625-2. Price: € 45, US$ 69, £ 32, ¥ 6 200.

Uranium 2007: Resources, Production and Demand
ISBN 978-92-64-04766-2. Price: € 120, US$ 186, £ 86, ¥ 16 600.

Nuclear Safety and Regulation

CSNI Collective Statement on Support Facilities for Existing and Advanced Reactors
The Function of OECD/NEA Joint Projects
NEA Committee on the Safety of Nuclear Installations (CSNI)
ISBN 978-92-64-99052-4. Free: paper or web.

Regulatory Goal of Assuring Nuclear Safety (The)
ISBN 978-92-64-99044-9. Free: paper or web.

Role of Research in a Regulatory Context (RRRC-2) (The)
Workshop Proceedings, Paris, France, 5 December 2007
ISBN 978-92-64-99045-6. Free: paper or web.

Radioactive Waste Management

Moving Forward with Geological Disposal of Radioactive Waste
A Collective Statement by the NEA Radioactive Waste Management Committee (RWMC)
ISBN 978-92-64-99057-9. Free: paper or web.

Regulating the Decommissioning of Nuclear Facilities
Relevant Issues and Emerging Practices
ISBN 978-92-64-99059-3. Free: paper or web.

Regulating the Long-term Safety of Geological Disposal of Radioactive Waste: Practical Issues and Challenges
Workshop Proceedings, Paris, France, 28-30 November 2006
ISBN 978-92-64-04812-6. Price: € 40, US$ 62, £ 28, ¥ 5 500.

Release of Radioactive Materials and Buildings from Regulatory Control
A Status Report
ISBN 978-92-64-99061-6. Free: paper or web.

Safety Cases for Deep Geological Disposal of Radioactive Waste: Where Do We Stand?
Symposium Proceedings, Paris, France, 23-25 January 2007
ISBN 978-92-64-99050-0. Free: paper or web.

Radiological Protection

Occupational Exposures at Nuclear Power Plants
Sixteenth Annual Report of the ISOE Programme, 2006
ISBN 978-92-64-99042-5. Free: paper or web.

今日の世界における放射線防護：持続可能性に向けて
Japanese version of Radiation Protection in Today's World:
Towards Sustainability
ISBN 978-92-64-99063-0. Free: paper or web.

Stakeholder Dialogue on the Implications of the ICRP Recommendations (A)
Summary of the Three NEA/ICRP Conferences
ISBN 978-92-64-99033-3. Free: paper or web.

Nuclear Science and the Data Bank

Analytical Benchmarks for Nuclear Engineering Applications
Case Studies in Neutron Transport Theory
ISBN 978-92-64-99056-2. Free: paper or web.

Burn-up Credit Criticality Benchmark – Phase II-C
Impact of the Asymmetry of PWR Axial Burn-up Profiles on the End Effect
ISBN 978-92-64-99049-4. Free: paper or web.

International Evaluation Co-operation, Volume 26 (+ CD-ROM)
Uncertainty and Target Accuracy Assessment for Innovative Systems Using Recent Covariance Data Evaluations
ISBN 978-92-64-99053-1. Free: paper or web.

Structural Materials for Innovative Nuclear Systems (SMINS)
Workshop Proceedings, Karlsruhe, Germany, 4-6 June 2007
ISBN 978-92-64-04806-5. Price: € 110, US$ 170, £ 79, ¥ 15 200.

Utilisation and Reliability of High Power Proton Accelerators (HPPA5)
Workshop Proceedings, Mol, Belgium, 6-9 May 2007
ISBN 978-92-64-04478-4. Price: € 100, US$ 140, £ 72, ¥ 13 900.

Nuclear Law

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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.

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NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1 February 1958 under the name of the OEEC European Nuclear Energy Agency. It received its present designation on 20 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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