The background of the cover is a blurred photograph of a nuclear power plant. Several large, cylindrical cooling towers are visible, with their forms softened by a shallow depth of field. The scene is bathed in a warm, golden light, suggesting either sunrise or sunset. The overall aesthetic is clean and professional, with a focus on the industrial subject matter.

NEA

Annual Report

2000

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

Organisation for Economic Co-operation and Development



The NEA in Brief

27 Member countries (21 in the Data Bank)

42 years of international service

7 standing technical committees

14 international joint projects funded by participants

72 professional and support staff

535 national experts participating in NEA committees

3 750 experts participating in policy and technical meetings organised at OECD headquarters

FF 59 million budget for the NEA in 2000, supplemented by voluntary contributions

FF 16 million budget for the Data Bank in 2000, supplemented by voluntary contributions

75 publications in 2000

Governing body: the Steering Committee for Nuclear Energy

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 co-operates with non-member countries of Central and Eastern Europe (CEEC) and the New Independent States (NIS) of the former Soviet Union.



Table of Contents

I. 2000 in Perspective	4
from the Director-General of the NEA	
II. Trends in Nuclear Power	6
III. Technical Programmes	10
Nuclear Development and the Fuel Cycle	10
Nuclear Safety and Regulation	12
Radiation Protection	16
Radioactive Waste Management	18
Nuclear Science	20
Data Bank	22
Legal Affairs	24
Joint Projects and Other Co-operative Projects	26
IV. General Information	30
Information Programme	30
NEA Publications Produced in 2000	32
Main Workshops and Seminars Held in 2000	37
Organisation Charts of the NEA	38



Mr. Luis Echávarri
Director-General of the NEA

2000 In Perspective

Events in 2000 in the international energy market reminded us that reliable supplies of energy at affordable prices are not a given, and that the public and private sectors need to work together in order to help provide a reasonable balance that is beneficial to all.

Fortunately, there are some energy sectors – and nuclear energy is one of them – which benefit from stable prices and are largely immune to supply disruptions. In addition, nuclear energy has the added advantage of not contributing to climate change because it emits virtually no carbon dioxide.

It is nevertheless very important to ensure that proper attention is paid to infrastructure and technology issues in the nuclear energy area. Regardless of the future of nuclear power, high-quality, nuclear-related competencies will be required for a long time to come, whether it be for making sure that operating plants work safely, or that plants being decommissioned are done so fittingly. Preservation of knowledge acquired over the years will help support the work of the next generation of engineers, who were not present when the industry was getting started. Continuous funding of research and development is necessary to improve current technology, including its safety and cost, and to develop new technologies and working methods.



Point Lepreau, AECL, Canada



The nuclear power sector also continues to face a number of other challenges. In particular, scientific and technical arguments alone have been found insufficient to gain wide public confidence and support for this energy source. The good nuclear safety records in OECD countries have often been unable to carry a sufficiently convincing message, and the management of nuclear waste remains a sensitive area for the public, in spite of the confidence expressed by the experts that solutions exist.

With this in mind, it has been found that greater public participation in nuclear energy decision making can contribute to improving mutual understanding among the various groups concerned – industry, government, civil society. The NEA has been working to help facilitate exchanges of information and experience in this field, as readers will see in the following pages.

At a time of ever-tighter government budgets, it is in Member countries' interest to pool their efforts in order to obtain maximum cost-effectiveness in relation to the investments made. Throughout 2000, the NEA strived to meet its primary objective of assisting 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. Our efforts have yielded positive results, which we will continue to pursue in future.



Trends in Nuclear Power

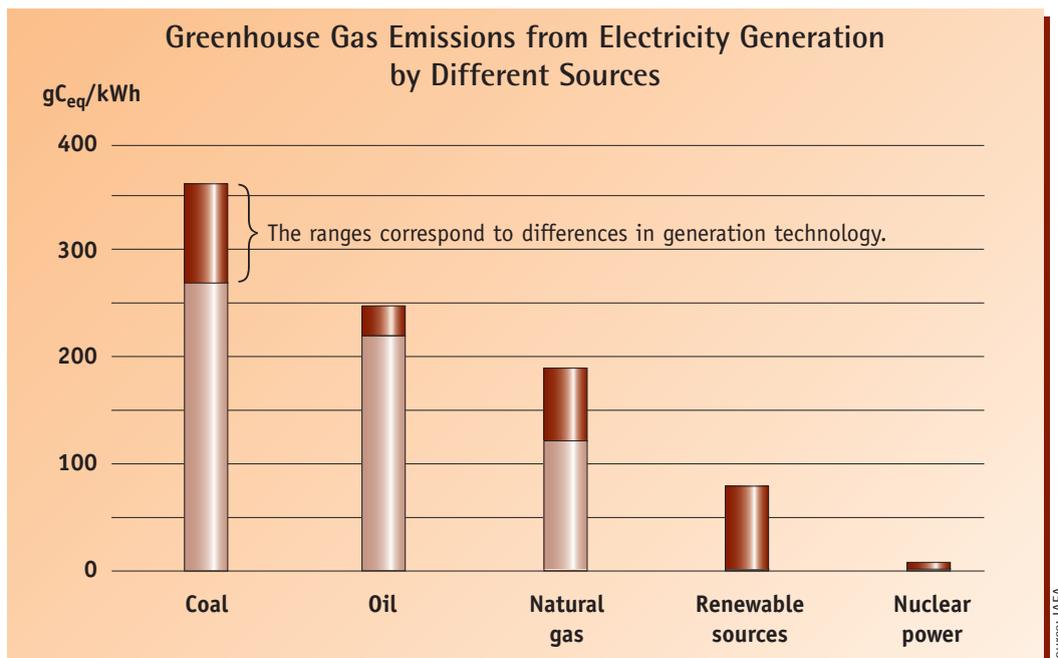
Nuclear energy development

At the end of 2000, a total of 359 nuclear power units were in operation in OECD countries, providing approximately 24% of the electricity supply. Three units were shut down in 2000: one in Germany and two in the United Kingdom. Twelve units were under construction: two in the Czech Republic, four in Japan, four in the Republic of Korea and two in the Slovak Republic.

Key trends that affected nuclear power development in 2000 included the continued deregulation of electricity markets, privatisation of the power sector and increasing awareness of environmental

the nuclear industry, including mergers and acquisitions for improving the profitability of the companies involved.

Global climate change is a key issue for Member countries committed to achieving their Kyoto Protocol targets through measures for reducing greenhouse gas emissions. Nuclear power, a nearly carbon-free energy source, has already played an important role in avoiding greenhouse gas emissions. Some countries consider nuclear energy as a key component of energy mixes that will help meet the requirements of the Kyoto Protocol.

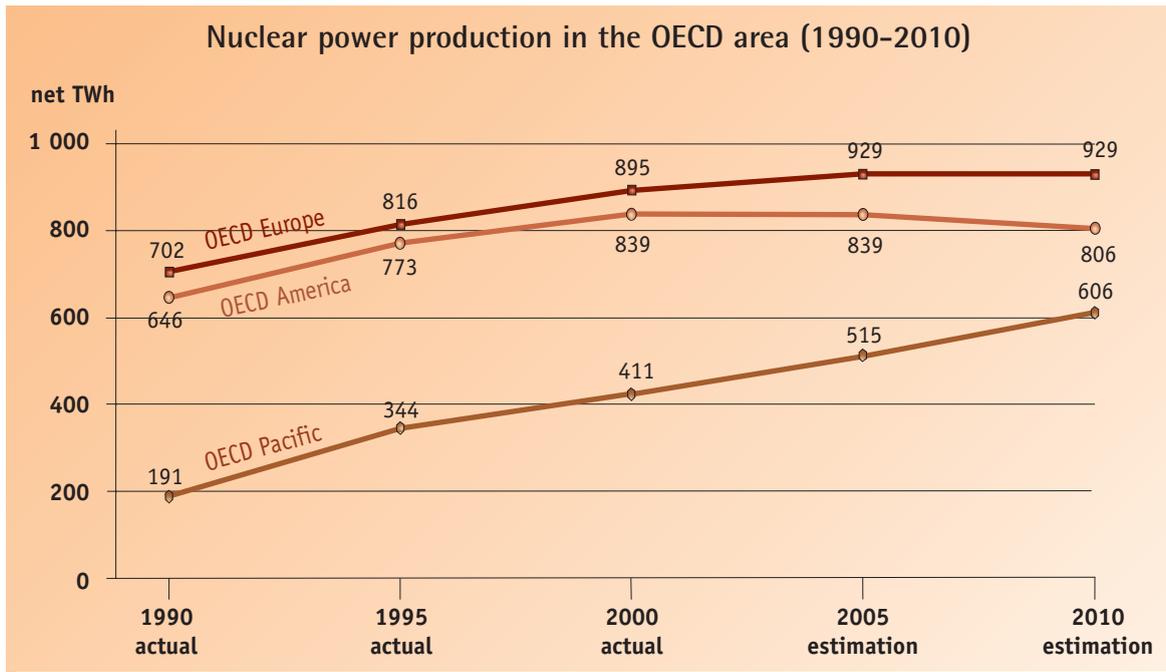


issues, especially the risk of global warming. In the medium and long term, the evolution of nuclear energy programmes in the OECD area is likely to be influenced by the implementation of sustainable development policies integrating economic, environmental and social goals.

Market deregulation has increased the incentive for nuclear power plant operators to enhance efficiency and, in fact, availability factors of existing nuclear units in OECD countries have generally been steadily increasing. There is also economic incentive to extend the lifetimes of plants that are operating well and the first such extensions up to 60 years have been granted to a few plants in the US. In addition, market competition has accelerated restructuring in

The turn of the century has brought a renewed interest in advanced reactors that would meet the requirements of society for economical and environmentally friendly energy sources. International initiatives – such as the Generation IV International Forum (initiated by the US Department of Energy) and the International Atomic Energy Agency (IAEA) International Project on Innovative Nuclear Reactors and Fuel Cycles – demonstrate a willingness to focus research and development efforts on designing nuclear energy systems adapted to future needs.

For the coming decade, electricity demand is expected to increase slowly in OECD countries. The percentage share of nuclear in total electricity generation is expected to decrease during the same period,



except in the OECD Asia-Pacific area, because there are very few plans for building new nuclear power units in OECD Europe and America, and some units are expected to be retired. Total nuclear electricity generation is, however, estimated to increase.

Nuclear safety and regulation

Once again the safety performance of the nuclear power plants operating in OECD/NEA countries was very good in 2000. No accident resulting in radioactive releases to the public took place and the data on performance indicators collected by industry organisations and regulatory bodies continued to show an improving trend.

Concerns remain in a number of OECD/NEA countries regarding the adequacy of the research programmes and infrastructure to

support the safe operation of nuclear power plants in the future. Initiatives are being taken both at the national and international levels to alleviate these concerns, including the establishment of joint, international research projects.

The regulatory and safety challenges arising from the introduction of competition in the electricity market continue to receive attention. Regulatory inspection programmes are being re-examined to ensure that they are adequate to detect early signs of declining safety performance. In addition, regulatory bodies are examining their own performance and seeking ways to increase and measure their effectiveness. Quality management models are being developed and implemented in many countries, along with indicators of regulatory performance. The issue of public confidence in the regulatory authority is also being addressed.

Radiation protection

The international radiation protection system is currently under review and further developments are being considered. While there is widespread belief that the present system is robust, and not under-protecting the public and workers, there is growing pressure for it to evolve towards greater coherence, clarity and transparency.

The overall coherence of the system of radiation protection has come under scrutiny. For example, the radiological criteria used for optimising protection in normal circumstances are inappropriate for judging optimisation in post-accident situations. Releases of slightly contaminated materials from the nuclear industry are addressed in a different manner than for similar (although naturally occurring) radioactive material from other industries, such as fertilisers, oil and gas, or phosphogypsum. Exposure to radon gas is not treated in the same way as exposure to the uranium and radium that produce the radon gas. The radiological criteria used for the release of solid

Control room at Callaway nuclear power station, United States.



Union Electric Co., United States

materials, gaseous and liquid effluents, and of sites and facilities are all different. While these differences are the result of the logical application of justification and optimisation principles to individual circumstances, the resulting incoherences are nonetheless significant.

Furthermore, there is an increasing desire in civil society to participate more actively in decision-making processes involving environmental and public health issues. However, the roles and responsibilities of the different parties involved still need to be defined and accepted by all. For example, while it is a technical question to assess the risk from a particular source, it is a social judgement as to whether that risk is acceptable. At the same time, industry, governments and regulatory bodies have acknowledged the need to improve the transparency of their operations. The evolution of the system of radiation protection must take these "process" questions into account.

Radioactive waste management

Developments related to the management of long-lived radioactive waste were mixed in 2000. It clearly stood out, however, that societal issues were becoming decisive factors in siting and operating repositories for this type of waste.

In France, construction work began on a new underground laboratory at Bure, in north-eastern France, in order to carry out research on the feasibility of reversible geologic disposal in a clay formation. Regarding the establishment of a second laboratory in a granite formation, the consultative group nominated by the government was unsuccessful in selecting potential sites. The waste programme in Germany experienced considerable challenges. As part of the agreement reached between industry and government on the long-term phase-out of nuclear power generation, the government stopped for up to ten years the further exploration of the suitability of the Gorleben salt dome as a geologic repository.

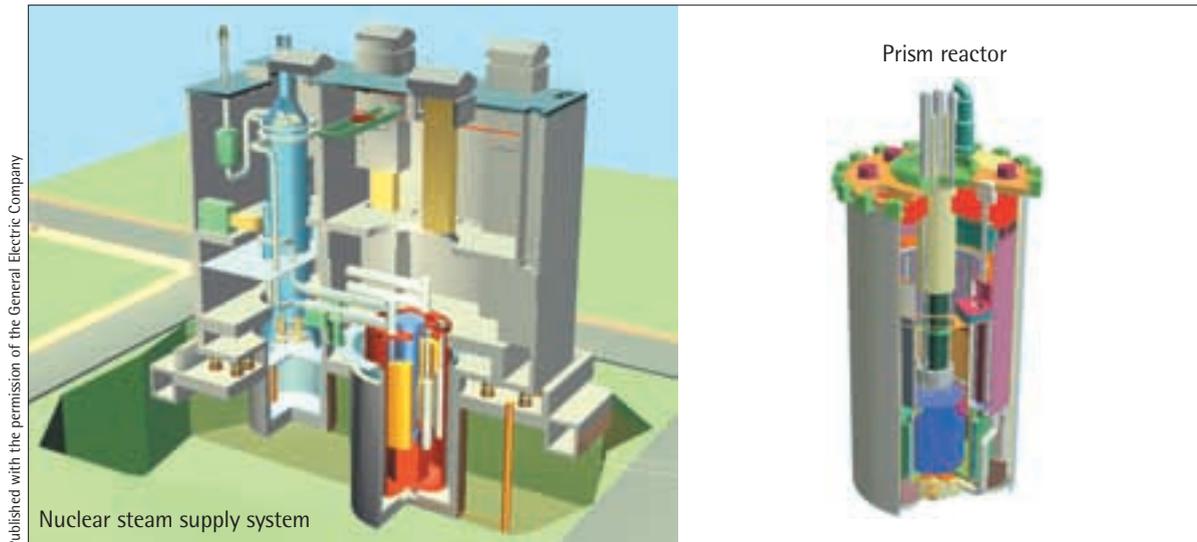
In the United States, the Waste Isolation Pilot Plant (WIPP), which benefits from good local support, continued to receive defence-related transuranic waste and was licensed to receive mixed waste (e.g. chemical, hazardous, radioactive waste). In Finland, the approval by the municipality of Eurajoki to host a spent fuel disposal facility cleared the way for a governmental Decision in Principle, which has now been submitted to Parliament for ratification.

Belgium successfully received the first shipments of vitrified, high-level waste for interim storage, sent from the French La Hague plant after the reprocessing of Belgian spent fuel.

Deep geologic repositories and underground research facilities for radioactive waste in operation in OECD countries



Note: Some points represent multiple facilities.



The S-Prism concept is being studied for the next generation of nuclear reactors.

Nuclear science

In the current context of budgetary constraints for nuclear R&D, the need to share work in an international framework is recognised. Many Member countries have started to review the availability of resources within present research programmes and to assess future scientific research needs, both in the medium and long term. These studies will help identify where there are common interests and possibilities for efficient international collaboration.

The interest in Member countries in studying the feasibility of nuclear waste transmutation continues. The goal is to reduce the amount and half-lives of the radioactive material that has to be stored in deep repository systems. One of the systems proposed for the transmutation of high-level radioactive waste is a sub-critical reactor coupled to an accelerator. Many different scientific aspects are being studied in relation to this concept, for example accelerator reliability, reactor physics, material science and separation chemistry.

As mentioned earlier, many Member countries have started to consider the next generation of nuclear reactors. Different advanced concepts with enhanced safety systems and more economic fuel cycles are being examined. These new concepts will have to undergo thorough scientific review, including theoretical modelling and calculation of different reactor parameters, before any prototype can be constructed.

Nuclear data and software

The need to preserve acquired competence in nuclear research as well as the results from earlier experiments is becoming more widely acknowledged. There is increased interest in courses organised to educate scientists in the use of selected computer programs employed in different nuclear application areas, indicating a willingness in Member countries to maintain a certain level of competence in the nuclear field. In addition, the nuclear industry and utilities are becoming more open to sharing proprietary information, for example

through increased participation in international standard problem exercises, and in contributing more actively to the preservation of integral experimental data.

The fast development of computer hardware and software has triggered the widespread development of graphical data visualisation programs. This concerns both programs aimed at comparing experimental and evaluated scientific data sets, as well as graphical interface programs developed to facilitate the modelling of input data to large calculation programs.

Nuclear law

The existence of sound national and international legal frameworks is essential to the safe use of nuclear power worldwide. More particularly, modernising, and encouraging adherence to, the international conventions on nuclear liability will help ensure the equitable compensation of nuclear damage in the event of a nuclear incident, while at the same time facilitating international trade in nuclear materials and equipment. In response to efforts made by the international community in 1997 to reform the nuclear liability regime established by the Vienna Convention, the Contracting Parties to the Paris Convention and to the Brussels Supplementary Convention have been actively negotiating the revision of both instruments. Major reasons for undertaking these revisions are not only to ensure that increased amounts of compensation will be available to victims, but that the revised Conventions will be, as much as possible, compatible with other existing international nuclear liability instruments providing for extended geographical coverage, supplementary funding for compensating victims, or both.

The trend towards strengthening the institutional and legislative framework in the field of nuclear energy in the countries of Central and Eastern Europe and the New Independent States continued. Countries from these regions pursued adherence to international conventions in the field of nuclear law, as well as the process of modifying and modernising their national legislation accordingly.

Nuclear Development and the Fuel Cycle

Nuclear Development Committee (NDC)

Mission

To provide authoritative, reliable information on nuclear technologies, economics, strategies and resources to governments for use in policy analyses and decision making, including on the future role of nuclear energy within the context of energy policies that contribute to sustainable development.

Highlights

- The report entitled *Nuclear Energy in a Sustainable Development Perspective*, prepared by the NEA as a contribution to the OECD horizontal project on sustainable development, was published. It reviews the characteristics of nuclear energy from a sustainable development policy perspective and provides data and analyses aimed at supporting policy decisions.
- As part of the Agency's nuclear fuel cycle studies, the 6th Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation was organised by the NEA in Madrid in co-operation with the European Commission. More than 160 experts from 15 countries participated.
- A report on nuclear education and training based upon a survey of almost 200 organisations in 16 Member countries draws the attention of policy makers to concerns raised by waning student interest in nuclear science and technology. It also provides recommendations on actions to be considered by government and industry.
- A Plant Life Management (PLIM) Workshop was held in Washington DC to discuss technical, regulatory and business issues related to the ageing, refurbishment and retirement of nuclear reactors.

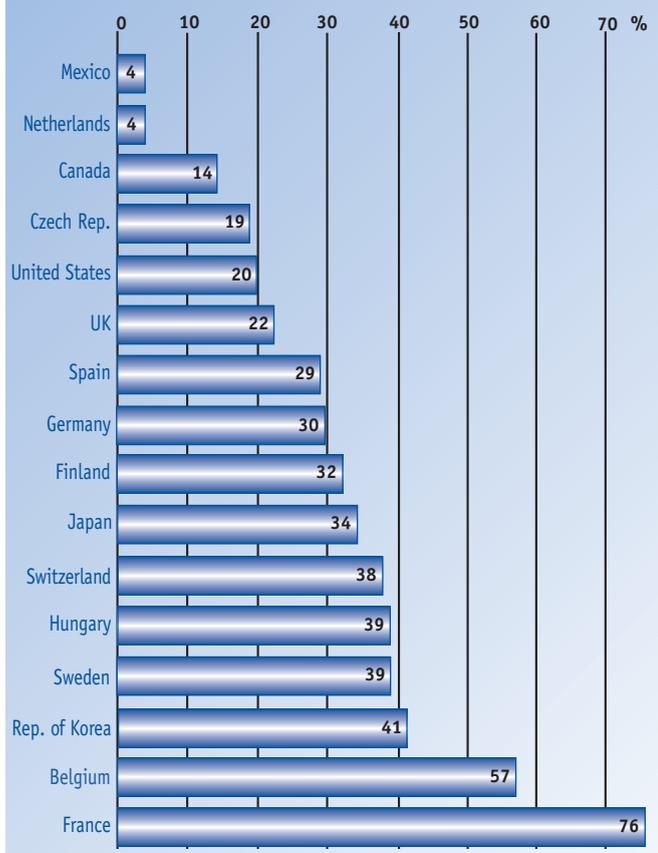
Nuclear policy issues

Responding to Member country interest in the role that nuclear energy could play in satisfying future electricity demand while preserving natural resources and the environment, the NEA published the report entitled *Nuclear Energy in a Sustainable Development Perspective*. The report is part of the NEA contribution to the OECD horizontal project on sustainable development and the preparation of the OECD Council meeting at ministerial level to be held on this topic in May 2001. The data and analyses presented in the report aim at assisting policy makers in assessing the contribution that nuclear energy can make to sustainable development goals and identifying the challenges to be overcome in order to make the contribution of nuclear energy positive.

A report on nuclear education and training was also published in 2000. The report highlights the concerns expressed by the scientific community about potential shortfalls of nuclear expertise in the medium and long term, and recommends that governments and industry consider measures to ensure the implementation of adequate educational programmes.

Plant life management (PLIM) continues to be of major interest to Member countries with mature nuclear programmes. In this light, the NEA organised a workshop on nuclear power plant life management in a changing business world, hosted by the US Department of Energy in Washington DC. Experts from 12 Member countries and two international organisations reviewed the prospects for plant life extension and discussed technological developments and regulatory issues relevant to the management and economics of nuclear plant life. The proceedings from this workshop, published in 2000, contain recommendations of interest to policy makers from governmental organisations and the industry.

Nuclear power share of total electricity production in NEA countries (2000)



Economics

In response to priorities identified by Member countries, activities in the field of economics focused on analyses of capital costs of nuclear power plants (and ways and means to reduce those costs), and the impact of electricity market deregulation on nuclear power competitiveness.

The study on *Reduction of Capital Costs of Nuclear Power Plants* concluded that significant economic gains could be obtained through technological progress, enhanced project management and policy measures. It highlights possible improvements to be made and illustrates them with examples provided by some countries and manufacturers of the expected achievements in terms of capital cost reduction. It states that significant capital cost reductions can be achieved through coherent programmes combining measures such as improved design, construction methods and project management, standardisation, series orders and streamlining of regulations.

The study on nuclear power in the context of economic deregulation was completed and a report entitled *Nuclear Power in Competitive Electricity Markets* was published. The report covers several topics including the impact of market deregulation on the competitiveness of existing and new nuclear power plants, guaranteeing funds for financing future liabilities and restructuring nuclear industries.

A study on methodologies for assessing the economic consequences of nuclear reactor accidents, carried out jointly by the NDC and the CRPPH, was completed and published in 2000. The study

provides a review of calculation methods used in evaluating the costs of nuclear accidents as well as the conclusions of the expert group in charge of the study. It highlights key issues, uncertainties and recommendations to policy makers with regard to interpreting and comparing results based upon various methods and assumptions.

Technology

The programme of work on fuel cycle studies included a review of trends in the nuclear fuel cycle and activities on various aspects of the back-end of the fuel cycle, with emphasis on actinide and fission product partitioning and transmutation. The 6th Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation was organised by the NEA in Madrid, in December, in co-operation with the European Commission. More than 160 experts from 15 countries participated.

An inventory of nuclear R&D projects in NEA Member countries is being established. The first phase of this project, consisting of linking various R&D organisations and existing databases within a page on the NEA website, was performed in 2000.

Data and resource assessment

The 2000 update of *Nuclear Energy Data* provided an overview of the status and trends in nuclear power programmes and fuel cycle activities in Member countries.

The report *Uranium 1999: Resources, Production and Demand* was published jointly with the IAEA. It includes updates of statistics from 49 countries, international expert analyses and projections of uranium requirements and supply.

A Joint NEA/IAEA Expert Group completed a study on environmental remediation of world uranium production facilities. A final report summarising analytical issues, findings and experiences in 22 countries will be published in 2001.

A joint NEA/IAEA study was conducted in 2000 on the management and uses of depleted uranium. Experts from countries holding stocks of this material resulting from enrichment operations discussed their concerns, programmes and plans. A report will be finalised in 2001.

An update of the study on *Beneficial Uses and Production of Isotopes* was carried out and a report providing data and analyses on the status and trends in the field was published. The report assesses the balance between production and demand of isotopes, and provides recommendations to governments on maintaining infrastructure in order to ensure security of supply, in particular for isotopes used in major R&D programmes.

Contact



Peter Wilmer

Head, Nuclear Development Division

Tel.: +33 (0)1 45 24 10 60

Fax: +33 (0)1 45 24 11 10

E-mail: peter.wilmer@oecd.org

Nuclear Safety and Regulation

Committee on the Safety of Nuclear Installations (CSNI) Committee on Nuclear Regulatory Activities (CNRA)

Mission

To assist Member countries in maintaining and further developing:

- the scientific and technical knowledge required to assess the safety of nuclear reactors and other nuclear installations;
- efficient and effective regulation that is based on current scientific and technical knowledge and gives priority to factors most important to the safety of nuclear power reactors and other nuclear installations.

Highlights

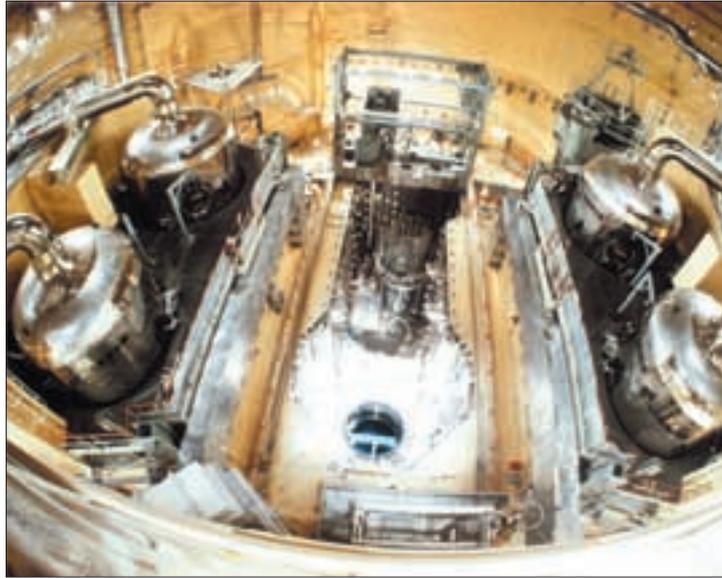
- The CSNI structure and working methods were extensively revised to ensure greater effectiveness, better direction of the overall programme and relevance to the needs of the Member countries.
- Considerable efforts were made to help maintain the research capabilities in OECD countries, with three new large international projects having been established. The projects deal with high burn-up fuel, severe accidents and safety thermal-hydraulics.
- The CNRA continued to address key issues being faced by regulatory bodies, including the interface between nuclear regulators and the public, ensuring future safety competence, enhancing regulatory effectiveness, and dealing with the challenges arising from competition in the electricity market.

Committee on the Safety of Nuclear Installations

Following the adoption of the CSNI Strategic Plan, a number of changes were made in the Committee's structure and working methods. In particular, the structure of the working groups was streamlined with additional emphasis being placed on technical issues, such as fuel safety margins and organisational factors. A Programme Review Group (PRG) was created to assist the CSNI Bureau in directing the overall programme. The PRG, which is composed of senior experts with broad management experience in safety research and technology, will also identify research facilities potentially suitable for future international collaboration, and compile and maintain a list of current safety topics or issues that require international attention.

Analysis and management of accidents

The CSNI activity in this area focuses on thermal-hydraulics, severe accidents and their management, and the confinement of accidental radioactive releases. A Workshop on Advanced Thermal-Hydraulics and Neutronics Codes was held to discuss long-term plans for the development of advanced codes; regulatory requirements for best-estimate code assessment; applications of thermal-hydraulics and neutronics codes for current safety issues; and the needs for integral plant transient and accident analyses. Several international standard



The reactor vessel and four steam generators at the Tsuruga nuclear power plant, Japan.

problem exercises were completed (including an exercise on rapid boron dilution transient), and there was progress on others.

Ageing and structural integrity of reactors

The main topics investigated in this area included metal components, concrete structures and seismic behaviour. One workshop was held and three reports were issued.

In the area of metal components, a benchmark on fatigue crack growth on a cracked pipe under cyclic four-point bending was completed. Fourteen organisations participated in this three-phase benchmark. The objectives were to compare methodologies on a) crack initiation, b) crack propagation and c) crack penetration. All calculation methodologies and criteria used were found to be valid when compared to the experimental results.

A workshop was held in March 2000 on the instrumentation and monitoring of concrete structures. Participants stressed the importance of such systems for assessing the integrity of the structures as part of plant life management policy.

In the field of seismic engineering, a paper was prepared on how ageing could affect the seismic response of structures and components. The proceedings of a workshop held in November 1999 on seismic input were issued.

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) in ensuring the continued safety of nuclear installations in Member countries. While PSA methodology has matured greatly over the past years, further work is required. WGRISK has been active in several areas, including human reliability, software reliability, passive systems reliability and low power and shutdown risk. In order to maintain a current perspective, the working group collaborates

with and assists other CSNI working groups, such as those on operating experience and organisational factors, as well as maintains close relations with other international organisations.

Preparations began for two workshops planned for 2001 on errors of commission and methods for collecting data on human reliability. State-of-the-art reports were under preparation in the areas of passive systems reliability; risk monitor applications for nuclear power plants; and the use of PSA in Member countries. In addition, WGRISK began re-examining the use of level-2 PSAs; probabilistic treatment of risk in nuclear activities and installations other than nuclear reactors; and in developing a fire risk analysis data collection system.

Operating experience

The joint NEA and International Atomic Energy Agency (IAEA) Incident Reporting System (IRS) is the only international system of its kind providing regulators and governmental organisations with an assessment of safety-significant events. During the year, a report was issued on lessons learned from safety-significant events that occurred in nuclear power plants during the period 1996-1999. More than 3 000 copies of the report were distributed to senior officials in industry and government who have decision-making roles in the nuclear power industry.

Other activities in the area of operating experience included:

- an in-depth discussion on recurring events, with further work having been initiated;
- an exchange of information among IRS co-ordinators during the annual joint meeting on recent events in NPPs;
- the testing of a database on operational experience related to computer-based systems important to reactor safety;
- the preparation of a report on sump screen clogging (an important issue related to the emergency core cooling system);
- the organisation of a workshop on safety performance indicators.

Fuel safety margins

The introduction of advanced fuel and core designs, the adoption of more demanding operational modes and the implementation of more accurate, but often less conservative, design and analysis methods raise the question of whether safety margins remain adequate. As a first step in addressing this question, a group of experts completed a technical review of existing fuel safety criteria, focusing on "new design" elements introduced by the industry (e.g. new fuel and core designs, cladding materials, manufacturing processes, high burn-up, MOX, etc.). In the report summarising the results of this review, a number of fuel-related criteria are discussed without attempting to categorise them according to event type or risk significance. For each of these criteria, a brief description of the criterion as it is used in several applications, along with the rationale for having such a criterion, is presented. The report also discusses various issues as they relate to one or more criteria, including high burn-up, core management, MOX, mixed cores, incomplete control rod insertion, and axial offset anomaly.

Following these assessments, the expert group concluded that the current framework of fuel safety criteria remained generally applicable, being largely unaffected by the new or modern design elements. The levels (numbers) in the individual safety criteria may, however, change in accordance with the particular fuel and core design features. International co-operation on ongoing fuel safety research programmes in NEA Member countries will further contribute to a more detailed understanding and realistic modelling of fuel behaviour in LWR accident scenarios.

Co-operation with the CEEC and the NIS

A small programme of co-operation with central and eastern European countries (CEEC) and the New Independent States (NIS) continued in the year 2000. In particular, a report documenting the validation matrix for the thermal-hydraulic code assessment of VVERs was completed. The report also provides an explanation of the important differences between VVERs and LWRs.

NEA experts continued to provide technical support for verifying the ability of the bubbler condenser containment system of VVER-440/213 reactors to maintain its integrity following certain

postulated accidents and thus limit the release of radioactive material to the environment. A report on the current situation of VVER-440/213 bubbler condenser research was completed during the year. The report recommended performing selected additional tests, undertaking further post-test analyses of the results obtained in experiments performed so far, and using post-test calculation results for bubbler condenser design qualification, code validation and modelling improvement.

Committee on Nuclear Regulatory Activities

The Committee on Nuclear Regulatory Activities continued in 2000 to implement a programme of work largely influenced by the findings of the report entitled *Future Nuclear Regulatory Challenges*. Issues addressed during the year are briefly described below.

Nuclear regulators and the public

Good governance and efficiency in decision making by government authorities are increasingly dependent upon mutual trust and confidence between those authorities and the public. A workshop on "Investing in Trust: Nuclear Regulators and the Public" provided an opportunity to exchange information and views on how national nuclear regulatory organisations can improve their interface with the public in a spirit of greater trust, confidence and accountability. It was attended by some 80 participants having responsibilities within nuclear regulatory bodies, either as top officials, communications or public relations specialists, or technical specialists with communications responsibilities. The workshop was part of a broader ongoing effort by the NEA to look into communicating with the public and involving it in decision making in the nuclear field.

Major topics explored at the workshop included:

- the nature and role of the regulator, and the composition and characteristics of discrete groups making up the public;
- the importance of communication and consultation with the public, openness and transparency, credibility and trust;
- communication experiences of regulatory organisations, which have pursued public participation;
- where to draw the line between the regulatory role and what is demanded from regulators by different groups within the public.

Assuring future nuclear safety competence

Maintaining nuclear safety competence in the regulatory authorities, and industry, will be one of the most critical challenges to effective regulation of the nuclear power industry in the coming decades. The challenge arises partly from the age profile of staff in the regulatory bodies, which could result in the loss of much of the present nuclear safety knowledge base due to retirements over the next ten or so years, and partly from a decline in the numbers of students graduating from courses in nuclear science and engineering. Whether

Inside the reactor hall of the Mochovce VVER unit in the Slovak Republic.



Bernard Collet, Framatome, France

new nuclear power plants are planned in Member countries or not, there will remain an ongoing requirement in regulatory bodies and the industry for several decades to recruit qualified staff. A report recommending specific actions to be taken in order to ensure future nuclear safety competence was completed.

Regulatory inspection practices

Inspectors from regulatory bodies meet periodically to exchange information and experience related to regulatory safety inspections, discuss commendable inspection practices and carry out studies. An international workshop was held this year on radiation protection inspections, regulatory inspections required for long shutdowns and subsequent restarts, and the use of objective indicators by the regulatory authority in evaluating the performance of plants. Other inspection issues studied included maintenance during operation, research reactors, fuel cycle facilities, and the inspection of contracted work.

Life extension and upgrading

A group of experts gathered information from Member countries on regulatory approaches to life extension and upgrading NPPs. The information was analysed and synthesised, and will form the basis of a new CNRA report. The report will focus on four main topics: legislative and regulatory aspects; key technical issues; key management issues; and the use of deterministic and probabilistic methods in safety evaluation. It will include a discussion of how the concepts of "life extension" and "upgrading" are viewed by different Member countries. Issues for the future and the conclusions and recommendations of the CNRA will also be provided.



K. Niederau, KKB/NOK, Switzerland

Delivery of a new high-pressure turbine to replace 25-year-old machines at a nuclear power plant in Switzerland.

Regulatory effectiveness

A small strategy group of senior experts established by the CNRA completed a report on this subject. The report includes a common definition of regulatory effectiveness, describes the difference between regulatory efficiency and regulatory effectiveness, and provides a model for assessing and measuring effectiveness based on conventional management wisdom as well as modern business



PAKS NPP, Hungary

Inspection of the Interim Storage Facility for Spent Fuel (ISFS) at the PAKS nuclear power plant in Hungary.

practice. It also discusses quality management models commonly used by regulatory bodies and the types of indicators that might be used to measure regulatory performance. Both direct indicators, i.e. indicators of effectiveness of the regulatory process, and indirect indicators of safety performance are examined in the report. The report also considers the value that a regulatory body adds to the overall nuclear safety system, discusses methods by which this value might be quantified, and provides recommendations for future CNRA activities.

Regulatory challenges arising from competition in the electricity market

A report on this topic, describing many of the challenges facing nuclear regulatory bodies as a result of the introduction of market competition, was completed during the year. It also discusses possible regulatory response strategies.

The report considers four broad categories of challenges, namely: governance issues, direct safety challenges, nuclear technology infrastructure issues, and increased pressures on the regulatory body. It concludes that, although the basic responsibility of the operator and the regulator do not change, a new regulatory approach is necessary. Elements of this new approach include:

- The regulator must fully understand the economic conditions of the competitive market.
- The regulator will have to consider how to maintain existing technical skills and what new ones should be added, particularly in areas such as market economics and organisational issues.
- The regulatory inspection programme should be re-examined to ensure that it is adequate to detect early signs of declining safety performance.

Contact



Gianni Frescura
 Head, Nuclear Safety Division
Tel.: +33 (0)1 45 24 10 50
Fax: +33 (0)1 45 24 11 29
E-mail: frescura@nea.fr

Radiation Protection

Committee on Radiation Protection and Public Health (CRPPH)

Mission

To assist Member countries in the application and further development of the system of radiation protection as well as to identify and address conceptual, scientific, policy, regulatory, operational and societal issues in a timely and prospective fashion, and to clarify their implications.

Highlights

- The CRPPH analysed the system of radiation protection and published a critical review aiming at consensus on how the system of radiation protection should evolve.
- The CRPPH initiated a discussion on stakeholder involvement in radiation protection decision making in order to help achieve a better integration of radiation protection in modern society.
- The INEX 2 series of regional international nuclear emergency exercises was completed, offering many lessons learned and resulting in improved emergency response capabilities worldwide.
- Participation in the ISOE system on occupational exposure at nuclear power plants reached a new high, including some 92% of the world's operating nuclear power plants (see page 28 for more information).

The evolution of the system of radiation protection

The CRPPH became increasingly engaged in the development of a new system of radiation protection intended to be more broadly understood and accepted. A *Critical Review of the System of Radiation Protection: First Reflections of the CRPPH* was published during the year. As a follow-up to this publication, the CRPPH will prioritise the areas identified in the Critical Review and help to develop consensus on improvements to be made. The CRPPH also actively engaged in a direct dialogue with the International Commission on

Radiological Protection (ICRP) regarding new approaches initiated by its Chairman. The CRPPH is thus acting as a focal point for the development of consensus in terms of policy, regulation and application. The concepts developed will be applied to specific case studies to test whether they result in a "clearer", more transparent, and coherent system of radiation protection.

The social process of radiological risk identification, assessment and management

In addition to the above-mentioned work on the system of radiation protection, the CRPPH feels that the "process" of radiation protection decision making must also evolve to better meet the needs of modern society. Society is showing an increasing desire to participate more actively in decision-making processes involving environmental and public health issues. At the same time, industry, governments and regulatory bodies have acknowledged the need to increase

For radiation protection purposes, plant personnel must change shoe covers and gloves before passing the decontamination check.



transparency in their operations. It is in view of this situation that the CRPPH has been examining stakeholder involvement in the identification, assessment and management of radiological risk.

In order to better understand how various players interact in the "process" of radiation protection risk identification, assessment and management, the CRPPH organised the first Villigen Workshop in 1998 to address "Decision Making in Complex Radiological Situations". As a follow-up, preparations were made during 2000 for a Second Villigen Workshop on "Better Integration of Radiation Protection in Modern Society", to be held in January 2001. The workshop was to address the new context of risk governance and modern theories of social conflict resolution; emerging expectations of society towards risk policies; national experiences in stakeholder involvement in radiological risk, assessment and management; and the evolving role of international expertise in structuring the system of radiation protection. Proceedings of this workshop will be published in 2001.

Radiological impacts of spent nuclear fuel management options

An important technical study on *Radiological Impacts of Spent Nuclear Fuel Management Options*, aimed at facilitating informed international discussions on the nuclear fuel cycle, was published in 2000. The study was prepared at the request of the OSPAR Commission, established under the international Convention for the Protection of the Marine Environment of the North-East Atlantic.

The study compares the radiological impacts on the public and on nuclear workers resulting from two approaches to handling spent fuel discharged from nuclear power plants: the reprocessing option, which includes the reuse of the separated plutonium in MOX fuel, and the once-through option, with no reprocessing of spent fuel and its direct disposal.

The report concludes that:

- The radiological impacts of both the reprocessing and the non-reprocessing fuel cycles studied are small, well below any regulatory dose limits for the public and for workers, and insignificantly low compared with exposures caused by natural radiation.
- The difference in the radiological impacts of the two fuel cycles studied does not provide a compelling argument in favour of one option or the other.

The study also points out that other factors, such as resource utilisation efficiency, energy security, and social and economic considerations would tend to carry more weight in decision-making processes.

INEX

The INEX 2 series of four international nuclear emergency exercises was completed at the end of 1999, and the analysis of the lessons learned began in early 2000. Based on the four objectives of the INEX2 series, many specific national and international lessons in operational nuclear emergency planning, preparedness and management were learned. The INEX 2 series resulted in the publication of *Monitoring*

and Data Management Strategies for Nuclear Emergencies, which defines emergency monitoring needs, and proposes strategies meant to assist decision makers by improving the selection of data to be transmitted and the way in which data and information are transmitted and received.

In order to identify how participants have incorporated the lessons learned from the INEX 2 exercises and to test the features of these newly developed strategies, an international nuclear emergency exercise, INEX 2000, was prepared, to be held in France on 22-23 May 2001 at the French Gravelines nuclear power plant (900 MWe PWR), with the participation of at least 36 countries and 3 international organisations. A new objective included in this international nuclear emergency exercise will be to test the mechanisms for the implementation of the Conventions on nuclear third-party liability. This aspect will be covered in a workshop to be held in Paris in October 2001. In parallel to the preparations for the INEX 2000 exercise, the CRPPH Working Party on Nuclear Emergency Matters has begun discussing future international nuclear emergency exercises, INEX 3.

Comparative risk assessment and management

Several years of work on the subject of comparative risk assessment and management culminated in the wide distribution of a report on risks related to public and worker exposure to radiation, asbestos, and nickel aerosols from the petro-chemical industry. The report concludes that the management and assessment issues in the three cases have close similarities. The dose-effect relationships established for ionising radiation based on the follow-up of survivors of the bombing of Hiroshima and Nagasaki are comparable to the dose-effect relationships established for asbestos and certain nickel compounds based on the epidemiological study of various situations involving occupational exposure. It is, therefore, generally accepted, as part of the management of cancer risks, that it is legitimate to extrapolate these relationships to low levels of exposure. Subject to some limitations, protective actions against exposures to both asbestos and nickel aerosols can in principle be taken on the basis of the optimisation principle, as is the case for ionising radiation. In addition, the existence of a level of residual risk is accepted in all three cases, to the extent that protective action is not aimed at achieving zero risk. Other similarities and differences in the assessment and management of these three risks are detailed in the report.

Contact



Ted Lazo
Head, Radiation Protection Programme
Tel.: +33 (0)1 45 24 10 42
Fax: +33 (0)1 45 24 11 10
E-mail: lazo@nea.fr

Radioactive Waste Management

Radioactive Waste Management Committee (RWMC)

Mission

To assist Member countries in the area of radioactive waste management, particularly in developing safe management and disposal strategies for spent fuel, long-lived waste, and waste from the decommissioning of nuclear facilities.

Highlights

- The new Integration Group for the Safety Case (IGSC) started its work, focusing on developing, evaluating, and communicating the "safety case" as a basis for confidence and decision making in radioactive waste disposal.
- The Forum on Stakeholder Confidence brought together government-nominated participants and a considerable number of stakeholders to address the role of open dialogue in all aspects of radioactive waste management.
- The NEA organised an international peer review of the Swedish SR 97 report, which forms an important part of the decision basis for the Swedish spent fuel disposal programme.
- A workshop on "Gas Generation, Accumulation and Migration in Underground Repository Systems for Radioactive Waste" was held in Reims, France, in June 2000.
- Under the auspices of the RWMC, a second phase of the Sorption Project was launched to benchmark chemical thermodynamic modelling.

The "safety case" for geologic disposal

The Integration Group for the Safety Case (IGSC) began its work with two meetings in 2000. The new group, which builds on solid NEA experience in the areas of performance assessment and site evaluation and design, will work on the development, evaluation and communication of the "safety case" as a basis for confidence and decision making. New activities under consideration will include a concise description of the safety case, the handling of time scales in assessing post-closure safety, and a co-operative project on the engineered barrier system.

Forum on Stakeholder Confidence

The RWMC set up a forum to facilitate the sharing of Member country experience in addressing the societal dimension of radioactive waste management, to explore means to ensure an effective dialogue with the public, and to consider ways to strengthen confidence in decision-making processes. A first workshop set up by the forum

Manufacturing of a bentonite barrier at Mont Terri, Switzerland.



ENRESA, Spain

In line with recent experience in Member countries, RWMC activities concerning long-term waste management solutions focused on improving confidence in such solutions, both from the technical and social points of view.

addressed a variety of topics ranging from evolving participatory democracy, stakeholder identity, and trust in the international framework, to the role of open dialogue in all aspects of radioactive waste management. The meeting brought together government-nominated participants and a considerable number of stakeholders including academics, sociologists, representatives of mediation and review groups, and elected political representatives.

Performance assessment

The main goal of the RWMC in the area of integrated performance assessments (IPAs) is to harmonise views on the role of IPAs as the core constituent of repository safety evaluations. After an examination of the desirable information content and of the concerns of regulatory bodies in reviewing IPAs, a third phase of the programme is under way to evaluate presentational needs for enhancing confidence in long-term safety. Preliminary findings show that messages must be clear and unambiguous, tailored to the audience and consistent with the assessment and the safety case. Different audiences have different information needs, and confidence has to be demonstrated, not just stated. The study to be published in 2001, the IPAG-3 report, will include international experience in achieving that goal.

GEOTRAP

The proceedings of the fourth workshop of the NEA GEOTRAP Project on Radionuclide Migration in Geologic, Heterogeneous Media, hosted by the United States Department of Energy (USDOE) and held in Carlsbad, New Mexico, were prepared for publication in the beginning of 2001. While this workshop focused on confidence in models of radionuclide transport for site-specific performance assessment, the fifth and final GEOTRAP workshop, which will be hosted by SKB in Äspö, Sweden, in May 2001, will address geological evidence and theoretical bases for radionuclide-retention processes in heterogeneous media.

Clay Club

The problem of extracting solutions from argillaceous formations for geochemical and isotopic characterisations is complex. A Clay Club report on *Porewater Extraction from Argillaceous Rocks for Geochemical Characterisation* provides a synthesis of available extraction methods and assesses their respective advantages and limitations. It also identifies key processes that may influence the composition of the extracted water and describes modelling approaches that are used to determine *in situ* porewater composition.

The FEPCAT project is under way and will provide a detailed catalogue of "Features, Events and Processes" specific to the disposal of long-lived waste in argillaceous formations. Work in 2000 focused on the answers to a questionnaire distributed amongst Clay Club members. The catalogue report will be reviewed in the second part of 2001.

At the 10th Clay Club meeting in spring 2000, the delegates showed considerable interest in the multidisciplinary issue of the self-healing of argillaceous rocks under repository conditions. It will be taken up at a special session of the 11th Clay Club meeting in 2001.

Gas generation and migration

In underground repositories for radioactive waste, significant quantities of gases may be generated as a result of several processes. Following the publication of an EC/NEA status report on Gas Migration and Two-phase Flow in 1999, a workshop on "Gas Generation, Accumulation and Migration in Underground Repository Systems for Radioactive Waste: Safety-relevant Issues" was held in Reims, France on 26-28 June 2000. Hosted by ANDRA, the two-part workshop attracted experts from 13 countries. The first part of the workshop, based on invited presentations, set the context for considering the way forward in this field. The second part, based on working group discussions, focused on specific issues in gas generation and migration, and on making relevant recommendations for future work. The workshop proceedings, prepared for publication early in 2001, will include a synopsis which draws out the main conclusions of the workshop.

Peer review

Following a request from the Swedish Nuclear Power Inspectorate (SKI), the NEA organised an international review of the recently completed Swedish SR 97 report, a safety assessment of the concept developed for the disposal of Sweden's spent nuclear fuel.

The review, which was carried out in the first half of 2000, found that the Swedish disposal concept has the essential elements of a sound approach to the disposal of spent nuclear fuel in a geologic repository. It provides "defence in depth" through a set of passive barriers with multiple safety functions. The concept is based on well-established science and a firm technological foundation.

The NEA's international review of the SR 97 report forms an important part of the decision basis for the future direction of the Swedish spent fuel management programme.

Co-operation and information exchange projects

Under the auspices of the RWMC, scientific co-operation projects study the potential contribution of sorption phenomena to the safety of geologic repositories. Complementary to the Thermochemical Database (TDB) Project, which focuses on data, a newly launched second phase of the Sorption Project investigates the capabilities of chemical thermodynamic modelling approaches through a benchmarking exercise. The RWMC also administers the information exchange project on decommissioning, which is a cornerstone of the NEA's activities in this cross-cutting area. These projects are described in the "Joint Projects" section on page 29.

Contact



Hans Riotte – Head, Rad. Waste Management and Radiation Protection Division

Tel.: +33 (0)1 45 24 10 40

Fax: +33 (0)1 45 24 11 10

E-mail: hans.riotte@oecd.org

Nuclear Science

Nuclear Science Committee (NSC)

Mission

To help Member countries identify, collate, develop and disseminate scientific and technical knowledge used to ensure the safe, reliable and economic operation of current nuclear systems and to develop next generation technologies.

Highlights

- A project to preserve integral nuclear data measured at different reactors or in mock-up experiments was launched. The first phase concentrates on reactor physics data.
- The results from a standard problem exercise on the use of mixed-oxide (MOX) fuels in reactors were published. The exercise was based on experimental data from the VENUS facility.
- A new working group was established to co-ordinate partitioning and transmutation activities in Member countries.
- A seminar was organised to assess the current understanding of fission gas behaviour and its impact on the fuel rods in a reactor.
- A workshop was organised to review the advancements in the scientific and technological field related to the nuclear production of hydrogen.

Reactor physics

The reactor physics programme is aimed mainly at the validation of different calculation schemes used in Member countries. Specifications for standard problem exercises or benchmarks, based on theoretical or experimental evidence, are distributed to scientists for them to calculate. The results are compared and the findings and lessons learned are then published.

One important part of the above-mentioned benchmarks are the experimental data, used as the basis for the specifications. An ambitious project was launched to preserve integral experimental data

measured at different research establishments. The first phase of the project concentrates on reactor physics data measured both at research and power-producing reactors. The data will be stored at the NEA Data Bank and made available to scientists who wish to test their calculation models and methods against experimental results.

The results from the first phase of a benchmark simulating a break of a main steam line in a pressurised water reactor (PWR) have been published. The benchmark is testing the prediction capability of three-dimensional, coupled neutronics/thermal-hydraulic codes. The results from the more complex second and third phases are being analysed and the report is under preparation.

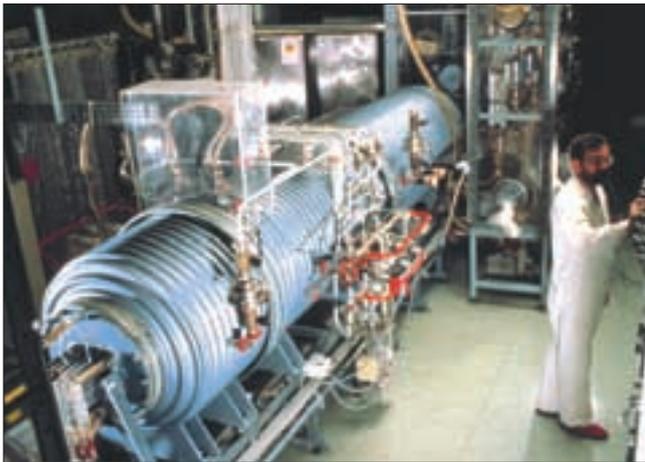
A benchmark simulating a reactor transient caused by a turbine trip in a boiling water reactor (BWR) has been undertaken. The benchmark is based on experimental data from a full-scale, power-producing reactor.

A study of the stability of a boiling water reactor (BWR) has been undertaken. The benchmark is based on measurements in a power reactor (Forsmark, Sweden) and is focused on the analysis of time series data by means of noise analysis techniques. The final report is under preparation.

Fuel cycle physics

New, more advanced and economic fuel cycles must be well-tested, both theoretically and experimentally, before being employed in power reactors. The working group on the physics of plutonium fuel and innovative fuel cycles is conducting a number of standard problem exercises related to mixed-oxide fuel (MOX). Results from an exercise based on experimental data from the VENUS zero power critical facility have been published. Another benchmark exercise related to the utilisation of MOX fuel in boiling water reactors (BWR) is ongoing. A separate expert group is studying the possibility of burning weapons-grade plutonium as mixed-oxide fuel in power-producing reactors.

A seminar on "Fission Gas Behaviour" was organised in France in September 2000. The meeting reviewed the current understanding of



Studies were performed by the NEA on nuclear fuel cycle physics, notably as related to the use of mixed-oxide (MOX) fuel. Shown above is a sintering oven used for the preparation of MOX fuel.

fission gas behaviour and its impact on fuel rods. MOX and other advanced fuel concepts, including high burn-up fuel, were also addressed.

The compilation of data into the International Fuel Performance Experiments (IFPE) database continues and it presently contains close to 400 fuel rod configurations. The data are available from the NEA on request. A users forum has been established to report feedback on the use of the data, to exchange information on specific experiments and to discuss difficulties in their interpretation.

Fuel cycle chemistry

There is increased interest in dry reprocessing (pyrochemical) methods for nuclear fuel. A workshop on pyrochemical separation was organised in France in March 2000 to review national and international R&D programmes in the field and the role and requirements of pyrochemical reprocessing in future fuel cycles. Following the workshop, an expert group was established mainly to draft a comprehensive state-of-the-art report on pyrochemistry separations.

The NEA also organised, in co-operation with the European Community and the Rossendorf research centre in Germany, a workshop on speciation, techniques and facilities for radioactive materials at synchrotron light sources. The workshop was held in September 2000 in Grenoble, France. The NEA will publish the proceedings.

Nuclear criticality safety

A new expert group was set up to study the outstanding Monte Carlo convergence problem for the calculation of interaction between weakly coupled fissile units.

A new version of the CD-ROM containing experiments evaluated by the International Criticality Safety Benchmark Evaluation Programme was published in September 2000. This new edition

contains 284 evaluations with benchmark specifications for 2 352 critical or near-critical configurations.

The expert group on burn-up credit published a new report entitled *OECD/NEA Burn-up Credit Criticality Benchmarks Phase IIIA: Criticality Calculations of BWR Spent Fuel Assemblies in Storage and Transport*.

Partitioning and transmutation of nuclear waste

The aim of partitioning and transmutation (P&T) is to reduce the long-term inventory of radiotoxic nuclides in nuclear waste by converting them either into short-lived radioisotopes or stable isotopes. A new working group was established to co-ordinate the different disciplines covered by P&T, such as accelerators, chemistry, material science, nuclear data and reactor physics. A first meeting of the working group was held at the end of 2000.

A benchmark exercise on an accelerator-driven transmutation system (ADS) was conducted and the results are being analysed for publication. The benchmark will be followed up by another ADS-based benchmark simulating effects of accelerator beam trips.

The 6th Information Exchange Meeting on Actinide and Fission Product Partitioning and Transmutation was organised jointly with the NEA Nuclear Development Division. The meeting was held in Spain in December 2000.

Radiation shielding

The fifth meeting of the expert group on shielding aspects of accelerators, targets and irradiation facilities (SATIF-5) was held in France in July 2000. Issues discussed included medium energy transmission of neutrons through structural material and calculation with a simple phantom for neutron dosimetry, as well as a new benchmark specification related to deep penetration shielding.

A new edition of the Shielding Integral Benchmark Archive Database (SINBAD) was issued in December 2000. This was a common effort between the NEA and the Radiation Safety Information Computational Center (RSICC) in the USA. The new edition contains 42 compilations for reactor shields (in particular for pressure vessel dosimetry), fusion applications and accelerator shields, and is mainly used for data and code benchmarking.

The results from a benchmark exercise to test the prediction capability of three-dimensional deterministic radiation transport codes were published.

Contact



Claes Nordborg
Head, Nuclear Science Section
Tel.: +33 (0)1 45 24 10 90
Fax: +33 (0)1 45 24 11 06
E-mail: nordborg@nea.fr

Data Bank

Mission

To be the international centre of reference for its Member countries with respect to basic nuclear tools, such as validated computer codes and nuclear data, and to provide a direct service to its users by developing, improving and validating these tools and making them available as requested.

Highlights

- Demand for the Data Bank's computer program services was at a record high in 2000. Close to 2 300 programs were dispatched.
- A new Java-based display program for nuclear data (JANIS) was developed and is undergoing testing.
- The radioactive decay data file of the Joint Evaluated Fission and Fusion (JEFF) data library was compiled.
- The book on recommended chemical thermodynamic data of neptunium and plutonium was finalised for publication.

Computer program services

The Data Bank makes tested computer program packages available to scientists in Member countries. The collection contains about 2 000 programs, covering all application areas related to nuclear energy. The Data Bank also provides programs to non-OECD countries through a co-operative agreement with the IAEA and has a special agreement with the US Department of Energy on the exchange of computer codes.

A special effort to review all computer program packages for possible Y2K problems was successful, with no difficulties reported at the beginning of the year. The Data Bank acquired 85 new or revised versions of computer codes during the year, of which 28 came from non-OECD countries.

A record-high 2 262 computer program packages were dispatched to requesters in 2000. About 50% of these requests came from national laboratories, whereas the remaining 50% were equally divided between universities and industry. The most requested programs were

in the areas of radiation shielding and nuclear safety. Two editions of the computer program abstracts database were published and distributed on CD to nominated establishments and customers.

A major effort has been devoted to transforming paper-based computer program documentation into electronic form. In all, 420 computer program packages were restructured and these can now be fully distributed in electronic form, either on CD or via network. Other program packages are normally sent out on CD together with a paper copy of the documentation.

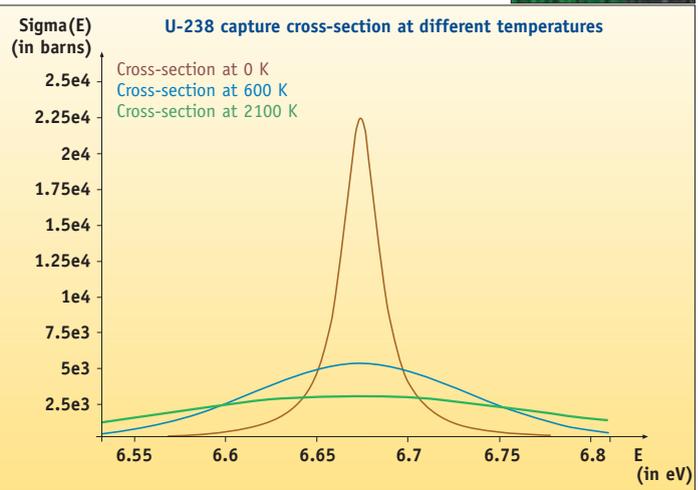
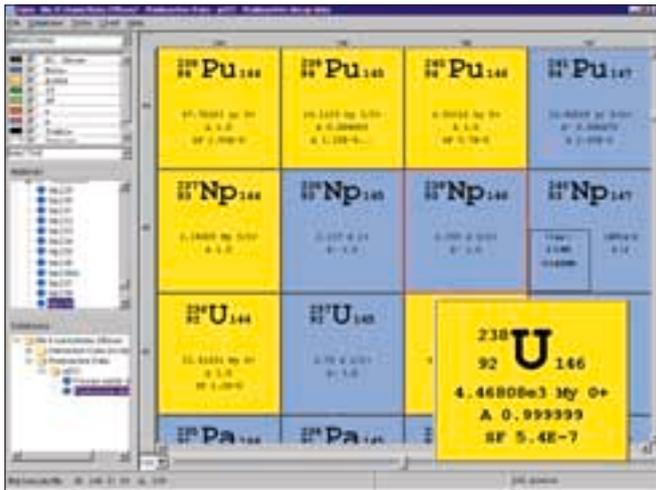
As part of the computer program services, the Data Bank organises training courses on the use of the programs. Three training courses were held in 2000, all concerned with Monte Carlo computer codes. They were either of introductory or advanced type and addressed modelling capabilities for shielding, criticality and core calculations, as well as visualisation of the geometry and results. The participants in the courses were mostly younger scientists. The list of courses was as follows:

- Advanced MCNP-4C training course, held in April in the United Kingdom;
- Training Course on Nuclear Criticality Safety Using KENO-VI – Handling, Transportation and Storage of Spent Fuel (included KENO-3D), held in May in France;
- Introductory MCNP-4C training course, held in July in Germany.

Integral nuclear data

Under the guidance of the Nuclear Science Committee, the Data Bank collects, stores and distributes integral nuclear data sets. These data sets contain complete information from experiments performed mainly at research or power reactors, and are primarily used for computer code and basic data validation purposes. The application areas covered are nuclear fuel behaviour, criticality safety and radiation shielding. The Data Bank also provides a service and distributes the integral data sets on request. 1 252 data sets were dispatched on CD from the following databases:

- International Criticality Safety Benchmark Experiments (ICSBEP);
- International Fuel Performance Experiments (IFPE);



- Radiation Shielding Experiments (SINBAD);
- Code Validation Matrix of Thermal-Hydraulic Codes (CCVM).

A project on general preservation of integral nuclear data was undertaken in 2000. The first application area to be considered was reactor physics experiments. A pilot project was started to explore the availability of data, to agree on a suitable storage format and to determine the resources needed to accomplish the project.

Nuclear data services

The Data Bank continued to compile and make available basic nuclear data within an international framework, comprised of five major data centres. The data centres are located in the USA (Brookhaven), France (NEA), Austria (IAEA) and Russia (Obninsk and Moscow). Both bibliographic and experimental nuclear data are compiled and exchanged between the centres. The databases containing nuclear data are directly available for registered users on the Data Bank's web page.

The bibliographic database, CINDA (Computer Index for Neutron Data), contains more than 260 000 references. The database is published annually, either as an annual or a cumulative update. The Data Bank has developed a CD version of the complete database, which is incorporated in the published book. The EXFOR (Exchange Format) database containing experimentally measured nuclear reaction data continues to be updated. The Data Bank added new data from 46 neutron-induced and 100 charged-particle-induced experiments during 2000.

Demand for nuclear data services remained high. During 2000, the Data Bank recorded over 20 000 retrievals from the on-line accessible databases containing nuclear data. Close to 2 000 scientists have registered and obtained passwords for access to these databases. Demand was distributed as follows: 30% of accesses concerned the bibliographic data in CINDA, 30% the evaluated nuclear data and 40% the experimental data in EXFOR.

The NEA organises international collaboration between the major nuclear reaction data evaluation projects in the world. The first meeting of the newly reorganised working party (WPEC) was held in Japan

in June 2000. The working party supports continued co-operation on the evaluated data formats and a high priority request list for nuclear data, in addition to a number of short-term expert groups on, for example, nuclear data standards. A report on *Processing and Validation of Intermediate Energy Evaluated Data Files* was published in 2000.

A new, completely rewritten data visualisation tool was developed and is undergoing thorough testing. The program is called JANIS (Java-based Nuclear Information System). Details are available on the Data Bank's web pages.

JEFF project

The complete documentation of the second version of the Joint Evaluated Fission and Fusion (JEFF) data file (JEF-2.2) was published. This was followed by the development of the new, third version (JEFF-3) of the data library. The correction of all format and physics problems discovered in the quality assurance checking of the new general-purpose file was finalised. The processing and benchmark testing of the most important isotopes in the JEFF-3 library began and the first results were presented at the biannual meeting in December 2000. The first version of the JEFF-3 radioactive decay data file was compiled and the checking of the data, using a newly developed checking code, was undertaken. A report on the evaluation and analysis of nuclear resonance data was also published in 2000.

A new Monte Carlo library based on the former version of the data library was developed for the MCNP-4B program. It contains more than 100 of the most important isotopes from the JEF-2.2 general-purpose library and can be obtained through the Data Bank computer program services.

Contact



Thierry Dujardin – Deputy Director for Science and Development
Tel.: +33 (0)1 45 24 10 06
Fax: +33 (0)1 45 24 11 06
E-mail: thierry.dujardin@oecd.org

Legal Affairs

Nuclear Law Committee (NLC)

Mission

- To foster progress towards a global regime addressing liability and compensation for nuclear damage.
- To contribute to the modernisation of the Paris Convention and the Brussels Supplementary Convention on nuclear third-party liability and compensation.
- To promote the harmonisation of Member countries' nuclear legislation and to assist selected non-member countries in the field of nuclear law.
- To analyse and disseminate information on nuclear law issues for the benefit of both Member and non-member countries.

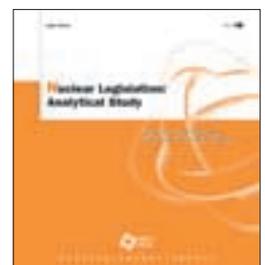
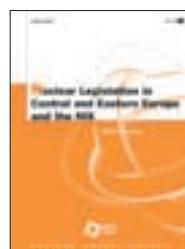
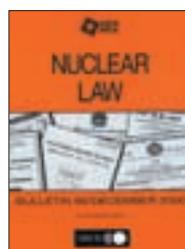
Highlights

- The Group of Governmental Experts on Third Party Liability in the Field of Nuclear Energy was renamed the "Nuclear Law Committee" and its mandate was expanded to include: examining issues concerning the interpretation and application of international nuclear liability instruments and encouraging adherence to those instruments so as to foster progress towards a global regime of nuclear liability and compensation; encouraging the development of national legislation governing the peaceful uses of nuclear energy based upon internationally accepted principles; serving as a forum for the exchange of information and the sharing of experience on nuclear law issues; and undertaking all other work of a legal nature that may be entrusted to it by the Steering Committee.
- With six meetings convened in 2000, the Paris Convention States and the Brussels Supplementary Convention States made substantial progress in their negotiations to revise both Conventions.
- An International School of Nuclear Law was established at the University of Montpellier 1 in co-operation with the NEA to provide a high-quality programme in the various disciplines of nuclear law.
- Two issues of the *Nuclear Law Bulletin* were published together with their Supplements, and a revised Index was made available.
- A new edition of the *Overview of Nuclear Legislation in Central and Eastern Europe and the NIS* was published.

Civil liability for nuclear damage

Through its legal affairs programme, the NEA continues to serve as a forum for the examination of legal issues in the nuclear field with particular emphasis on civil liability and compensation for nuclear damage.

The programme's objective of pursuing the modernisation of the international nuclear liability regime was largely met in 2000 through two activities. The first was to support the Nuclear Law Committee in its work aimed at minimising legal impediments to the safe use of nuclear energy, encouraging provisions for equitable compensation of nuclear damage in the event of a nuclear incident, analysing issues relating to the emergence of a global nuclear liability regime and addressing problems associated with the interpretation and application of various international nuclear liability instruments. The Committee met in October 2000 to study and deliberate upon a variety of such issues. The second activity was to provide support to the Contracting Parties to the Paris Convention and to the Brussels Supplementary Convention in their ongoing efforts to revise both Conventions, efforts which included six negotiating meetings in 2000. This revision exercise is of real significance, given the operation of the 1988 Joint Protocol on the Application of the Vienna and Paris Conventions, the amendment of the Vienna Convention in 1997 and the adoption, in that same year, of a new global Convention on Supplementary Compensation for Nuclear Damage.





University of Montpellier 1

Another important objective of the legal affairs programme is to provide legal assistance to certain non-member countries in which NEA Member countries have a particular interest, such as the countries of Central and Eastern Europe and the New Independent States. This assistance is primarily aimed at helping those countries develop nuclear legislation that reflects internationally accepted principles for the peaceful utilisation of nuclear energy and in particular, legislation that will permit adherence to one or more of the international nuclear liability instruments including that which establishes a global regime. Most of this work is undertaken within the ambit of the NEA Contact Group, which met in February 2000 or, in the case of Ukraine, the Joint Task Force on Nuclear Legislation, which met in May 2000 in Kiev.

Information on nuclear law

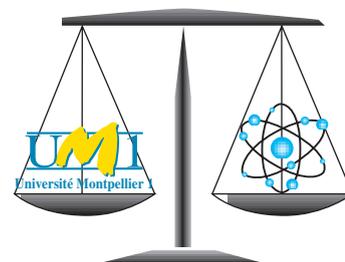
Issues No. 65 and 66 of the *Nuclear Law Bulletin* were published in June and December 2000, along with their respective Supplements reproducing new nuclear legislation adopted in Armenia, Croatia and Ukraine. This periodical, issued twice a year, provides up-to-date information on recent developments in the field of nuclear law at the national and international levels. The Bulletin has proved an invaluable tool over the past thirty years for those in government, regulatory, academic, industry and international circles that work closely with nuclear law. The Index to this publication was also revised during 2000 and is now available, along with back issues of the Bulletin, on the NEA website at www.nea.fr/html/law/pub.html.

A new, updated edition of *Nuclear Legislation: Analytical Study - Regulatory and Institutional Framework for Nuclear Activities* in OECD Member countries was also published in 2000. This latest edition, which has been completely reformatted, provides comprehensive information on nuclear regulatory activities in all OECD countries. The year 2000 also saw the publication of the proceedings of the Budapest international symposium on the *Reform of Civil Nuclear Liability* and a new, revised edition of the *Overview of Nuclear Legislation in Central and Eastern Europe and the NIS*.

International School of Nuclear Law

An International School of Nuclear Law was established in 2000 within the University of Montpellier 1 in co-operation with the NEA. The school also benefits from the support of the International Nuclear Law Association and the European Commission.

The objective of this school is to provide a high-quality, two-week programme on various aspects of nuclear law both to law students pursuing their studies at doctoral or masters level and to young legal professionals who are already active in the nuclear sector.



The opening session of the school, which is due to take place in summer 2001, will include classes on the following subjects: protection against ionising radiation; safety of nuclear installations; radioactive waste management; transport of nuclear materials; physical protection; non-proliferation; regulation of trade; third-party liability and the compensation of nuclear damage; and environmental law. An information brochure, application form and further details on the programme may be downloaded from the NEA website at www.nea.fr/html/law/.

Contact



Patrick Reyners
 Head, Legal Affairs
Tel.: +33 (0)1 45 24 10 30
Fax: +33 (0)1 45 24 11 10
E-mail: patrick.reyners@oecd.org

Joint Projects and Other Co-operative Projects

NUCLEAR SAFETY

The Halden Reactor Project

The Halden Reactor Project is the oldest and largest NEA project and constitutes a very important international technical network in the areas of nuclear fuel reliability, integrity of reactor internals, plant control/monitoring and human factors. The project has been operating by way of three-year renewable mandates for the past 40 years. The present mandate started at the beginning of 2000. The programme of work for the year 2000 in the fuel and materials area included fuel experiments in the high/very high burn-up range (UO₂ and MOX fuels) at normal operating conditions, and preparations for transient tests. Investigations of embrittlement and cracking behaviour of reactor internals materials have been carried out experimentally at representative reactor conditions and with the utilisation of advanced instrumentation. The programme on plant control and monitoring provided assessments of systems having the potential to improve plant performance and operational safety. The activities on human factors extended the knowledge of human performance in a control room environment and demonstrated how this knowledge can be incorporated in control room engineering solutions. The Halden Project is carried out at the Halden establishment in Norway and is supported by approximately 100 organisations in 20 countries.

The Halden Board of Management decided that a review of technical priorities, programme set-up and programme execution needed to be carried out in order to adequately prepare the direction of future programmes. The review was conducted by Board Members in 2000 with involvement of the NEA Secretariat.

Following a recommendation of the Halden Board to actively pursue the transfer of nuclear technology and know-how to the younger generation, a Halden summer school was started in August 2000. The NEA Nuclear Safety Division supported this endeavour.

The Cabri Water Loop Project

The Cabri Water Loop Project is investigating the ability of high burn-up fuel to withstand the sharp power peaks that can occur in power reactors due to rapid reactivity insertion in the core (RIA accidents). It involves substantial facility modifications and upgrades and consists of 12 experiments to be performed with fuel retrieved from power reactors and refabricated to suitable length. The project began in 2000 and will run for eight years. While the main lines of the programme of work and schedule have been defined, details of the scope and of the experimental conditions are still being discussed by the

participants. The experimental work will be carried out at the *Institut de protection et de sûreté nucléaire* (IPSN) in Cadarache, France, where the Cabri reactor is located. Programme execution can, however, involve laboratories in participating organisations (for instance, in relation to fuel characterisation or post-irradiation examinations).

The Cabri Agreement was reviewed in March 2000, including recommendations from participants. Upon completion of discussions and reviews, the final version of the Agreement was prepared by the NEA Secretariat and circulated to participants. Eleven out of the twelve countries to which the Umbrella Agreement was originally addressed have signed the Agreement.

Three meetings of the Cabri Technical Advisory Group (TAG) and two meetings of the Cabri Steering Committee were held in 2000. Progress was made in defining the scope of the first tests (i.e. the types of fuel to be studied) and the scope of the pre-test and post-test examinations. Actions were identified for the acquisition of fuel, for the requirements on the test section and instrumentation, and for the definition of the thermal-hydraulic conditions of the tests.



Halden Hammlab research facility for human factor research.

OECD Halden Reactor Project, Norway

The Rasplav Project

The Rasplav¹ Project, devised to support accident management strategies for potential reactor accident scenarios involving core melt,

1. "Rasplav" means "melt" in Russian.

was successfully concluded. The results are contained in the project's final report that was presented and reviewed at the last Rasplav Seminar 2000 held in November.

The Rasplav Project was established as an OECD/NEA Project six years ago. It consisted of four large-scale tests complemented by a series of smaller-scale experiments, all involving the use of materials representative of power reactor cores. Experiments with these test materials in molten condition required temperatures of approximately 3000°C, which represented a major challenge, especially for large-scale tests. The experiments were carried out at the Kurchatov Institute near Moscow. The analytical work was done at the Institute of Nuclear Safety (IBRAE) of the Russian Academy of Science.

The Rasplav Project brought together Russia and 16 OECD Member countries, including the United States, Canada, the Republic of Korea, Japan and 12 European countries.

Eighty experts from 14 countries attended the final Rasplav seminar held in Munich, which was hosted by the German *Gesellschaft für Anlagen- und Reaktorsicherheit* (GRS). The executive summary of the seminar is available on the NEA website at www.nea.fr/html/jointproj/rasplav.html.

The MASCA Project

Following a recommendation by the NEA Committee on the Safety of Nuclear Installations (CSNI), a proposal for a Rasplav follow-up project, denominated MASCA, was submitted by the Kurchatov Institute to potential participants during a meeting of technical experts organised by the NEA in spring 2000. The proposal aims to resolve remaining uncertainties on heat load to the reactor vessel and thus on the possibility of retaining melt in the vessel. These uncertainties are mainly associated with scaling effects and coupling between thermal-hydraulic and chemical behaviour in the melt. To achieve this basic objective, supporting experiments and analyses will be performed with a view to providing an understanding of the phenomena of interest, and to producing a consistent interpretation of the results by means of mechanistic models.

The technical expert meeting endorsed the Kurchatov Institute proposal and organisations from 17 countries confirmed their participation in the project. It will include tests with prototypical materials to be carried out at the Kurchatov Institute. The duration of the project is three years, with completion planned by mid-2003.

The Sandia Lower Head Failure Project

This three-year OECD/NEA project started in 1999. It brings together eight Member countries for the purpose of studying the creep rupture behaviour of models of light water reactor lower heads. This information is useful for the development of severe accident management strategies for coping with ex-vessel behaviour. To date, two of the five steel models of a lower head have been tested to failure. The project is the continuation of a similar one carried out previously at Sandia National Laboratories with US Nuclear Regulatory Commission funding.

The MCCI Project

Following a recommendation by the CSNI, experts convened by the NEA recommended that initiatives be taken to address molten core ex-vessel phenomena. The proposal for an experimental project set forth by the Argonne National Laboratory in the United States, denominated MCCI Project, was recommended.

The 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. To achieve these basic objectives, supporting experiments and analyses will be performed, with a view to providing an understanding of the phenomena of interest, and to producing a consistent interpretation of the results relevant for accident management. It is envisaged that the MCCI Project will be established during 2001.

The SETH Project

A recent CSNI report addresses the need for safety research in the area of thermal-hydraulics as well as facilities requiring international collaborative efforts for their continued operation. Two of these facilities have proposed an experimental programme, which constitutes the SETH Project, aimed at studying important thermal-hydraulic phenomena in support of accident management.

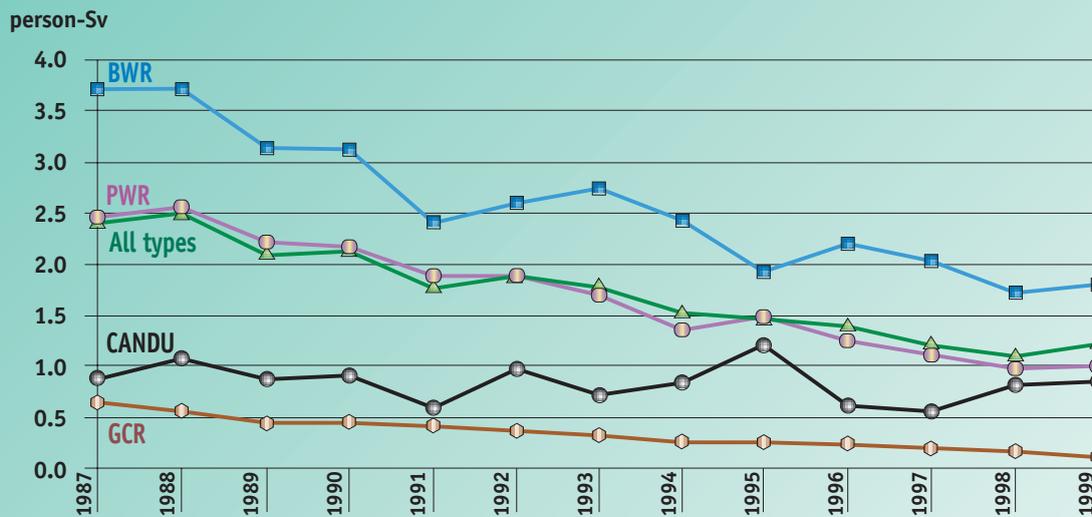
The experiments, to be carried out at the Paul Scherrer Institute PANDA facilities in Switzerland, are to provide data on containment 3D gas flow and distribution issues that are important for code prediction capability improvements, accident management and design of mitigating measures. These experiments will be conducted at large scale in multi-compartment geometries in order to provide data suitable for the improvement and validation of safety analysis codes. The tests to be carried out at the Siemens *Primär Kreislauf* in Germany will investigate two pressurised water reactor safety issues, i.e. boron dilution accidents and loss-of-heat removal during mid-loop operation (shutdown conditions). The first category of tests will verify if conditions can arise for core reactivity insertion due to boron dilution during a small-break, loss-of-coolant accident accompanied by natural circulation restart. The second test series will assess primary circuit accident management operations aimed at preventing fuel uncoverage as a consequence of loss-of-heat removal in mid-loop operation conditions.

The SETH Project has received support from 14 NEA Member countries. It is due to start in spring 2001 and will have a duration of four years.

The PLASMA Project

The PLASMA Project could be considered as a spin-off from the Halden Project in that it represented a practical utilisation and extension of

Average collective dose per reactor for operating reactors included in ISOE by reactor type



the technology developed at Halden on plant monitoring. As in the case of a previous project (SCORPIO VVER), it also represented a way to enhance interaction among Halden participants on practical plant applications.

The PLASMA Project was a collaborative effort among the Japan Atomic Energy Research Institute (JAERI), the Hungarian Academy of Sciences (KFKI), the Paks nuclear power plant in Hungary and the Halden establishment in Norway. The objective was to implement a system to monitor plant safety parameters in VVER power plants as part of VVER control upgradings. Paks was the reference plant in which the system was first implemented and demonstrated. The project had a duration of two years and was completed in 2000.

As a final step in this project, a workshop was conducted to familiarise other operators of VVER power plants with the characteristics of the PLASMA system.

ICDE Project

The International Common-cause Data Exchange (ICDE) project has been operating under NEA auspices since 1998. A new agreement covering the period 2000-2002 is being implemented. Nine NEA Member countries currently participate.

The ICDE Project aims at collecting data on all possible "events", comprising complete, partial and incipient common-cause failures (CCF). The project covers the key components of the main safety systems, such as centrifugal pumps, diesel generators, motor-operated valves, power-operated relief valves, safety relief valves, check valves, reactor protection system circuit breakers, batteries and transmitters.

These components have been selected because several probabilistic safety assessments have identified them as major risk contributors in the case of common-cause failures. Qualitative insights from analysis of the data help reduce the number of CCF events that are significant contributors to risk. In the long-term, a broad basis for quantifying CCF events will be established.

RADIATION PROTECTION

International Accident Dosimetry Inter-comparison

Over the past few years several accidents have occurred involving the occupational overexposure, sometimes very seriously, of radiation workers. Having accurate personal dosimetry in such cases is essential in order to effectively design medical treatment for highly exposed personnel, and to appropriately assess the accident and its consequences so as to avoid such situations in the future. For these reasons, the French Institute for Protection and Nuclear Safety (IPSN) and the NEA are organising an international inter-comparison of accident dosimetry, with financial assistance from the European Commission.

The performance of accident dosimetry systems will be validated through controlled irradiation in the well-characterised, mixed neutron and gamma field environment of the SILENE reactor. Because the radiation fields generated by the SILENE reactor can be varied from extremely intense to extremely low levels, several types of accident dosimetry can be tested. This includes biological methods (using blood samples for example), personal dosimeters, area radiation monitors, and even environmental radiation monitors.

The technical scenarios and organisational details of the exercise were finalised in 2000. Some 60 organisations have already indicated their interest in participating in this inter-comparison exercise, which is scheduled to take place in the spring of 2002.

ISOE: The Information System on Occupational Exposure

The objectives of the ISOE Programme, launched in 1992 and co-sponsored by the IAEA, are to promote and co-ordinate international co-operative undertakings in the area of worker protection at nuclear power plants; to collect annual occupational exposure data from commercial nuclear power plants and to analyse them for general

trends; and to provide a forum for communication among radiation protection experts.

At the end of 2000, the programme involved the participation of 450 reactors (in operation, cold shutdown or some stage of decommissioning), owned by 72 utilities in 27 countries. National regulatory authorities from 26 countries also participate in the ISOE programme. The participation of 397 operating reactors represents 92% of the operating commercial nuclear reactors worldwide (out of a total of 433), making ISOE the largest occupational exposure database in the world. During 2000, the Russian Federation joined the ISOE programme with 13 VVER reactors and one fast breeder reactor.

Regarding the average collective dose per operating reactor included in the ISOE database, a significant downward trend can be observed over the period 1987 to 1999. More information and trends can be found in the recent publication *Occupational Exposures at Nuclear Power Plants: Ninth Annual Report of the ISOE Programme, 1999* (OECD/NEA, 2000).

RADIOACTIVE WASTE MANAGEMENT AND DATA

Decommissioning

The RWMC Co-operative Programme for the Exchange of Scientific and Technical Information Concerning Nuclear Installation Decommissioning Projects (CPD) expanded its membership to 39 projects, and implemented a co-ordinated communication programme to develop and disseminate the policy, strategy and technical views of the decommissioner. The CPD continues to play a key role in the Agency's decommissioning activities as a whole.

In addition to the specific work of the CPD, the NEA has adopted a broad, cross-cutting approach to addressing higher-level policy and regulatory issues in decommissioning. Based on the NEA's collective experience in decommissioning, as well as on the 1999 Workshop on the Regulatory Aspects of Decommissioning, an issues paper has been developed in which several key topics have been identified. The following topics will be addressed by combining the competencies of the NEA's various standing technical committees within their existing programmes of work:

- Decommissioning Policy and Strategies;
- Waste Management and Material Reuse Considerations;
- Authorised Release of Sites and Facilities;



ENRESA, Spain

Dismantling operations at Vandellos 1, Spain.

- Securing Long-Term Funding and Responsibility;
- Framework for Safety Regulation of Decommissioning.

The Thermochemical Database (TDB) Project

The NEA Thermochemical Database (TDB) Project makes available an internationally recognised and quality-assured chemical thermodynamic database of selected chemical elements for use in the safety assessment of radioactive waste repositories.

The NEA Data Bank acts as project co-ordinator and is responsible for maintaining and updating the database, providing bibliographic and data services to Member countries, and publishing the recommended thermochemical data. The review of recommended chemical thermodynamic data for neptunium (Np) and plutonium (Pu) has been completed and the manuscript was sent for publication at the end of 2000.

As part of the second phase of the TDB Project, five separate expert teams, responsible for the evaluation and selection of recommended data, have worked on the following tasks:

- updating the existing reviews of U, Am, Tc, Np and Pu;
- evaluating the simple organic compounds of U, Am, Tc, Np, Pu, Se, Ni and Zr;
- evaluating the inorganic compounds of Se, Ni and Zr.

The expert teams are expected to finalise their work in 2001.

Sorption Project

In October 1995, the NEA Sorption Project was launched to study the potential of thermodynamic models for improving representation of sorption phenomena in performance assessments of radioactive waste repositories. A first phase of the project was initiated with the objectives of gathering new information to be presented in a comprehensive status report. This phase focused on advances that have been made in the field of sorption modelling, with presentation of successful examples of radionuclide sorption in natural samples.

In a further attempt to better understand and quantify the potential contribution of sorption phenomena to the safety of geologic repositories, participants decided to launch a second phase of the project. The objective of Sorption II is to demonstrate the applicability of different chemical thermodynamic modelling approaches to support the selection of sorption parameters for safety assessments. The project is taking the form of a "benchmarking" exercise for the different modelling approaches being pursued by the participating organisations. The overall aim is to interpret selected, well-characterised datasets for sorption in complex materials. By applying the various modelling approaches in a systematic way to the same measured data, an evaluation of the merits and limitations of the approaches will be possible and thus recommendations on their use.

A total time scale of 24 months is envisaged for the project, with an intermediate milestone after the first six months. This milestone is considered important to allow an assessment of the viability of the project based on existing data sets. At present, 14 organisations from 10 Member countries participate in Sorption II.

Information Programme

Mission

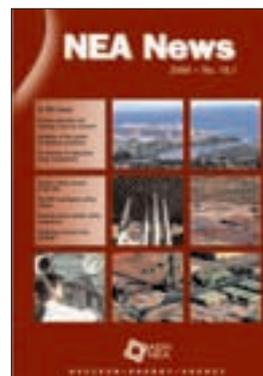
The main goal of the NEA in the area of information and communication is:

- to provide Member governments and other interested parties with information resulting from the activities of the NEA, and
- to enhance awareness and understanding of the scientific, technical and economic aspects of the nuclear option, as well as awareness of the NEA itself.

Highlights

- A total of 75 publications were produced in 2000 covering the full range of NEA activities.
- A first series of improvements was made to the NEA website, with a major upgrade planned for 2001.
- NEA information and publications stands were organised at six major international conferences.
- The NEA co-sponsored 18 international conferences during 2000.

The *NEA Newsletter* was renamed *NEA News* in order to better reflect the type of publication and its content. The change of name was accompanied by a fresh new design for the cover and inside pages.



Publications

The Agency produced 75 publications in 2000, of which 43 were on sale and 32 were distributed free of charge. The list of these publications is provided on page 32. Best sellers included *Radiological Impacts of Spent Nuclear Fuel Management Options*, *Reform of Civil Nuclear Liability* and *Uranium 1999: Resources, Production and Demand*. In addition to standard distribution, over 700 requests for free publications were received (primarily via e-mail), involving the shipment of more than 1 300 reports.



A database-driven photo library containing over 1 800 images was made available to staff via the Intranet in order to help in the preparation of Agency publications and articles for *NEA News*. Contributions to the photo library from outside sources – including nuclear power plants, fuel cycle facilities and information centres – are welcome.

Improvements to the publications programme database were defined in 2000, and will be implemented in 2001. It is hoped that these changes will help speed up the publications process, and thus provide valuable information to Member country experts more quickly.



Internet communication

More and more people are visiting the Agency's website, and spending more time once they are there. The number of visitors to the website rose steadily throughout the year, from 37 000/month in January to 55 000/month in December. Individual page viewings rose from 137 000 in January to 228 000 in December. *Chernobyl – Ten Years On: Radiological and Health Impact* (OECD/NEA, 1996) continued to be the most highly accessed report, followed by "What's New" (the NEA online bulletin) and Nuclear Data Services. By the end of the year, over 2 000 reports were available in full.

Two main improvements were made in terms of Internet communication. In follow-up to the international marketing survey carried out in 1999, a new section for "NEA Policy Papers" was created on the Agency's website. The material in this section is designed to cater to the needs of policy makers who require concise summaries of the Agency's technical and scientific work. The other improvement concerned the modernisation of the Agency's monthly electronic bulletin, which provides updates of the Agency's work to a mailing list of over 4 000 subscribers. Subscriptions are free of charge and can be made at www.nea.fr/html/signon.html. A progressive update of the entire site's contents will be carried out during 2001, culminating in the implementation of a new graphical interface by the end of the year.

The Agency also participated in the launch of two new OECD products, SourceOECD and OECD direct, and the re-launch of the OECD online bookshop. www.sourceoecd.org is the Organisation's new online publications portal containing the full text of all OECD books on sale that have been published since January 1998. All NEA committee members are entitled to free access to this service. (The "Delegates' Area" located at www.nea.fr continues to serve NEA committee members with official reports and meeting documents.) OECDdirect is a free e-mail alerting service offering a choice of 29 thematic areas, including nuclear energy. The OECD online bookshop introduced two innovative features during 2000: *Browse_it* and *Buy_it-Read_it*. *Browse_it* is a service whereby visitors to www.oecd.org/bookshop/ can scroll through the pages of the book on screen before buying it. *Buy_it-Read_it* goes one step further, allowing online purchasers to download immediately a pdf file of all books they order.

International co-operation

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

- DISTEC 2000, International Conference on Radioactive Waste Disposal, Berlin, Germany, 4-6 September;
- SAFEWASTE 2000, Montpellier, France, 2-4 October;
- Monte Carlo 2000, Lisbon, Portugal, 23-26 October;
- 12th Pacific Basin Nuclear Conference (PBNC), Seoul, Korea, 29 October-2 November;
- American Nuclear Society "Winter Meeting", Washington DC, USA, 12-16 November;
- Investing in Trust: Nuclear Regulators and the Public, Paris, France, 29 November-1 December.

The NEA presence at these conferences allowed the Agency to inform its usual "clients" of the latest developments in the programme of work and publications. It also provided a means to reach out to new audiences, including academics and national experts not yet familiar with the networks and information available at the international level.

Co-sponsorship of 18 international conferences was organised in 2000. Some of the events at which the NEA made significant contributions included DISTEC 2000, Monte Carlo 2000 and the International ISOE ALARA Symposium held in Tarragona, Spain on 4-7 April.

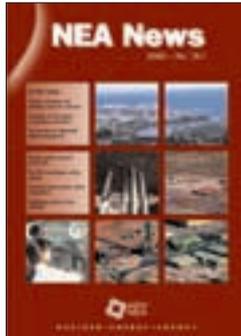
Contact



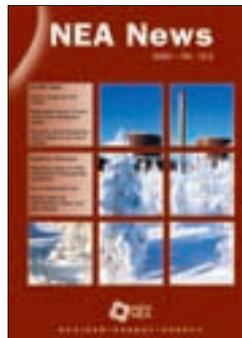
Jacques de la Ferté
 Head, Central Secretariat
Tel.: +33 (0)1 45 24 10 10
Fax: +33 (0)1 45 24 11 10
E-mail: jacques.delaferte@oecd.org

NEA Publications Produced in 2000

Publications of General Interest

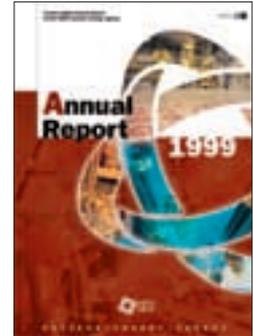


NEA News
Vol. 18 Nos. 1 and 2
ISSN 1605-9581
Annual subscription price:
FF 240, US\$ 45, DM 75, £ 26, ¥ 4 800.



NEA Annual Report – 1999

Free: paper or Web.



**Catalogue of
publications – 2000**

Free: paper or Web.



**Geologic Disposal of
Radioactive Waste
in Perspective**

ISBN 92-64-18425-2
Price: FF 130, US\$ 20, DM 39, £ 12, ¥ 2 050.

Nuclear Safety

**Nuclear Power Plant Operating
Experiences from the IAEA/NEA
Incident Reporting System – 1996-1999**

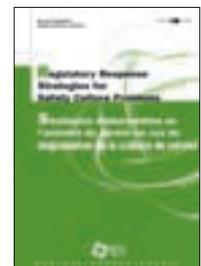
ISBN 92-64-17671-3
Free: paper or Web.



Nuclear Regulation

**Regulatory Response
Strategies for Safety
Culture Problems**

Bilingual
ISBN 92-64-07672-7
Free: paper or Web.



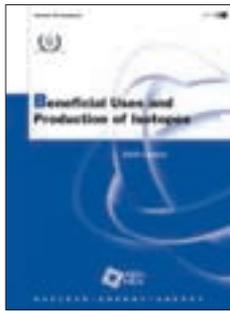
**Assuring Nuclear Safety Competence
into the 21st Century**

Workshop Proceedings, Budapest, Hungary
12-14 October 1999

ISBN 92-64-18517-8
Price: FF 340, US\$ 50, DM 101, £ 31, ¥ 5 300.



Economic and Technical Aspects of the Nuclear Fuel Cycle



Beneficial Uses and Production of Isotopes – 2000 Update

ISBN 92-64-18417-1
Price: FF 160, US\$ 15, DM 48, £ 15, ¥ 2 450.

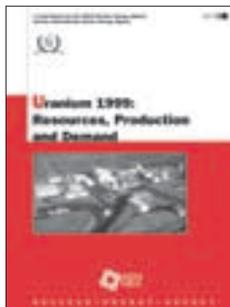
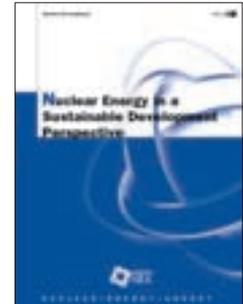


OECD Nuclear Energy Data – 2000

Bilingual – ISBN 92-64-05913-X
Price: FF 130, US\$ 20, DM 39, £ 12, ¥ 2 050.

Nuclear Energy in a Sustainable Development Perspective

ISBN 92-64-18278-0
Free: paper or Web.



Uranium 1999: Resources, Production and Demand

ISBN 92-64-17198-3
Price: FF 510, US\$ 77, DM 152, £ 48, ¥ 8 100.

Methodologies for Assessing the Economic Consequences of Nuclear Reactor Accidents

ISBN 92-64-17658-6
Price: FF 200, US\$ 31, DM 60, £ 19, ¥ 3 250.

Reduction of Capital Costs of Nuclear Power Plants

ISBN 92-64-17144-4
Price: FF 240, US\$ 38, DM 72, £ 24, ¥ 4 400.



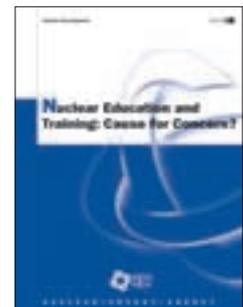
Nuclear Power in Competitive Electricity Markets

ISBN 92-64-18262-4
Free: paper or Web.

Nuclear Education and Training: Cause for Concern?

ISBN 92-64-18521-6
Price: FF 210, US\$ 31, DM 63, £ 19, ¥ 3 300.

A Summary Report
ISBN 92-64-18260-8
Free: paper or Web.



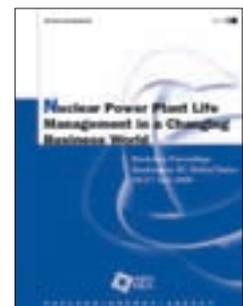
Business as Usual and Nuclear Power

ISBN 92-64-17175-4
Price: FF 160, US\$ 25, DM 48, £ 16, ¥ 2 850.

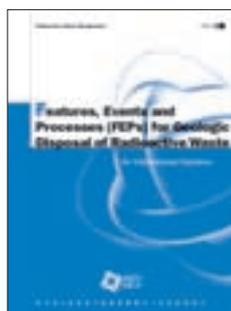
Nuclear Power Plant Life Management in a Changing Business World

Workshop Proceedings, Washington DC, United States, 26-27 June 2000

ISBN 92-64-18429-5
Price: FF 375, US\$ 53, DM 112, £ 35, ¥ 5 680.



Radioactive Waste Management



Features, Events and Processes (FEPs) for Geologic Disposal of Radioactive Waste

An International Database

ISBN 92-64-18514-3

Price: FF 150, US\$ 24, DM 45, £ 15, ¥ 2 900.



CD-ROM – 2000 Edition

ISBN 92-64-16795-1

Price: FF 400, US\$ 58, DM 119, £ 37, ¥ 6 250.

SR 97: Post-closure Safety of a Deep Repository for Spent Nuclear Fuel in Sweden

An International Peer Review

ISBN 92-64-18261-6

Free: paper or Web.

Regulatory Reviews of Assessments of Deep Geologic Repositories

Lessons Learnt

ISBN 92-64-05886-9

Price: FF 210, US\$ 32, DM 63, £ 20, ¥ 3 400.



Stakeholder Confidence and Radioactive Waste Disposal

Workshop Proceedings, Paris, France
28-31 August 2000

ISBN 92-64-18277-2

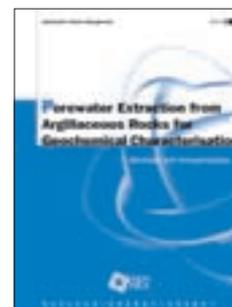
Free: paper or Web.

Porewater Extraction from Argillaceous Rocks for Geochemical Characterisation

Methods and Interpretations

ISBN 92-64-17181-9

Price: FF 380, US\$ 60, DM 113, £ 37, ¥ 6 350.



Strategic Areas in Radioactive Waste Management

The Viewpoint and Work Orientations of
the NEA Radioactive Waste Management
Committee

Free: paper or Web.

Radiation Protection



Occupational Exposures at Nuclear Power Plants

Ninth Annual Report of the
ISOE Programme, 1999

ISBN 92-64-18270-5

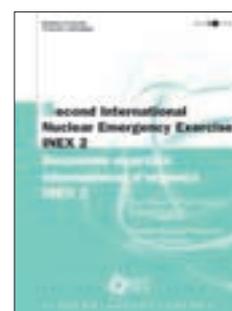
Free: paper or Web.

Second International Nuclear Emergency Exercise INEX 2

Final Report of the Finnish
Regional Exercise

ISBN 92-64-08580-7

Price: FF 150, US\$ 21, DM 45, £ 14, ¥ 2 250.



A Critical Review of the System of Radiation Protection

First Reflections of the OECD Nuclear Energy Agency's Committee
on Radiation Protection and Public Health (CRPPH)

ISBN 92-64-18554-2 – Free: paper or Web.



Monitoring and Data Management Strategies for Nuclear Emergencies

ISBN 92-64-17168-1

Price: FF 160, US\$ 26, DM 48, £ 16, ¥ 2 850.

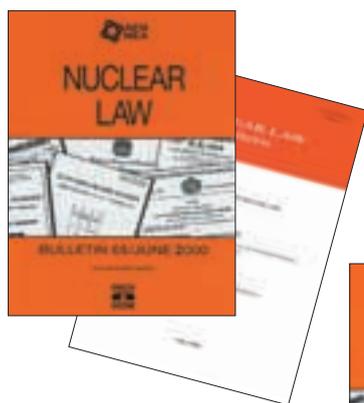
Radiological Impacts of Spent Nuclear Fuel Management Options

A Comparative Study

ISBN 92-64-17657-8

Price: FF 215, US\$ 32, DM 64, £ 20, ¥ 3 400.

Nuclear Legislation

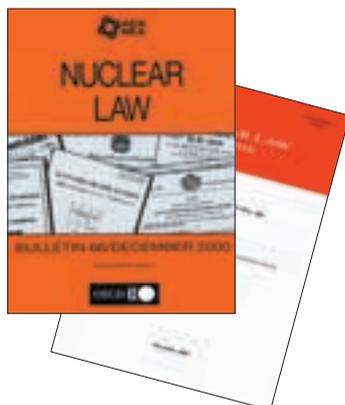


Nuclear Law Bulletin

Nos. 65 and 66 plus Supplements
June and December 2000

ISSN 0304-341X

Annual subscription price:
FF 460, US\$ 80, DM 140, £ 48, ¥ 9 550.



Nuclear Legislation: Analytical Study

Regulatory and Institutional Framework for
Nuclear Activities – New Edition

ISBN 92-64-17676-4

Price: FF 950, US\$ 143, DM 283, £ 89, ¥ 15 050.



Reform of Civil Nuclear Liability

Budapest Symposium 1999

Bilingual

ISBN 92-64-05885-0

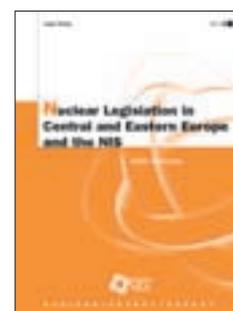
Price: FF 800, US\$ 129, DM 239, £ 79, ¥ 13 850.

Nuclear Legislation in Central and Eastern Europe and the NIS

2000 Overview

ISBN 92-64-18525-9

Price: FF 220, US\$ 32, DM 66, £ 20, ¥ 3 400.



The Data Bank

International Evaluation Co-operation



Volume 14: Processing and
Validation of Intermediate
Energy Evaluated Data Files

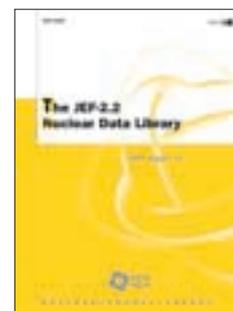
Free: paper or Web.

The JEF-2.2 Nuclear Data Library

JEFF Report 17

ISBN 92-64-17686-1

Free: paper or Web.



CD-CINDA 2000

Index to Literature and Computer Files
on Microscopic Neutron Data

Free CD-ROM on request.



Evaluation and Analysis of Nuclear Resonance Data

JEFF Report 18

ISBN 92-64-18272-1

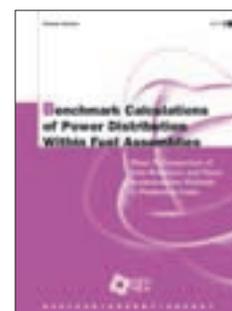
Free on request.



Basic Studies on High-temperature Engineering

First Information Exchange Meeting, Paris, France
27-29 September 1999

ISBN 92-64-17695-0
Free: paper or Web.



Benchmark Calculations of Power Distribution Within Fuel Assemblies

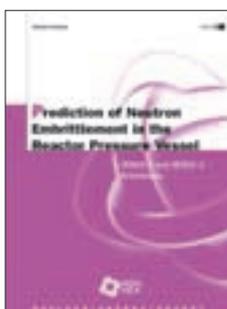
Phase II: Comparison of Data Reduction and Power Reconstruction Methods in Production Codes

ISBN 92-64-18275-6
Free: paper or Web.

Prediction of Neutron Embrittlement in the Reactor Pressure Vessel

VENUS-1 and VENUS-3 Benchmarks

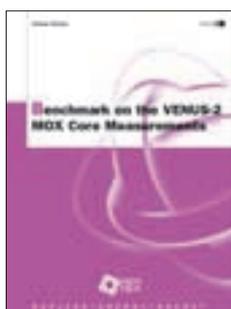
ISBN 92-64-17637-3
Free: paper or Web.



Calculations of Different Transmutation Concepts

An International Benchmark Exercise

ISBN 92-64-17638-1
Free: paper or Web.

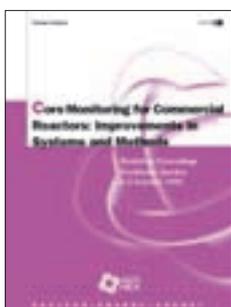


Benchmark on the VENUS-2 MOX Core Measurements

ISBN 92-64-18276-4
Free: paper or Web.

Pressurised Water Reactor Main Steam Line Break (MSLB) Benchmark

ISBN 92-64-18280-2
Free: paper or Web.



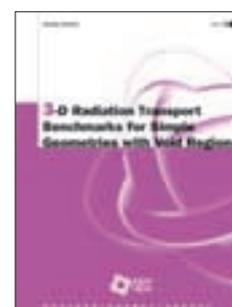
Core Monitoring for Commercial Reactors: Improvements in Systems and Methods

Workshop Proceedings, Stockholm, Sweden
4-5 October 1999

ISBN 92-64-17659-4
Price: FF 460, US\$ 71, DM 137, £ 44, ¥ 7 450.

3-D Radiation Transport Benchmarks for Simple Geometries with Void Regions

ISBN 92-64-18274-8
Free: paper or Web.



Main Workshops and Seminars Held in 2000

March

14-15 Workshop on Pyrochemical Separations - Villeneuve-les-Avignon, France.

22-23 Workshop on the Instrumentation and Monitoring of Concrete Structures - Brussels, Belgium.

April

04-07 International ISOE ALARA Symposium - Tarragona, Spain.

10-13 Workshop on Advanced Thermal-Hydraulic and Neutronic Codes: Current and Future Applications - Barcelona, Spain.

May

14-17 Workshop on Regulatory Inspection Activities - Baltimore, Maryland, USA.

18-19 Workshop on the Preservation of Experimental Integral Reactor Physics Data - Budapest, Hungary.

29-31 Workshop on the Safety of the Nuclear Fuel Cycle - Tokyo, Japan.

June

26-27 International Workshop on Nuclear Power Plant Life Management in a Changing Business World - Washington DC, USA.

July

17-21 5th Specialist Meeting on Shielding Aspects of Accelerators, Targets and Irradiation Facilities (SATIF 5) - Paris, France.

August

28-31 Forum on Stakeholder Confidence - Paris, France.

September

04-07 International Conference on "Supercomputing in Nuclear Applications" (SNA 2000) - Tokyo, Japan.

26-29 Seminar on Fission Gas Behaviour in Water Reactor Fuels - Cadarache, France.

October

17-18 Workshop on Safety Performance Indicators - Madrid, Spain.

23-26 International Conference "Monte Carlo 2000 - Advanced Monte Carlo Techniques for Radiation Physics, Particle Transport Simulation and Applications" - Lisbon, Portugal.

November

14-15 RASPLAV 2000, Final Seminar - Munich, Germany.

29-01 Workshop on Investing in Trust: Nuclear Regulators and the Public - Paris, France.

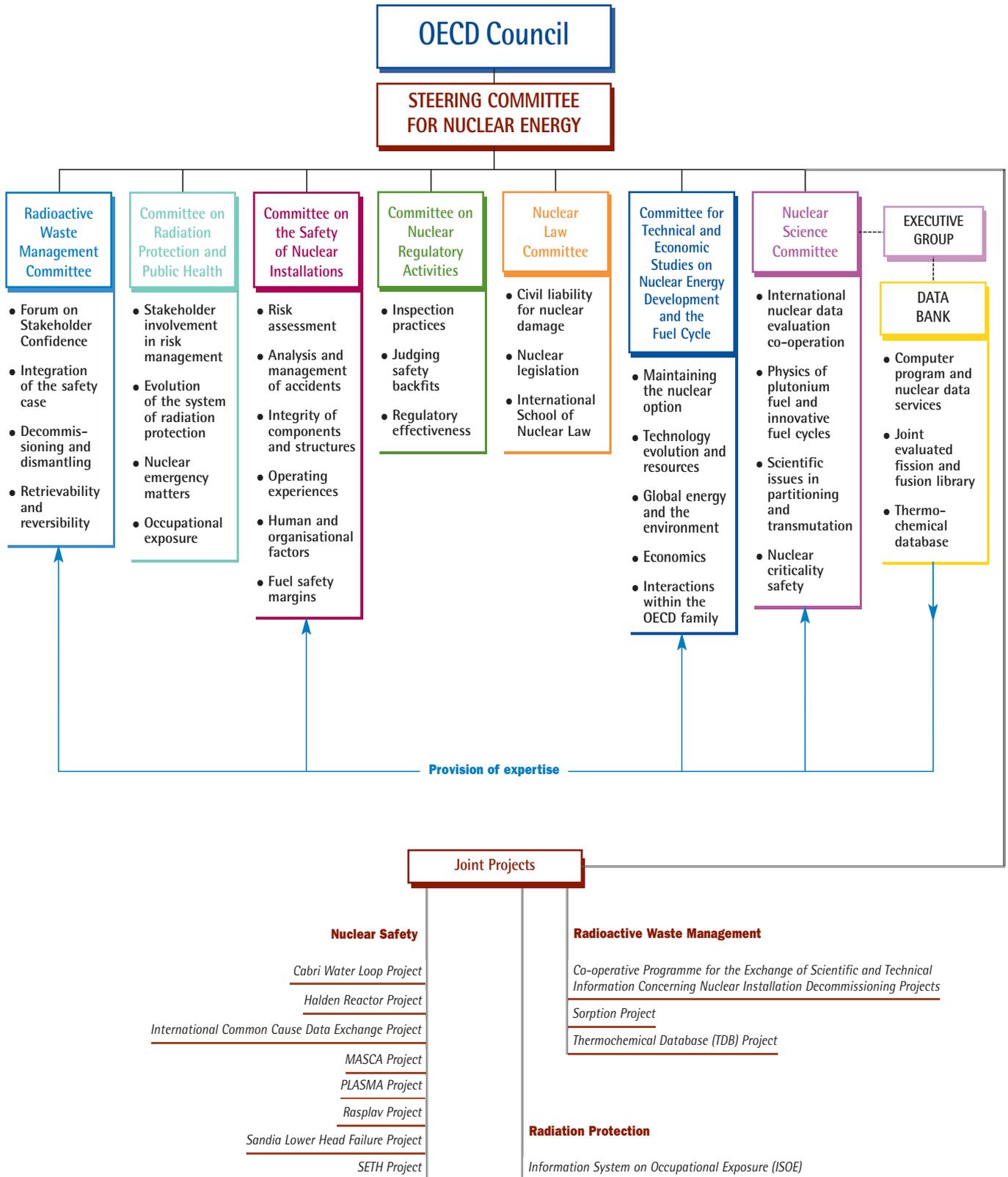
Where to buy NEA publications

www.oecd.org/bookshop

Where to order free NEA publications

e-mail: neapub@nea.fr

Organisation Charts of the NEA



NEA Secretariat Structure in 2000



Director-General
Luis Echávarri



**Deputy
Director-General**
Sam Thompson



**Safety and
Regulation**
Kazuo Shimomura
Deputy Director



**Science and
Development**
Philippe Savelli*
Deputy Director

* Retired



**Central Secretariat,
Information and
Publications**
Jacques de la Ferté
Head



**Legal
Affairs**
Patrick Reyners
Head



**Management
Support Unit**
John Hembury
Head



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



**Nuclear
Safety**
Gianni Frescura
Head of Division



**Nuclear
Development**
Peter Wilmer
Head of Division



**Nuclear
Science
and
Data Bank**
Claes Nordborg
Principal Administrator

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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

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

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

NUCLEAR ENERGY AGENCY

The OECD Nuclear Energy Agency (NEA) was established on 1st February 1958 under the name of the OEEC European Nuclear Energy Agency. It received its present designation on 20th April 1972, when Japan became its first non-European full Member. NEA membership today consists of 27 OECD Member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Luxembourg, Mexico, the Netherlands, Norway, Portugal, Republic of Korea, 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.

Publié en français sous le titre :
AEN – RAPPORT ANNUEL – 2000

© OECD 2001

Permission to reproduce a portion of this work for non-commercial purposes or classroom use should be obtained through the Centre français d'exploitation du droit de copie (CCF), 20, rue des Grands-Augustins, 75006 Paris, France, Tel. (33-1) 44 07 47 70, Fax (33-1) 46 34 67 19, for every country except the United States. In the United States permission should be obtained through the Copyright Clearance Center, Customer Service, (508)750-8400, 222 Rosewood Drive, Danvers, MA 01923, USA, or CCC Online: <http://www.copyright.com/>. All other applications for permission to reproduce or translate all or part of this book should be made to OECD Publications, 2, rue André-Pascal, 75775 Paris Cedex 16, France.

OECD PUBLICATIONS, 2 rue André-Pascal, 75775 Paris Cedex 16

OECD No. 81341 2001
ISBN 92-64-18467-8

Printed by OCEP, Coutances, France