

NEA

1998 Annual Report

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

T H E N E A I N B R I E F



NEA Directors and Staff

From left to right: M. Takahashi, A. Bruchet, S. Thompson, P. Savelli, K. Flood, L. Echavarrri, A. Casseville.

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 contribute to the development of nuclear energy as a safe, environmentally acceptable and economical energy source through co-operation among its participating countries.

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 former Soviet Union (NIS).

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27 Member countries (21 in the Data Bank)

40 years of international service

7 standing technical committees

5 international joint projects funded by participants

73 professional and support staff

570 national experts participating in NEA committees

5 300 experts participating in policy and technical meetings organised at OECD headquarters

FF 57.7 million budget for the NEA in 1998, supplemented by voluntary contributions

FF 16.9 million budget for the Data Bank in 1998, supplemented by voluntary contributions

55 publications in 1998

Governing body: the Steering Committee for Nuclear Energy

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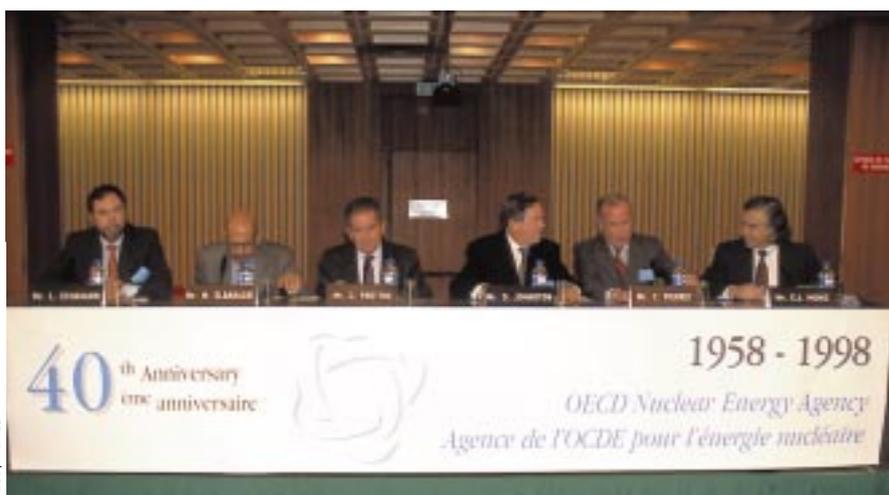
Mr. Luis Echávarri
Director-General of the NEA

1998

In Perspective

The year 1998 marked a particularly significant milestone in the life of the Nuclear Energy Agency. The fortieth anniversary of the Agency was celebrated in October with the participation of high-level government officials in the field of energy, nuclear energy and the environment. The theme of this anniversary session – *The contribution of nuclear energy to a new global age* – echoed the wide-ranging debate as to what extent nuclear energy would be relied upon for providing electricity in the future. Discussions focused on what role international co-operation could play in assisting governments and industry to adjust to the new parameters of the energy market, in a world marked by economic globalisation, the deregulation of the electricity market, and increasing interest in sustainable development.

These factors have contributed to shaping the Agency's programme over the past year. The NEA was called upon to "manage the present, while preparing for the challenges of the future." If, in some countries, the economic and political climate is not propitious for a major expansion of nuclear energy, many others consider that continuing research efforts are essential both to resolve issues arising from current nuclear energy management practices, and also to prepare the ground for future development.



Conference of the NEA 40th anniversary. From left to right: Mr. L. Echávarri, Director-General of the NEA; Mr. M. ElBaradei, Director-General of the International Atomic Energy Agency (IAEA); Mr. C. Prettre, Chairman of the Steering Committee for Nuclear Energy; Mr. D. Johnston, Secretary-General of the OECD; Mr. C. Pierret, Secretary of State for Industry, France; and The Honorable E.J. Moniz, Under-Secretary for Energy, United States.



Budget constraints are limiting national research activities, particularly for the long-term. International co-operation is therefore now even more important to meet the growing need for common and internationally recognised references. International research is needed to ensure the active maintenance of the underlying knowledge base and scientific infrastructure, without which the future of nuclear technology may be at risk. To meet these needs, the NEA has continued its long tradition of organising and co-ordinating autonomous co-operative projects, and pooling the resources of interested Member countries to address technical and scientific problems of common interest.

1998 also saw an in-depth review carried out addressing how the Organisation's role in nuclear energy should evolve over the next decade and beyond. The conclusions of this review, which were endorsed by the OECD Council, point toward a greater integration of elements of the Agency's work into the Organisation's activities, particularly relating to sustainable development. Another follow-up of this review was the adoption of a Strategic Plan for the NEA, aimed at strengthening the Agency's role as a forum for exchanging information and experience, a centre of nuclear competence, and a contributor of nuclear policy analysis. The NEA Strategic Plan provides a road map for the Agency to discharge its mission of assisting its Member countries to maintain and further develop, through international co-operation, the scientific, technological and legal basis required for a safe, environmentally friendly and economical use of nuclear energy for peaceful purposes. In addition, the NEA is to provide authoritative assessments and forge common understandings on key issues, while giving input to government decision-makers and broader OECD policy analyses.

The present report on the activities of the NEA in 1998 offers a brief overview of the Agency's achievements during the year, and testifies to the value of common efforts toward the safe use of nuclear energy.

Trends in Nuclear Power

Nuclear energy development

In 1998 some 345 nuclear power units were in operation in OECD countries, providing approximately 24% of the electricity supply. Two new nuclear units were connected to the grid (in Korea) while five units were shut down (one in France, one in Japan and three in the United States).

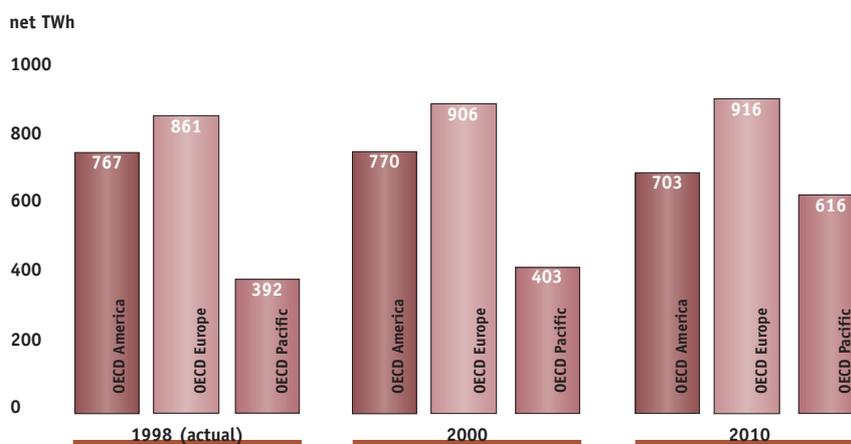
During 1998, the Czech Republic, France, Japan and Korea had nuclear units under construction or firmly committed while Hungary,

upgrade are being implemented or considered in many countries. Such refurbishment programmes are also consistent with carbon abatement goals.

Economic deregulation and privatisation of the power sector will affect nuclear power development. In this new economic landscape, the competitiveness of nuclear power needs to be improved by measures to reduce capital costs without compromising stringent safety standards. Furthermore, the evolution of

greenhouse gas emissions from the power sector. In this context, nuclear power, which is essentially a carbon-free electricity generating source, may be considered by some countries as an attractive option. The economic viability of nuclear power might be further enhanced by a wide adoption of measures to internalise the external costs of all energy sources. In the medium and long term, nuclear energy could play a key role in sustainable energy supply strategies.

Nuclear Power Production in the OECD Area (1998-2010)



Japan, Korea, among others, reported plans for new nuclear capacity. Owing to the limited need for additional base-load capacity and the trend to electricity market deregulation, gas-fired power plants tend to be the preferred option when investments in new plants are considered. While nuclear power is seldom the cheapest option for new generation capacity, existing nuclear units compete favourably with fossil-fired plants in terms of marginal cost. Therefore, refurbishment programmes aiming at lifetime extension and/or capacity

nuclear power programmes in OECD countries will depend not only on economics, but also on political factors which are increasingly influential in energy policy making.

Although the search for comprehensive international solutions to climate change is likely to take time, there is increasing recognition of the need for concrete measures to reduce greenhouse gas emissions. In particular, the implementation of the Kyoto Protocol will require measures for reducing

Nuclear safety and regulation

Nuclear regulatory bodies are responsible for ensuring that economic pressures do not diminish nuclear safety and that current safety levels will be maintained. In 1998 safety authorities and their technical support organisations faced increasing challenges brought on by governments pursuing policies of energy-sector privatisation and deregulation.

An increasingly competitive economic environment and the privatisation and



NAGRA, Switzerland

Mont Terri underground research laboratory in Switzerland, excavated to allow the *in situ* characterisation of the Opalinus clay.

largely to the reduction in outage duration achieved through better work selection and management. At the same time, many plants, particularly in Europe, are beginning to shift from a fuel cycle involving annual refuelling to a fuel cycle involving refuelling every 18 months, and in some cases even longer. The effects of these lengthened operational periods on outage duration and occupational exposure are not yet certain, because longer operation cycles may result in the need to perform more maintenance work. However, good work selection and management should minimise this need.

Radioactive waste management

In 1998 radioactive waste processing, conditioning, transportation and interim storage continued to be carried out at an industrial level in Member countries. Several near-surface and underground engineered facilities for short-lived radioactive waste disposal continued to be safely operated. A new rock-cavern repository located at a depth of approximately 110 metres was licensed in Finland to hold this category of waste.

National waste management programmes continued to be strategically focused on the development of deep repository systems for long-lived waste, taking into account an increasing participation of the public in the decision-making process. Major steps forward were achieved in the United States. In May, the US authorities granted the Waste Isolation Pilot Plant (WIPP) the first license for underground disposal of low and intermediate-level, long-lived radioactive waste. The WIPP repository is located at a depth of 655 metres in a bedded salt formation in New Mexico. Disposal of waste is expected to begin in 1999.

A viability assessment for the planned repository for high-level waste at Yucca Mountain (Nevada) was submitted to the US Congress. This document provides an informed assessment of the viability, from a safety and economic point of view, of licensing and constructing a repository at Yucca Mountain, and clarifies the remaining work required to evaluate the site and to prepare a license application.

Public participation in the decision-making process was a key issue in the Canadian Government's response to a review of the Canadian disposal concept for nuclear fuel

deregulation of the energy sector has led the nuclear industry to optimise output from existing reactors and fuel cycles, minimising outages and uprating power. There is pressure to reduce staff as well as to optimise safety margins. Plant ageing must also be taken into account.

These factors require in-depth analyses to evaluate possible safety impacts. However, the need for such studies must be set against the general trend in Member countries to cut R&D budgets, sometimes drastically. In addition, the lack of national and international support for some of the existing experimental facilities, as well as for new ones, could lead to loss of competence, reduced capability to deal quickly and efficiently with future safety issues, and reduced ability to support operating reactors and the development of new designs. In 1998, a consensus emerged on the need to maintain safety research as an essential contribution to the continued safe operation of nuclear plants, and the NEA assisted its Member countries in addressing this issue. There are signs that reduced national capabilities will lead to even closer and more extensive international collaboration among Member countries and with non-members.

Radiation protection

In response to the pressure to cut costs, utility operators have worked towards making their nuclear power plants more efficient and effective, particularly in terms of planned maintenance and refuelling outages. To achieve this, various approaches to work management are being implemented in different countries around the world.

For the fifth consecutive year, the average annual occupational exposure per unit decreased for both pressurised water reactors (PWRs) and boiling water reactors (BWRs). Figures dropped from 2.21 person-Sv in 1996 to 2.05 person-Sv in 1997 for BWRs, and from 1.27 person-Sv in 1996 to 1.20 person-Sv in 1997 for PWRs. This drop has been attributed



Annual Occupational Exposure Trends for Two Reactor Types in OECD Countries

waste carried out by a special panel. The panel had rejected the proposed programme, considering that the concept was technically safe but lacked broad public support.

Research in the area of high-level waste and spent fuel disposal continued, supported by the operation of underground research facilities, and experience in operating repositories at various depths in several Member countries. For example, an important step in the development process for the geological disposal concept was taken in France, where the government decided that an underground research laboratory would be constructed in a deep clay formation in the eastern part of the country. The government also decided to maintain the option for an underground research laboratory in granite, although a second site in clay was rejected.

Technical confidence continued to be gained through *in situ* testing and expanded experimental programmes in underground

research facilities. Initiated in 1996 and officially inaugurated in 1998, the Mont Terri international underground laboratory in Switzerland provides new opportunities for *in situ* research on geological disposal.

Nuclear science

Following the declared intentions of many Member countries to keep the nuclear option open in order to meet certain general goals such as security of energy supply and environmental protection, there has been an increased focus on maintaining the necessary scientific knowledge to do so. One area of importance is the safeguarding of experimental data and results from different intercomparison exercises, where the NEA and other international organisations play a fundamental role. Another area of concern is the rejuvenation of qualified nuclear expertise, linked to an increased effort on suitable educational programmes.

Discussions of basic scientific concepts for advanced nuclear systems continue to be of interest to most Member countries. These concepts involve not only new types of reactor systems, such as accelerator-driven hybrid reactors or other types of advanced reactors, but also new nuclear fuel cycles in which the utilisation of mixed-oxide (MOX) fuel plays a key role.

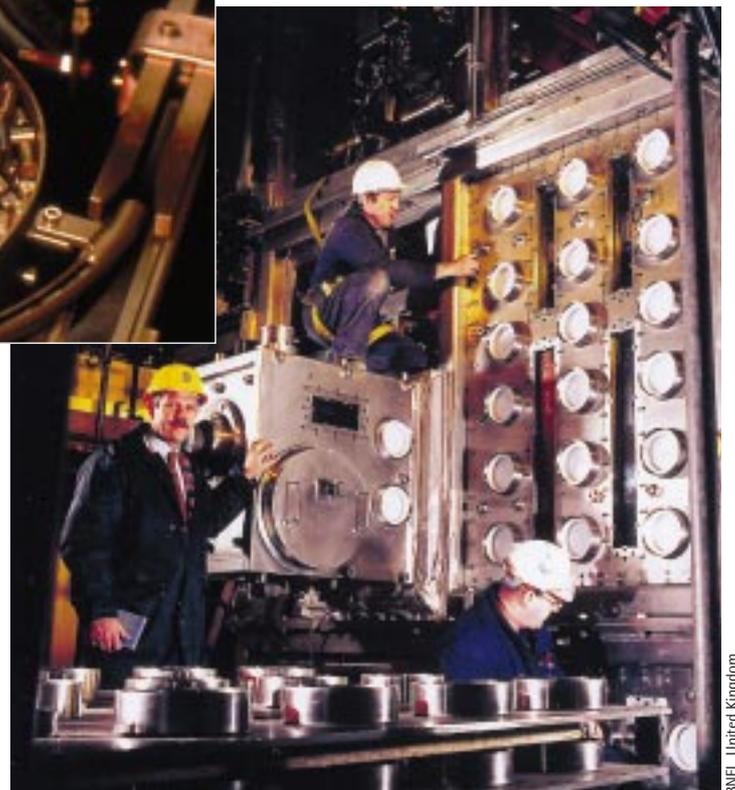
Nuclear data and software

The interest in Member countries in intermediate energy nuclear data continued to be high in 1998. There is a demand for compiled experimental data as well as for evaluated data libraries used in modelling exercises. The main driving force behind this demand is a need for complete, and as accurate as possible, nuclear data libraries for feasibility studies of different accelerator-driven hybrid transmutation systems which help to reduce the amount of nuclear waste.



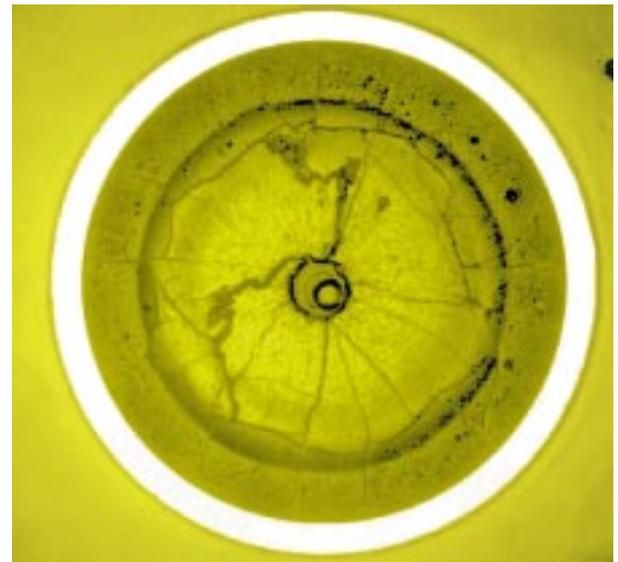
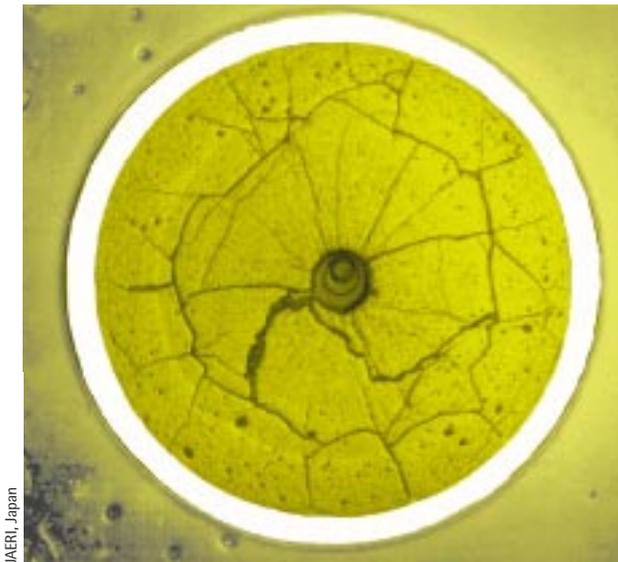
MELOX, COGEMA, France

MOX pellets being fabricated at the MELOX plant in France.



BNFL, United Kingdom

Process equipment being installed in the Sellafield Mixed Oxide (MOX) Fuel Plant, United Kingdom.



Microstructure of a fuel pellet after irradiation: left: before etching; right: after etching.

JAERI, Japan

Strong interest was also observed in experimental integral data, used in computer modelling and data validation. An increase in the demand for computer programs relevant to nuclear safety issues was noted, while less interest was shown for multi-group, cross-section libraries than in the past.

Nuclear law

The existence of sound national and international legal frameworks is essential to the safe use of nuclear power world-wide. More particularly, the modernisation of, and 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 commerce of nuclear material and equipment.

NEA Member countries closely followed the negotiations which resulted in 1997 in the adoption of a Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage and a new Convention on Supplementary Compensation for Nuclear Damage. In response to these changes, the contracting parties to the Paris Convention on Third Party Liability in the Field of Nuclear Energy commenced negotiations to revise the Paris Convention. One of the primary reasons for undertaking the revision was to ensure harmonisation between the Paris and Vienna Conventions, especially in light of the fact that a significant number of contracting parties to those two conventions have adhered to the 1988 Joint Protocol Relating to the Application of the Vienna Convention

and of the Paris Convention. Three negotiating sessions were held and significant progress was made. It was acknowledged that a revision of the Brussels Supplementary Convention might be required once the Paris Convention revision has been completed. It was expected that the revision of both of these conventions would be completed by 2001.

The trend to strengthen 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 their adherence to international conventions in the field of nuclear law, as well as the process of modifying and modernising their national legislation accordingly.



A tractor-trailer, called a TRUPACT-II transportation system, travels to the US Department of Energy's Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico.

Department of Energy, United States

Nuclear Development and the Fuel Cycle

Nuclear Development Committee (NDC)

Mission

■ To provide Member countries with data, information and analysis on technical, economic and resource aspects of the peaceful use of nuclear energy in order to assist national policy and decision making in the field.



NEA Nuclear Development Division

From left to right: M-L. Peyrat, P. Wilmer, H. Yamagata, I. Vera, E. Bertel, L. Van Den Durpel, C. Braesch, M. Domae and S. Coleman.

Not represented: Y-E. Jung, F. Joyeux.

Nuclear policy issues

Sustainable development is high on the agenda of policy makers in OECD Member countries. In recognition of the importance of international co-operation in this regard, the OECD has initiated a major horizontal activity on sustainable development aiming at producing a comprehensive report to be presented at the OECD Ministerial Council Meeting in 2001. The NEA is participating in this effort, in particular, by analysing the sustainability of nuclear energy from the social, environmental and economic viewpoint.

A study on the economic, financial, industrial and environmental effects of three alternative nuclear development paths to 2050 was carried out in order to provide a quantitative basis for assessing the potential role of nuclear power in energy strategies aiming at reducing greenhouse gas emissions. The main findings and conclusions of the study entitled *Nuclear Power and Climate Change* include:

- Nuclear power can contribute significantly to reducing emissions of greenhouse gases.
- Uranium available through conventional means can support the projected levels of nuclear power development.

- Siting of nuclear power plants and fuel cycle facilities will not be a constraint at the global level.

The NEA, in co-operation with the International Atomic Energy Agency (IAEA), undertook a study on the role of nuclear power in sustainable energy mixes for the next century. The study analyses the nuclear component of energy supply scenarios to 2050 and beyond, investigating the implication of alternative nuclear energy production variants and their consequences in terms of economic and environmental impacts.

Environmental issues have become increasingly important in uranium mining and milling in the last few decades due to important developments affecting the uranium industry. These developments include the large number of uranium production facilities which have been taken out of operation recently; the stricter requirements for new facilities being imposed by many countries in the form of environmental clearance approvals;

and the restoration and reclamation measures that are being considered for many old sites. A comprehensive report on *Environmental Issues in Uranium Mining and Milling* was completed by the NEA (jointly with the IAEA) which provides an overview of environmental activities related to uranium production. Another environmental study has been initiated by the NEA, in co-operation with the IAEA, to assess more specifically site restoration activities in world uranium production facilities.

A glossary on common ageing terminology in English, French, German, Spanish and Russian, prepared in co-operation with the IAEA and the EC, was also completed for publication. It will improve the understanding of ageing phenomena and facilitate communication between industries and regulators in different countries on topics related to plant maintenance and lifetime management.

Other NEA studies addressed issues related to maintaining adequate nuclear infrastructure

and the role of governments in this regard. Educational programmes in the nuclear field were identified as a key component of this infrastructure and a study was prepared aimed at drawing governments' attention to measures that could maintain an adequate level of scientific knowledge and technical know-how in various nuclear-related disciplines.

Economics

Several studies on various economic aspects of nuclear power were published in 1998 or will be completed early in 1999.

An update of the study on projected costs of generating electricity was published. Prepared jointly by the NEA and the International Energy Agency (IEA), with the participation of the IAEA, it analyses projected costs of generating electricity, under common assumptions, from coal, gas and nuclear sources, for supplying base-load electricity. The study, based upon cost elements provided by fifteen OECD countries and five non-OECD countries, shows that no single technology is the clear economic winner in all countries. However, it highlights that, at present and expected future gas prices, combined-cycle, gas-fired power plants have a competitive edge over coal and nuclear sources.

Highlights

- The fifth in a series of comparative studies on base-load electricity generation costs, *Projected Costs of Generating Electricity*, was published jointly with the International Energy Agency (IEA).

- *Nuclear Power and Climate Change*, a study investigating the role that nuclear energy could play in reducing greenhouse gas emissions, was published and



made available to experts and policy makers involved in the debate on climate change and the international negotiations related to the UN Framework Convention on Climate Change (UNFCCC).

- A report was published on *Low-Level Waste Repository Costs*. It analyses relevant cost elements provided by Member countries where such repositories are in operation and/or planned, and investigates ways of reducing their costs while ensuring the highest level of safety.



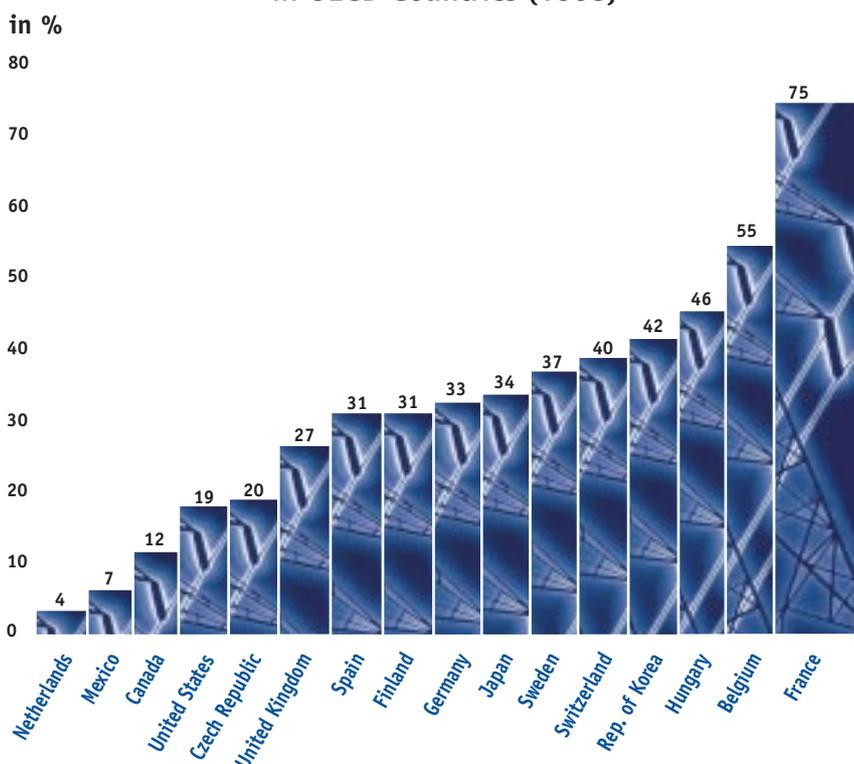
Reducing the capital cost of nuclear power plants, which typically represents some 60% of nuclear electricity generation cost, is essential to the competitiveness of nuclear energy. A study is being published which identifies the most

significant means to reduce the capital costs of nuclear units including increasing plant standardisation, building multiple units on the same site, series orders and increasing plant size. Other important factors such as improved designs aiming at consuming fewer materials, facilitating construction, and streamlining licensing processes, are also addressed in the study.

Deregulation is modifying the economic landscape and will affect the criteria for assessing competitiveness. Electricity market liberalisation is being considered world-wide and has already been achieved in several countries. This trend is likely to have significant impacts on existing nuclear power plants and future programmes. A new NEA study investigates a range of issues on nuclear power prospects in the context of deregulated electricity markets which may lead to early retirement of nuclear units and affect capabilities to fund future financial liabilities. The potential obstacles to nuclear power development caused by market liberalisation and how this factor could affect security of energy supply and, more generally the sustainability of energy mixes, are also addressed.

The report on low-level waste repository costs, to be published early in 1999, contributes to the NEA work on nuclear waste management and disposal. The scope of the analysis includes 19 repositories in operation

Nuclear Power Share of Total Electricity Production in OECD Countries (1998)



or planned in 15 Member countries. The report confirms that the cost of low-level waste disposal is a small part of the total cost of nuclear electricity generation but that the absolute cost of building and operating

low-level waste repositories is by no means trivial. The study analyses the different low-level waste repository cost elements and investigates technical and managerial means for reducing those costs.

Technology

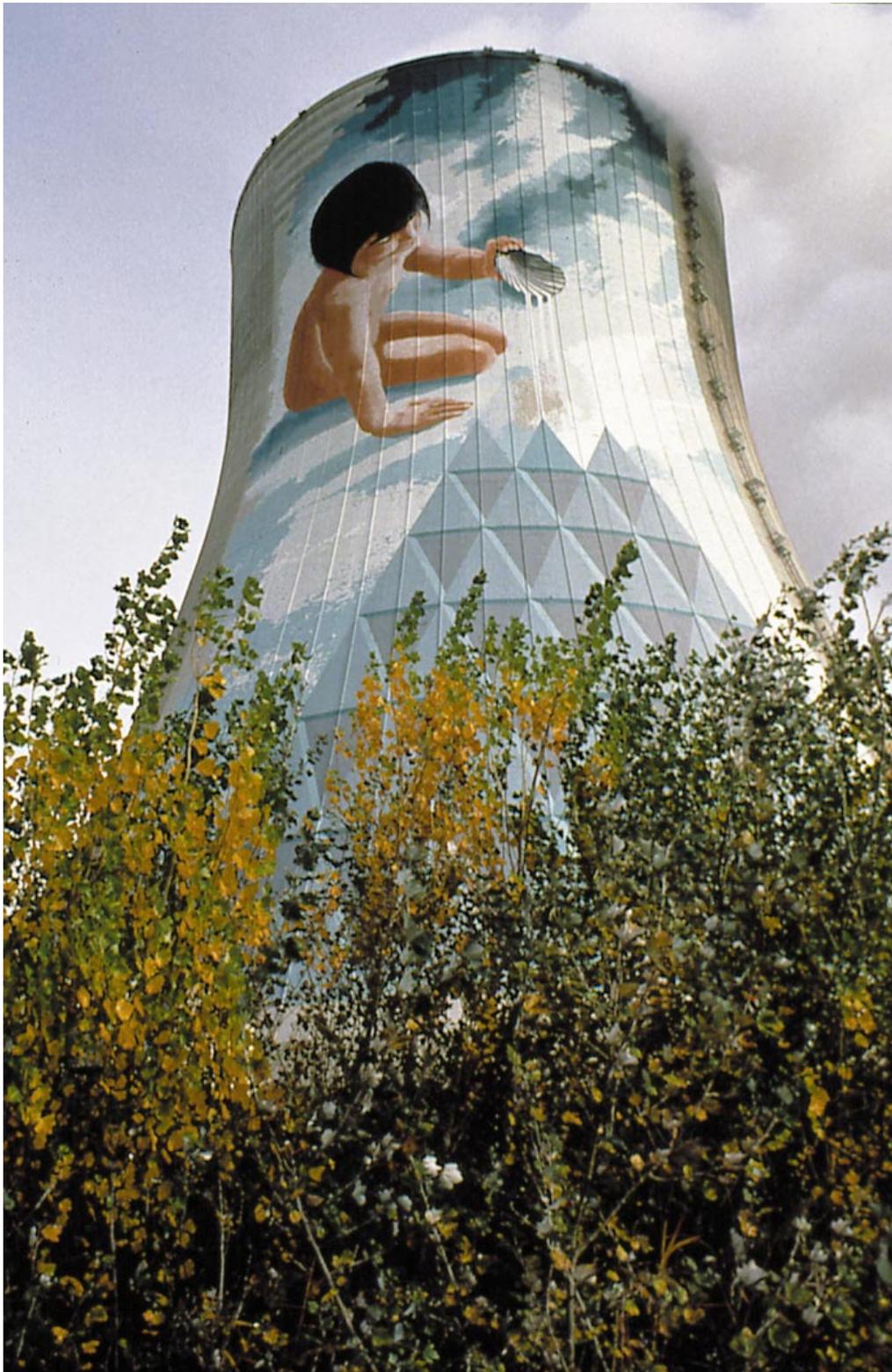
An international symposium on "Evolutionary water-cooled reactors: strategic issues, technologies and economic viability", organised by the IAEA in co-operation with the NEA, was held in Seoul, Republic of Korea. The papers presented indicated that a large number of evolutionary water-cooled reactor designs are available that would meet the technical and safety requirements of the next century. However, a key finding from the discussions was that those reactors are only marginally competitive owing to market liberalisation and to the integration in nuclear generation costs of externalities not factored in for alternatives.

A workshop on the "Back-end of the nuclear fuel cycle in a 1 000 GWe nuclear scenario by 2050", hosted by the French *Commissariat à l'énergie atomique*, was organised in Avignon, France. The workshop showed that extensive R&D activities are ongoing world-wide to investigate alternative back-end nuclear fuel cycle strategies with a view to helping nuclear power meet the objectives of sustainable development.

The scope, objective and outline of a study aiming at an integrated assessment of the nuclear fuel cycle were discussed by a group of experts from interested Member countries. The study, which is to be completed by the end of 2000, will examine alternative fuel cycle options and strategies while taking into account the economic, environmental and societal dimensions of sustainable development.

Partitioning and transmutation (P&T) of minor actinides and fission products contained in high-level radioactive waste would reduce the radiotoxicity of waste streams arising from

One of the main cooling towers at the Cruas nuclear power plant in France.





CAMECO, Canada

Uranium from the Rabbit Lake mill, in Canada, is sent to the above Cameco's Blind River refinery for further processing.

nuclear electricity generation, although it would not eliminate the need for repositories ensuring the long-term safe disposal of radioactive waste. The *Status and Assessment Report on Minor Actinide and Fission Product Partitioning and Transmutation*, completed in 1998, reviews the progress in research and development on the separation of long-lived isotopes and transmutation options, and the impact of P&T on waste management and disposal. The report concludes that dedicated fast reactors (FRs) or accelerator-driven systems (ADS) are more efficient for P&T than current light water reactors (LWRs), and stresses that P&T is a long-term venture which may require decades in order to reach equilibrium in transuranium inventories.

The Fifth Information Exchange Meeting on Partitioning and Transmutation, hosted by the Energy Research Centre SCK•CEN, was held in Belgium at the end of the year. The

presentations and discussions highlighted breakthroughs in reprocessing technology resulting in the ultimate separation of americium and curium in laboratory conditions, and addressed transmutation in LWRs, FRs and ADS. The feasibility and main technological challenges of ADS were presented.

Data and resource assessment

According to the 1998 update of *OECD Nuclear Energy Data*, in 1997 nearly one-quarter of the electricity generated in OECD countries came from nuclear energy, although the proportion is expected to decline slightly in the future due to plant closures. France continued to have the highest share of nuclear electricity at 75%. Spare fuel cycle service capacity is expected until 2015. Cumulative nuclear capacity retirements in OECD countries are expected to reach approximately 58 GWe by 2015.

A study on *Beneficial Uses and Production of Isotopes* was published. Prepared in co-operation with the IAEA, the study is the first international survey of the main applications of radioactive and stable isotopes, and the facilities that produce them world-wide. It analyses trends in isotope supply and demand and highlights key issues to be considered by governments in order to ensure security of supply for isotopes that are essential in many scientific, medical and industrial activities. Further work on this topic will aim at establishing a comprehensive database on isotope production capabilities world-wide.

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Nuclear Safety and Regulation

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

Mission

- To add value to the national nuclear safety programmes of NEA Member countries by bringing together experts to identify issues of concern and to develop common positions on them.
- To collect and analyse safety-related operating experience.
- To carry out international safety research projects and studies, thereby ensuring that a number of countries can benefit from the results while achieving cost-sharing.



NEA Nuclear Safety Division

From left to right: J. Royen, L. Carlsson, E. Mauny, A. Miller, A-M. Christiansen, A. Drozd, G. Frescura. Not represented: B. Kaufer, S. Elie and B. Palus.

Operating experience and human factors

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. The system contains some 2 700 reports, and is increasing by more than 100 reports per year. New guidelines for the IRS were adopted in July 1998. The IRS database is distributed on CD-ROM and is used in all Member countries.

Examples of work carried out in the areas of operating experience and human factors are given below:

- A database on operational experience related to computer-based systems
- A state-of-the-art report on the identification and assessment of organisational factors for safety in nuclear power plants was produced, based on the conclusions of a workshop.
- An international common-cause failure data exchange was established as an OECD project to provide qualitative understanding of common-cause failure events, their basic causes and possible remedies. Data collection guidelines and a report on centrifugal pumps were prepared, while data collection on diesel generators progressed.
- A workshop was held on experience with thermal fatigue in light water reactor piping caused by the mixing and stratification of hot and cold water.
- A report on strategies for human performance research was completed and is being used to define future activities.
- A study on methods for, and experience in, analysing events caused by organisational and human factors was initiated. Various methods are used in the Member countries and further development is still needed.
- A state-of-the-art report on the identification and assessment of organisational factors for safety in nuclear power plants was produced, based on the conclusions of a workshop.

Primary coolant system behaviour

Work in this area focused on the thermal-hydraulic phenomena of primary cooling systems, degraded core cooling and safety aspects of fuel behaviour. The most important topics under investigation were:

- The coupling of thermal-hydraulic calculation with reactor physics (neutronics) models.
- The quenching of core debris and associated generation of hydrogen.
- The application of best-estimate methods in safety analysis.
- Plant safety margins.
- The review of safety criteria for various fuels and core designs under transient and accident conditions.

Other activities included a report on common practices to reduce variation in the results caused by different code users; a report on molten material relocation into the lower plenum, the space below the core during a severe accident; a workshop on in-vessel retention and coolability of melted core material; and a seminar on best-estimate methods in thermal-hydraulic safety analysis.

Ageing and structural integrity of reactors

The main topics investigated in this area include metal components, concrete structures and seismic behaviour. Two workshops were held and three reports were issued.

The workshop on finite element analysis of degraded concrete structures covered both accidents and seismic loads. Unresolved questions were identified regarding the modelling of material behaviour in such circumstances.

Another workshop was held to analyse a three-dimensional, reactor pressure vessel, pressurised thermal shock benchmark. This workshop combined thermal-hydraulic, probabilistic and deterministic fracture mechanics analysis. It followed previous exercises where tests under two-dimensional loading had been considered, and good results achieved.

A report was issued on the development priorities for non-destructive examination of concrete structures. In this area, work

Highlights

■ There were 17 reports produced this year that focused on human factors, the prevention and mitigation of the consequences of accidents, the ageing of reactors and probabilistic techniques.

■ The possible consequences of computer failures associated with the passage to the next millennium (the Y2K problem) were extensively reviewed, and a programme to facilitate the international exchange of experience on ways to prevent difficulties was put in place.

performed in other sectors of civil engineering, notably dams, was found to be of interest. However, the application of these techniques to nuclear plants is influenced by certain factors such as heavy steel reinforcement and difficulty of access.

Another report dealt with the seismic re-evaluation of nuclear plants. Seismic loadings are postulated for nuclear power plants in the case of a seismic event, and are used to calculate the strength of these structures so that they survive an earthquake without unacceptable damage. This report took into account the fact that older stations were often not specifically designed for seismic loading. It also indicated, though, that most countries have now successfully completed the process of re-evaluating these stations seismically.

A report addressed the ageing of organic components. In this area the main concern is electrical cables, but there are other materials, such as sealing materials, which also need to be considered. It was found that there is a need for a better understanding of the interpretation of accelerated ageing tests, including the effects of various interactions.

Confinement of accidental radioactive releases

Activities in this area concern severe accident phenomena in the reactor containment and the possible ways to mitigate them. An important aspect of these activities focuses on the study of the phenomena of the transport of fission products in the containment and the primary circuit.

International standard problem (ISP) exercises are comparative exercises in which predictions of different best-estimate computer codes for a physical problem are compared with each other, and with the results of a carefully specified experimental study. A computer code comparison carried out in the framework of an ISP exercise based on an experiment on aerosol deposition and resuspension in the primary circuit performed at the Joint Research Centre of the European Commission (ISP-40), was completed. In addition, substantial progress was also made towards completing an ISP exercise based on a Canadian experiment on iodine behaviour in the containment under severe accident conditions (ISP-41).

Reports were issued on the following topics:

- Containment thermal hydraulics and hydrogen distribution.
- Accident management aspects of controlling the release of iodine, caesium, strontium and other fission products during a severe accident.

The bottom of the pressure vessel of Oskarshamn 1 nuclear power station, in Sweden, is shown here with details of the guide tubes for the control rods.



A report on the impact on long-term plant and site recovery of short-term severe accident management actions and a state-of-the-art report on flame acceleration and detonation-to-deflagration transition in nuclear safety are in preparation.

A specialist meeting on nuclear aerosols in reactor safety was held during the year. Its main aim was to identify areas where problems had been solved and to discuss additional work needed for plant applications.



Nuclear Information Center, CRIEPI, Japan

The main control room of Unit 6 at the Kashiwazaki Kariwa nuclear power station in Japan.



Integral Fuel Assembly

Designed by one of the OECD Halden reactor Project teams, this integral fuel assembly has been tested in the reactor core for the past three years.

OECD Halden Reactor Project, Norway

Probabilistic safety assessment

Throughout the world there has been a shift towards using risk-based regulation. Input from other activities, such as studies on operating feedback, human factors and structural integrity, and from the Committee on Nuclear Regulatory Activities (CNRA), is helping to prepare for the future programme of work. While probabilistic safety assessment (PSA) has matured greatly in recent years, there is still a need to develop PSAs further in certain areas such as human and software reliability. "Living PSA" is a probabilistic safety analysis that is kept updated during the operation of the plant to account for modifications to the plant and the operating procedures. It can be used to show the changes in risk due to temporary situations.

In this area, two reports were issued: one on living PSA, and one on the proceedings of a workshop which dealt with reliability data collection. Studies in progress included fire simulation, fire spreading and the impact of smoke on instrumentation electronics; human reliability and commission errors; low power and shutdown PSA; and PSA-based event analysis. Several opinion papers are in preparation on such issues as: seismic risk; human reliability; PSA standards, and living PSA.

Safety research

A senior group of experts on nuclear safety research facilities and programmes (SESAR/FAP) was set up to identify facilities which are potentially interesting for present or future international collaboration, to collect and analyse cost information about these facilities, staffing needs, and in some cases upgrading systems. The group was also entrusted with making specific recommendations regarding research programmes and joint projects for both new and existing facilities, as well as discussing other possible forms of international collaboration, such as databanks, the exchange or sharing of experts, and the joint development of computer codes. The group submitted preliminary recommendations at the end of the year.

Fuel cycle safety

The nuclear fuel cycle covers the procurement and preparation of nuclear fuel for nuclear power reactors, its recovery and recycling after use and the safe storage of all waste generated through these operations. The NEA group in charge of nuclear fuel cycle safety addressed the issues of spent fuel transportation and decommissioning activities in fuel facilities. A survey on research programmes in Member countries reached its final stage of completion.

Operation of the Fuel Incident and Notification Analysis System (FINAS) continued to expand during the year as more reports were received from nuclear fuel cycle facilities. Further development of the database is planned. A small task group was set up to analyse the FINAS database in order to derive conclusions from it. Transportation incidents were added to the database and pre-1993 incidents will be added on a voluntary basis.

Regulatory activities

The NEA activities on the regulation, licensing and inspection of nuclear installations are guided by the Committee on Nuclear Regulatory Activities (CNRA). In 1998 the Committee held a "special issue" meeting to consider regulatory aspects of ageing reactors. The discussion dealt not only with physical ageing of components and systems, but also with ageing management issues arising from developments in technology, obsolescence, etc. The final report on this topic was issued in early 1999.

The role of the regulator in promoting and evaluating safety culture was discussed by a task group that will prepare a report to be issued in 1999. The report will address, in particular, early signs of deteriorating safety performance, regulatory response strategies for addressing safety culture problems, and criteria for resumption of normal operation following the occurrence of safety problems.

As the year 2000 approaches, the Committee is following the activities taking place in Member countries related to the control of the "Y2K millennium bug". A programme was put in place to facilitate the exchange and discussion of information available. A workshop to review how the problem is being managed was to be held in early 1999.

Studies continued on safety and regulatory inspection practices, notably in the areas of decommissioning inspection activities, the establishment of good regulatory inspection practices, and management inspection.

A workshop on regulatory inspection activities related to older operating nuclear



OKG Aktebolag, Sweden

Consequences of major pipe breaks in nuclear power plants have played an important role in operating experience feedback. Above workers install essential piping insulation.

power plants, risk evaluation and licensee resource commitment was held, and the proceedings will be published in 1999.

A previously issued report on inspection philosophy, organisation and practices, that provides information on regulatory bodies and organisations in 32 NEA Member countries and non-member countries, was posted on the NEA Web site. An updated version is being prepared for early 1999. A list of

common (non-obligatory) inspection practices that have been formulated from several recent reports will also be placed on the site.

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Radiation Protection

Committee on Radiation Protection and Public Health (CRPPH)

Mission

■ To assist Member countries in the regulation and application of radiation protection by identifying and addressing conceptual, scientific, policy and operational issues in a timely and prospective fashion, and by clarifying their potential implications.



NEA Radiation Protection Programme

From left to right: T. Lazo, B. Rügger, A. Beggs, H. Riotte, J. Laviéc, S. Mundigl.

Radiation health science

New research on how radiation exposure translates into human health risks, e.g. our understanding of cancer induction and growth mechanisms, could have significant impacts on the application and regulation of radiation protection. A study of the status of current knowledge in these areas was carried

out and published as *Developments in Radiation Health Science and their Impact on Radiation Protection*. The report concludes that for most cases, our current scientific knowledge supports the use of a precautionary approach to radiation protection application and regulation. However, in some well-characterised cases involving the inhalation or ingestion of specific radionuclides, existing scientific models should be used to predict the dose more accurately.

Comparative risk assessment and management

Work progressed on a report showing how radiation risks are assessed and managed in different situations and in comparison to other risks. This work focused on how the system of radiation protection compares to approaches taken for the protection of the public and workers from other risks, such as exposure to

chemicals or asbestos. The various approaches taken for different types of radiation risk – including at hospitals, in the non-nuclear industry, at laboratories, and in the nuclear industry – will be covered in this report. The objective of this work is to put the risks from radiation into a more global perspective, as compared to other risks and across different industries, in order to assist decision makers, notably in allocating resources.

Societal aspects

A workshop on the "Societal aspects of decision making in complex radiological situations" used case studies to draw generalised conclusions concerning the decision-making process. The case studies focused on the technical and societal process of re-establishing daily life after either a significant radiological accident, or the discovery of significant radiological contamination in an inhabited area. The workshop concluded that the key to arriving at a broadly accepted decision is to involve stakeholders in all aspects of the decision-making process at an early stage. It was recognised that the current system of radiation protection should focus more on integrating radiation protection into societal decisions, as opposed to integrating societal aspects into



Development of an automatic welding method at the Framatome Technical Center in France allows the limitation of radiation doses to technicians during operations in hostile environments.

radiation protection decisions. It was also agreed that these conclusions are applicable to many situations, including site selection for nuclear waste repositories.

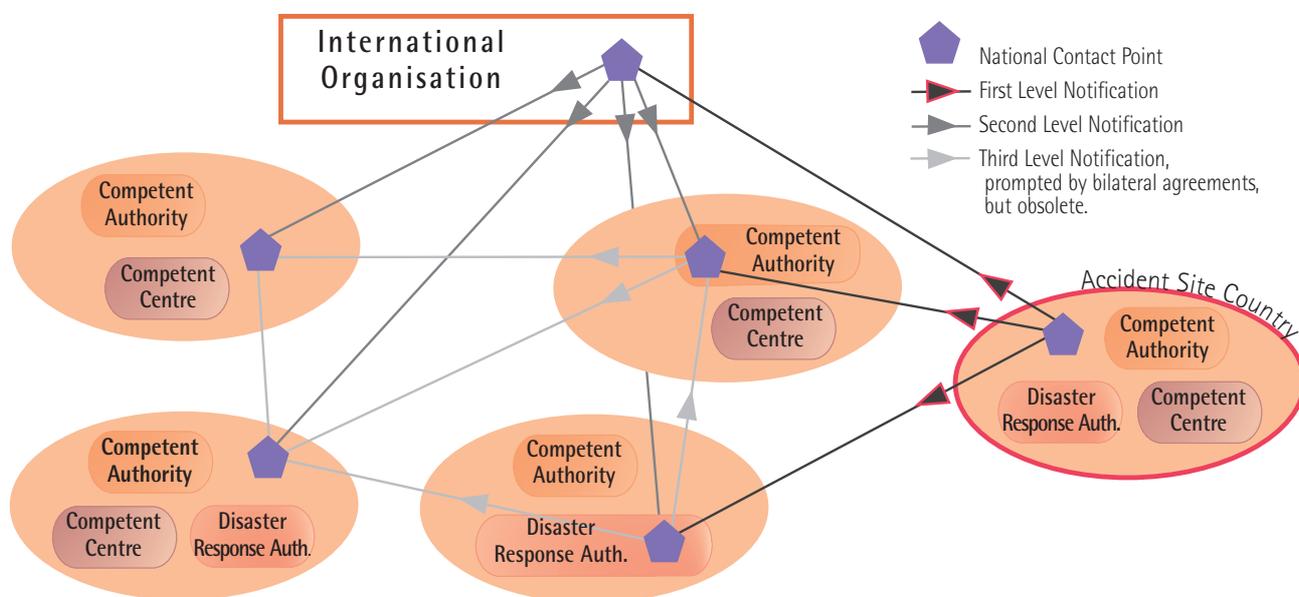
Operational radiation protection

The more practically oriented part of NEA work in the field of radiation protection has focused, for some time, on two areas; the Information System on Occupational Exposure (ISOE) programme, which deals with occupational exposure at commercial nuclear power plants, and the International Nuclear Emergency Exercise (INEX) programme. The ISOE Programme, which is self-financed and somewhat autonomous, is described in more detail under the section on "Joint Projects and Other Co-operative Projects".

Highlights

- A study on the status of radiation health science research indicated that in some very specific cases, the linear non-threshold model of the dose/response relationship, although generally applicable, may not be the most appropriate.
- Lessons learned from the study on decision making in complex radiological situations pointed towards a need for greater stakeholder involvement and improved presentation and coherence of the radiation protection system.
- Based on experience from the INEX 2 exercises, the programme on nuclear emergency matters developed a new strategy for emergency notification, communication, monitoring and decision making.
- The membership of the Information System on Occupational Exposure (ISOE) grew to 421 reactors representing 77 utilities from 26 countries, and included regulatory authorities from 21 countries.

International Communication Links Used for Emergency Notification and Information



INEX

For many years, but particularly since the Chernobyl accident, the NEA has been involved in the area of nuclear emergencies, and since the early 1990s it has had a programme of nuclear emergency exercises. As part of the second series of International Nuclear Emergency Exercises (INEX 2), an exercise was organised in 1998 simulating an accident at the PAKS nuclear power station in Hungary. Based on the experience of this and earlier exercises, working groups addressed

the question of how communications and emergency environmental monitoring strategies could be improved. The results of this work, to be published in 1999, suggest that significant improvements in effectiveness and efficiency of existing systems can be made through the use of a strategy focusing on the collection and dissemination of key data and analyses which address the decision maker's needs at various phases of an accident, and for various geographic regions surrounding the accident site. The use of modern

communication technologies has been identified as critical to the efficiency of emergency notification and information. The overall strategy proposed by the report will be tested in an exercise, INEX 2000, to take place late in that year.

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Radioactive Waste Management

Radioactive Waste Management Committee (RWMC)

Mission

■ To assist Member countries to develop safe management strategies for long-lived radioactive waste and waste products from the decommissioning of nuclear facilities.



NEA Radioactive Waste Management Programme

From left to right: H. Riotte, L. Guyot, C. Pescatore, P. Lalieux, A. Beggs, B. Rüeegger.

Strategic issues dialogue

The NEA is paying increasing attention to the growing influence of societal and economic concerns, and has identified four areas for future work and cross-sectorial co-operation aimed at examining waste management within a broader environmental debate, and the process of repository development and system analysis. These areas include radioactive waste management strategies, the process of repository development, public perception and confidence, and the management of wastes from decommissioning.

Review of progress

An important study, based on direct input from national radioactive waste management institutions, was launched to review progress in geologic disposal over the last decade. Preliminary results showed that confidence in the feasibility of safe repository systems has been built up by the development of repository concepts, the application of rigorous safety assessment methods, and their independent review. However, there is widespread recognition that implementation is increasingly determined by public acceptance rather than technical factors.

Peer reviews

The NEA continued to help individual Member countries by co-ordinating international peer reviews of key radioactive waste management studies in response to requests. In 1998 a peer review was undertaken of the UK Nirex scenario methodology for safety assessment. A request was also received from Belgium to carry out a peer review of the feasibility and safety assessment of a repository located in a specific clay geologic formation (Boom Clay).

Building confidence

Work progressed on a report addressing the needs of decision makers, regulators and implementers in terms of confidence in the safety approach of radioactive waste repositories, given the uncertainties that inevitably exist in the description of the system and in its evolution. The report argues that a complete description is not a requirement for decision making and discusses how confidence can be evaluated, enhanced, and finally communicated. It also describes procedures for deriving a safety case.

Integrated performance assessments

Integrated performance assessments (IPAs) usually form part of a stepwise decision-making process in the development of deep repositories. After evaluating the lessons learned from an initial series of ten performance assessment studies, preparations began for an exercise which will address experience from eleven regulatory reviews of IPAs in eight Member countries. The exercise will be finalised in 1999 and is expected to clarify many aspects of the review process. One preliminary conclusion is that dialogue among the different bodies involved is of paramount importance.

FEPs and scenario analysis

The NEA International Database on features, events and processes (FEPs) is now available on CD-ROM. This tool can be used in building scenarios for safety assessments of radioactive waste disposal systems. A second recently launched initiative aims at providing a catalogue of FEPs specific to the disposal of

long-lived waste in argillaceous formations. The catalogue will provide for each FEP an up-to-date assessment of the current level of scientific understanding and its relevance to the long-term performance of the geologic barrier.

Geochemistry

Activities in the field of chemical modelling of sorption of radionuclides in host rocks continued with a view to the issuing of a state-of-the-art report in 1999.

Phase II of the Thermochemical Database (TDB) project started in March 1998 and will cover an initial period of three years. It will include a review and critical evaluation of thermochemical data of relevance to safety assessments of nuclear waste management systems, and reviews of the inorganic chemistry of nickel, selenium and zirconium, as well as data on complexation with simple organic ligands of uranium (U), americium (Am), neptunium (Np), plutonium (Pu) and technetium (Tc). The reviews on U, Am, Np, Pu and Tc, performed in Phase I of the project, will be updated.

Chemical and isotopic measurements of water samples extracted from argillaceous sediments are delicate. The NEA "Clay Club" will produce a report evaluating the latest developments in the field of water and solutes extraction from argillaceous rocks.

Highlights

- Integrated performance assessments (IPAs) are part of the repository development process in most countries and are reviewed by the relevant safety authorities. An RWMC study compared how the safety authorities from eight Member countries reviewed the IPAs of their national repository projects.
- The third GEOTRAP workshop, out of a planned series of five, was held in Barcelona, Spain, in June. These workshops provide

a unique international forum for promoting multi-disciplinary dialogue in the area of radionuclide migration in geological media.

- The NEA Database on Features, Events and Processes (FEPs) was prepared for distribution on CD-ROM early in 1999. The database helps to ensure comprehensive safety assessments of waste disposal systems.

- The NEA co-ordinated a peer review in the United Kingdom.

GEOTRAP

The proceedings of the second workshop of the GEOTRAP Project on Radionuclide Migration in Geologic, Heterogeneous Media were published. They address the effects of spatial variability on migration and include a synthesis of the main outcomes of the workshop discussions. The third workshop was held in June and dealt with the characterisation and modelling of water-conducting features in various geological media.

One of the conclusions emerging from the GEOTRAP workshop series is that, in spite of the significant advances achieved in the understanding of groundwater flow, a deeper comprehension of radionuclide transport processes on many levels should be investigated.

The effect of gas on repository performance

A critical review was launched of the potential impacts of gas that could be produced in some geological repository systems. The review, commissioned jointly by the European Commission and the NEA, is to assess the state of the art in this field from an international perspective and assist Member countries in identifying and prioritising research needed on these issues.

Decommissioning

One emerging area that requires a dialogue between regulators and implementors is the decommissioning of nuclear facilities, where a significant convergence of interests has been identified. A symposium being organised on the regulatory aspects of decommissioning will include participation by industry, waste management organisations, safety authorities and other governmental bodies.

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SKB, Sweden

View of the Äspö Island underground research laboratory in Sweden for *in situ* characterisation of crystalline rocks.

Nuclear Science

Nuclear Science Committee (NSC)

Mission

■ To advance the scientific knowledge needed for the development of new nuclear technologies, as well as for current nuclear applications, by facilitating co-operation between scientists in national laboratories, universities and industry, and by helping to maintain the necessary scientific infrastructure.



NEA Nuclear Science Section
From left to right: C. Nordborg, C. Morris, S. Sakurai.

As part of the nuclear science programme a large number of workshops was organised, covering issues relevant to both present-day problems and the development of new nuclear applications. Other activities carried out addressed reactor physics and fuel cycle modelling exercises as well as criticality safety, shielding and material science issues.

Reactor physics

In the field of reactor physics the programme concentrated on introducing and validating modern calculation and modelling methods and on addressing scientific issues related to the development of new reactor types.

An international exercise comparing calculations relating to a main steam line break in a pressurised water reactor (PWR) using three-dimensional coupled neutronics/thermal-hydraulic computer programs, has been undertaken in close co-operation with the NEA nuclear safety programme. A series of tests to compare methods for determining boiling water reactor (BWR) core stability parameters and their uncertainties was also underway.

A workshop on advanced reactors with innovative fuel cycles was held at the Paul Scherrer Institute in Switzerland. The

meeting covered both water-cooled and fast reactors, as well as hybrid reactors with fast and thermal neutron spectra. The proceedings are to be published in 1999.

Fuel cycle physics

Work in this area was mainly devoted to understanding the scientific phenomena affecting fuel behaviour in a reactor and advancing knowledge related to the use of mixed oxide (MOX) fuel.

In 1998, the International Fuel Performance Experiments (IFPE) Database contained more than 320 fuel rod experiments for PWR, BWR, CANDU and WER reactors. The data are available on CD-ROM from the NEA Data Bank. A workshop on thermal performance of high burn-up LWR fuel was organised in Cadarache, France, and the proceedings were published.

The working group on the physics of plutonium recycle and innovative fuel cycles started one theoretical benchmark exercise on MOX fuel assemblies in a BWR reactor and one benchmark based on experimental data from the VENUS-2 programme, provided by SCK•CEN Nuclear Energy Research Centre in Mol, Belgium.

A workshop on physics and fuel performance of reactor-based plutonium disposition was organised in Paris, France to exchange information on experience and ongoing activities related to reactor-based, weapons-grade MOX fuel issues, and to identify areas of research suitable for international collaboration under the auspices of the NEA.

Material science and dosimetry

The material science and dosimetry programme aimed at achieving a better understanding of the basic phenomena behind radiation damage to structural materials.

Work started on the redefinition of the basic damage parameters for materials under irradiation. The objective is to promote a consensus among specialists on how to predict the response of nuclear structural materials to irradiation.

A workshop on ion and slow positron beam utilisation was held in Costa da Caparica, Portugal to discuss different application areas of relevance to the analysis of material properties.

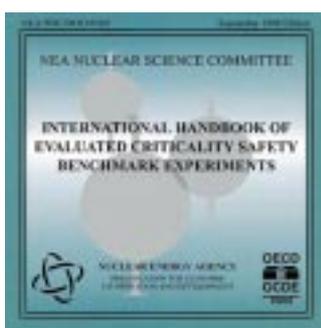
Applied methods and computer programs for the calculation of radiation doses to

reactor pressure vessels and internals were validated in a benchmark exercise using data from the VENUS facility in Mol, Belgium. The final report will be issued in 1999.

Criticality safety and radiation shielding

This area addresses the storage and transportation of spent fuel, as well as the shielding of radioactive sources.

A series of benchmarks on burn up credit criticality safety was continued, as part of the working party on nuclear criticality safety studies. It also identified needs for further



criticality experiments and for compiling data from sub-critical experiments.

As regards radiation shielding, a meeting on shielding aspects of accelerators, targets and irradiation facilities (SATIF) was organised

Highlights

- A task force was established to tackle the problem of predicting the short- and long-term response of structural materials to irradiation.
- A workshop on utilisation and reliability of high power accelerators was organised to address the importance of accelerator beam stability in hybrid reactor systems.
- A workshop on reactor-based plutonium disposition was held to address technical issues related to the utilisation of weapons-grade plutonium in mixed-oxide fuel in reactors and to identify areas of work suitable for international co-operation.
- A workshop on thermal performance of high burnup light water reactor fuel was organised in close co-operation with the nuclear industry.

in Knoxville, Tennessee, USA. Other activities included the compilation of experimental data into the radiation shielding experiments database (SINBAD), and the organisation of a benchmark on three-dimensional radiation transport problems.

Transmutation and chemistry

The concept of transmutation is a nuclear transformation of long-lived radioactive nuclides into shorter-lived or stable nuclides,

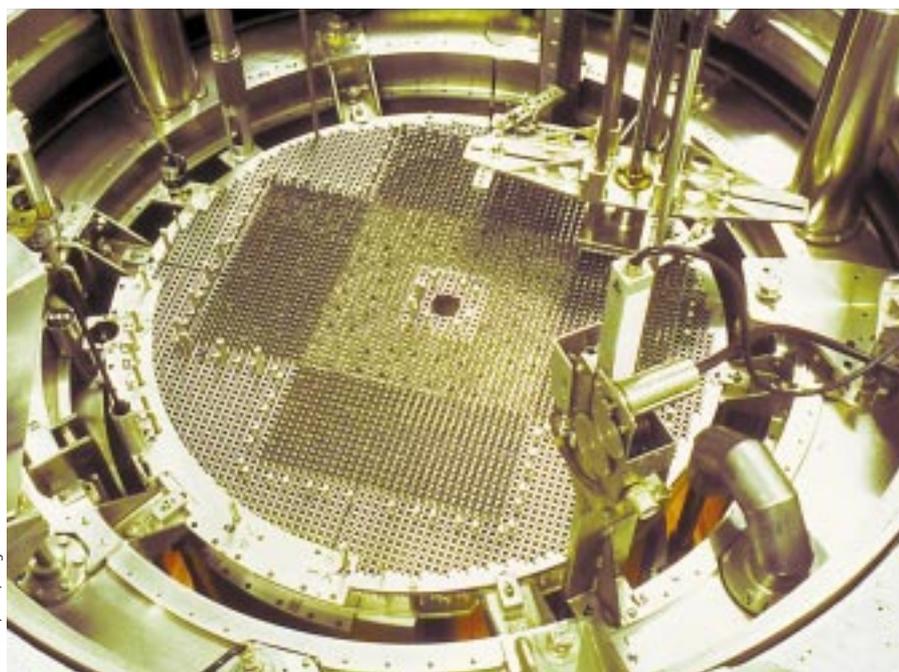
thereby reducing the radiological hazards and waste disposal problems. Scientific studies related to different transmutation concepts have been undertaken, as well as the speciation of radionuclides.

An international benchmark exercise, comparing calculations of the nuclear waste inventory after different transmutation scenarios has been undertaken and the results are being analysed. A final report will be issued in 1999.

A workshop on the utilisation and reliability of high power accelerators was held in Mito, Japan to discuss the possibility of a more efficient utilisation of these accelerators, and to review the importance of accelerator beam fluctuations for hybrid reactor systems. A follow-up workshop will be held in 1999.

A workshop on speciation techniques and facilities for radioactive materials at synchrotron light sources was organised at the European Synchrotron Radiation Facility (ESRF) in Grenoble, France. The meeting covered the theoretical background and the applications of high intensity light sources to the speciation of radioactive materials.

The VENUS zero power critical facility at the Belgium nuclear energy research centre SCK-CEN in Mol.



SCK-CEN, Mol, Belgium

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Data Bank

Mission

■ To serve as the international centre of reference for its Member countries for basic design and simulation tools, such as validated computer codes and nuclear data, and to provide a direct service to its users by sharing, improving, validating and distributing these tools.



NEA Data Bank Staff

From left to right: A. Nouri, P. Nagel, E. Ostholts, P. Vaz, C. Nordborg, C. Iglesias, C. Penon, C. Morris, A. McWhorter, B.C. Na, B. Armand, M. Kellett, J. Galan, P. Savelli.

Not represented: E. Sartori.

Demand for NEA Data Bank scientific services continued to be very high in 1998. The computer program services registered a 30% increase in the number of requests for computer codes. The on-line databases containing nuclear reaction and structure data were consulted 20 000 times throughout the year.

The compilation of the new version of the Joint Evaluated Fission and Fusion (JEFF) data library was almost completed, and a new three-year phase of the Thermochemical Database (TDB) project started.

Computer program services

The Data Bank plays an active role in the collection, validation and dissemination of computer codes used in many different nuclear applications, for example in reactor safety or radioactive waste management calculations.

In 1998, the Data Bank added 115 new or updated versions of computer codes to

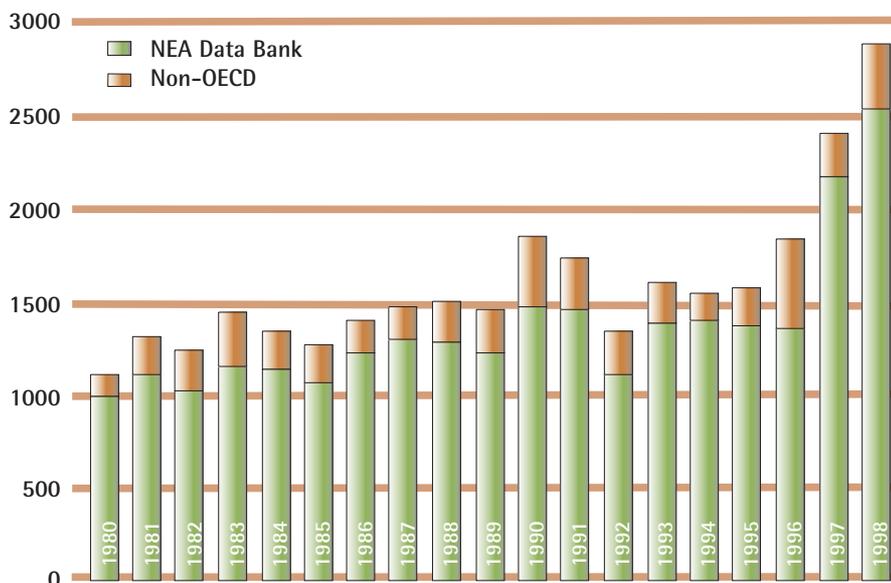
its collection. Of these 115 programs, 15 were received from non-OECD countries through the special co-operative agreement between the NEA Data Bank and the International Atomic Energy Agency (IAEA).

The demand for validated program packages reached a record high in 1998. The Data Bank distributed approximately 2 900 programs, of which 345 were sent to various non-OECD countries. These figures confirm the trend of an increase in demand over the last three years. The Data Bank managed this workload by continuously developing and implementing well-structured and streamlined working methods.

Preservation of integral experimental data

The Data Bank continued to compile integral experimental data under the supervision of the Nuclear Science Committee. Databases containing fuel behaviour, shielding, and criticality safety data were maintained and made available to scientists. The requests for data were channelled through the computer program services. A new edition of the CD ROM *International Handbook of Evaluated Criticality Safety Benchmark Experiments* was issued and distributed. The preservation of

Requests by Electronic Means for Data Bank Programs

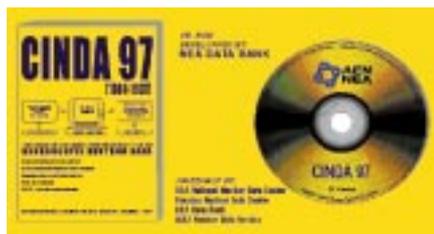


integral experimental data was considered to be of high value by the scientific community and NEA Member countries. This work will continue under the scientific guidance of the NEA Nuclear Science Committee.

Nuclear data services

The Data Bank is one of the major contributors to an international network of data centres providing scientists with validated and easily accessible nuclear data for their calculation and modelling exercises.

The compilation of bibliographic (CINDA) and experimental nuclear reaction data (EXFOR)



continued throughout 1998. The Data Bank made more than 800 entries in the CINDA database and approximately 200 entries, on new experiments, in the EXFOR database. A preliminary CD-ROM version of the CINDA database was developed and has been sent to corresponding data centres for testing before final release.

The Data Bank provides direct services via the Internet. Its on-line databases include bibliographic, experimental and evaluated nuclear reaction and structure data which are used extensively by the scientific community. More than 5 000 megabytes of nuclear data information was downloaded by registered users in 1998.

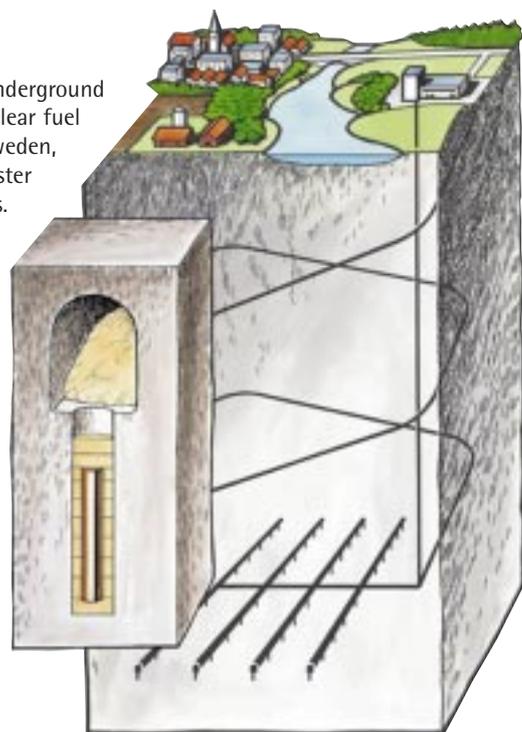
The JEFF project

The Data Bank co-ordinates the development of the Joint Evaluated Fission and Fusion (JEFF) data library which is used as the reference data library by many Member countries. A new improved version of the JEFF data

Highlights

- The demand for validated computer programs and integral data sets reached a record high this year: 2 882 programs were distributed, compared to a yearly average of about 1 800 in preceding years.
- A second phase of the Thermochemical Database (TDB) project was started as a semi-autonomous, separately funded project.
- The use of the Data Bank's on-line services remained very high in 1998. Close to 20 000 entries to the databases containing nuclear data were registered.
- The compilation of data for the next version of the Joint Evaluated Fission and Fusion (JEFF) library was carried out using strict quality assurance procedures.

A design for an underground repository of spent nuclear fuel such as this one in Äspö, Sweden, showing details of the canister enclosing the fuel elements.



library is being developed, and in 1998 the Data Bank compiled, according to approved quality assurance methods, more than 90% of the initially selected data. Subgroups to review the selection of activation, fission product, intermediate energy, radioactive decay and fission yield data were also established.

The TDB project

The Thermochemical Database (TDB) project is a joint project between the Data Bank and the NEA Radioactive Waste Management Division to select recommended chemical thermodynamic data for the safety assessment of nuclear waste repositories. Work continued to finalise two reports, one on technetium and one on neptunium/plutonium data, which form part of the first phase of the project.

A second, externally funded phase of the project, began formally in April 1998.

The reviews to be performed include: updates of the uranium, americium, technetium, neptunium and plutonium reports; a review of the complexation of these radionuclides with simple organic ligands; and reviews of the inorganic chemistry of nickel, selenium and zirconium respectively.

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Legal Affairs

Group of Governmental Experts on Third-Party Liability in the Field of Nuclear Energy

Mission

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

Civil liability for nuclear damage

The NEA continues to serve as an important forum for the examination of legal issues in the nuclear field, with particular emphasis on the civil aspects of liability and compensation for nuclear damage. In this regard, it supports the work of the Group of Governmental Experts on Third Party Liability in the Field of Nuclear Energy aimed at minimising legal impediments to the safe use of nuclear energy and at encouraging provisions for equitable compensation of nuclear damage in the event of a nuclear incident. Such work includes discussing issues relating to the emergence of a global nuclear liability regime and addressing problems associated with the interpretation and implementation of the Paris Convention, the Brussels Supplementary Convention, as



NEA Legal Affairs Section

From left to right: J. Schwartz, T. Yamamura, N. Ventosa, P. Reyners, F. Wagstaff, M-L. Noonan and G. Régnier. Not represented: A. de Kageneck.

well as their interface with other international instruments in this field, such as the Vienna Convention and its Amending Protocol and the Convention on Supplementary Compensation for Nuclear Damage.

The NEA also supports the work commenced by the Contracting Parties to the Paris Convention to revise that Convention, based largely upon the modifications made to the Vienna Convention by the Amending Protocol concluded in 1997. Efforts to achieve the greatest possible harmonisation between the two conventions are clearly desirable given that a significant number of Contracting Parties to the Paris and Vienna Conventions have adhered to the Joint Protocol concluded in 1988, which regulates the application of these two Conventions and has the effect of extending to each state the coverage that is provided under the Convention (Paris or Vienna) to which it is *not* a Contracting Party.

In connection with nuclear safety assistance programmes administered by or on behalf of NEA Member countries, the NEA assists certain central and eastern European countries (CEEC) and New Independent States (NIS) in overcoming legal uncertainties

surrounding liability for nuclear damage in strengthening their nuclear legislation. By assisting such countries to develop nuclear legislation which reflects internationally accepted principles for the peaceful utilisation of nuclear energy the NEA is able to promote and develop harmonised nuclear legislation. Such assistance places particular emphasis upon encouraging provisions on liability and compensation for nuclear damage that will permit membership in a global regime. It also co-operates with other selected non-member countries in which NEA Members have a particular interest.

Much of this work is undertaken within the ambit of a Contact Group on Liability Questions raised by Nuclear Safety Assistance Programmes for Eastern Europe and, in the particular case of Ukraine, through a Joint Task Force on Nuclear Legislation in Ukraine. Both groups work to encourage the recipients of such assistance and co-operation to establish appropriate legislation and to adhere to the existing international conventions in the nuclear liability field. As a result of these initiatives, many of the CEEC/NIS have adopted such legislation and adhered to the Vienna Convention as well as the above

mentioned Joint Protocol with Ukraine being a particularly successful example.

The NEA also co-operates with other international organisations in facilitating the implementation of nuclear safety assistance programmes. This year, it worked closely with the European Bank of Reconstruction and Development to assist in the Chernobyl Shelter Implementation Plan in Ukraine, and with Member countries participating in the Multi-lateral Nuclear Environmental Programme to enhance the safety of spent fuel and radioactive waste management in the Russian Federation.

Information on nuclear law

The *Nuclear Law Bulletin*, issued twice a year, provides current and concise information on recent developments in the field of nuclear law, at the national and international levels.

Highlights

■ Three meetings of the Contracting Parties to the Paris Convention on Third Party Liability in the Field of Nuclear Energy were organised in 1998 to negotiate a revision of that Convention.

■ An advanced training seminar on nuclear law was organised in Estonia for the benefit of central and eastern European countries and the New Independent States on rules governing the international transfer and transport of nuclear material.

This periodical has proved to be a valuable tool for those in government, regulatory, academic, industry and international circles who work closely with nuclear law. The analytical study on the regulatory and institutional framework for nuclear activities in OECD Member

countries was partly revised in 1998, and will continue to be updated on an annual basis. This work of reference provides a systematic analysis of nuclear legislation and institutions in all OECD countries.

Relations with non-member countries

The final in a series of six advanced training seminars on nuclear law organised by the NEA, with the collaboration of the IAEA and the EC, was held in Tallinn, Estonia in August. This seminar took place within the framework of the programme of co-operation with and assistance on nuclear law to central and eastern European countries and the New Independent States. It was designed to advise these countries on the rules governing international exchanges of nuclear materials, equipment and technology. These seminars, in which the emphasis has lately moved from training to dialogue, have proved to be of increasing success, as testified by the active participation of young professionals from recipient countries. The papers submitted to this seminar are available from the NEA.

A regional seminar on "Nuclear liability and insurance, radwaste management and radiation protection legislation in Lithuania" took place in Vilnius in November. This event, which was co-organised by the NEA and the Nuclear Power Safety Inspectorate/VATESI of Lithuania, brought together experts from the host country, Belarus, Estonia, Latvia, Poland, the Russian Federation and Ukraine.

Liability Amounts Under National Legislation

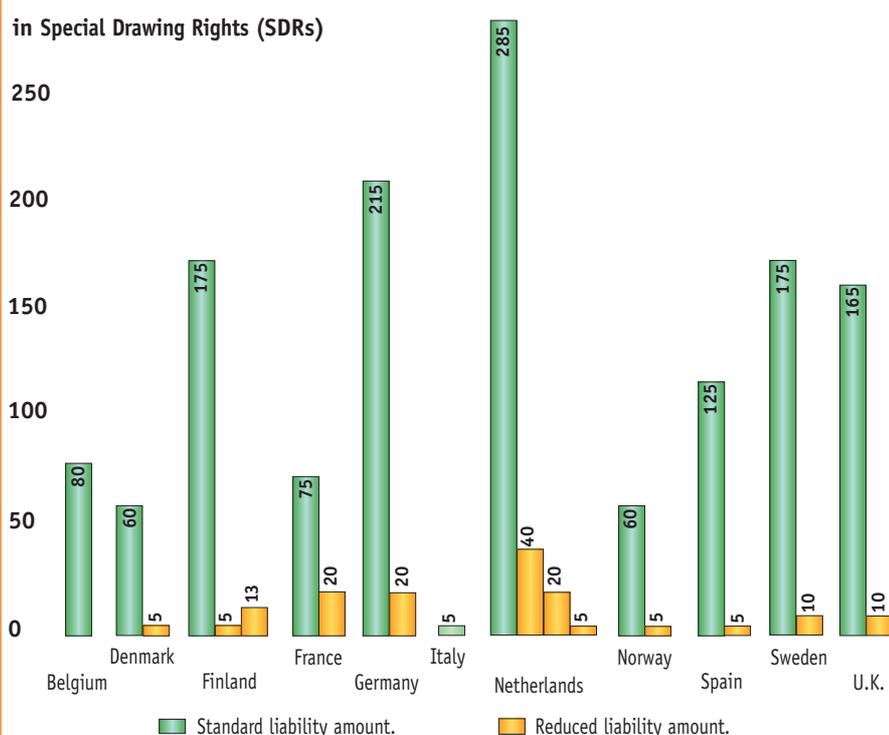
The bar graph below reflects national legislative requirements with respect to liability for third party nuclear damage in all countries Party to the Paris Convention, with the exception of Greece, Portugal and Turkey which have no relevant legislation. The Special Drawing Rights (SDR) calculations are based upon the rate of exchange of national currency units per SDR as of 30 November 1998 and have been rounded off to the nearest 5 million SDRs.

Green bars indicate the standard liability amounts applicable to nuclear power plants and other major nuclear installations.

Orange bars indicate the reduced liability amounts for equipments and materials. The assessment of such risks takes into account the nature of nuclear installation or nuclear materials involved and the likely consequences of an incident. Neither Belgium nor Italy have legislated a reduced liability amount whereas Finland and the Netherlands have adopted several reduced liability amounts corresponding to variations in the level of risk.

For Germany, where the liability amount is unlimited, the bars indicate the amounts of required financial security.

in Special Drawing Rights (SDRs)



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Joint Projects and Other Co-operative Projects

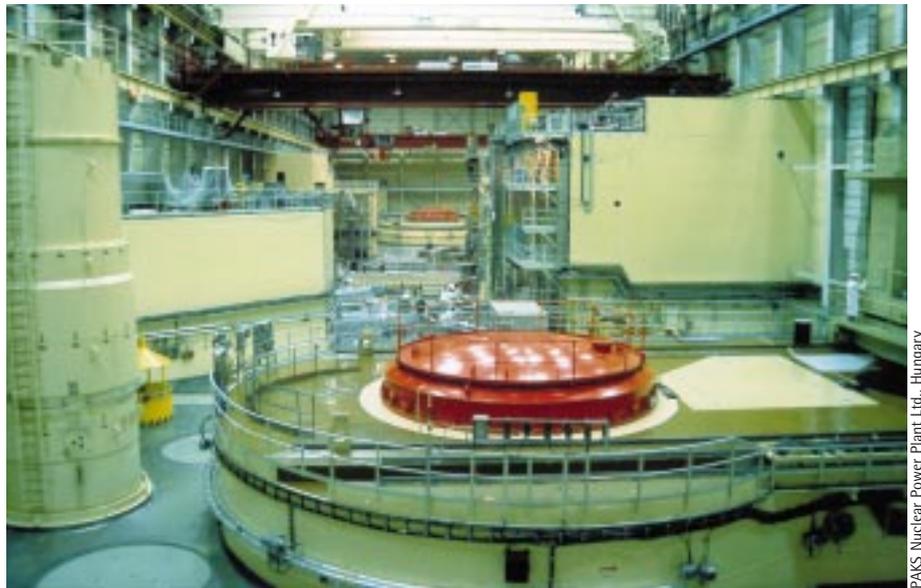
The RASPLAV Project

The second phase of the NEA-sponsored RASPLAV project started in mid-1997 and has a three-year duration. It brings together 16 OECD Member countries for the purpose of advancing the knowledge necessary to establish effective strategies for dealing with the retention of molten core material inside the reactor pressure vessel during an accident. As part of the project, a number of integral tests with prototypic core materials, molten salt simulant tests, as well as several smaller-scale separate effects tests are being conducted at the Kurchatov Institute in Moscow. The aim is to measure material properties and understand the relevant phenomena. In 1998, a third integral test using 200 kg of corium was carried out, for the first time, on fully oxidised ceramic core material. This material has a higher melting point than the partly metallic materials used in the first two tests, hence, further approaching the limits of the facility.

As a result of the tests to date, increased emphasis has been placed on the chemical aspects of the problem, and the project has been reoriented to conduct more smaller-scale tests addressing these issues. A computer model has been developed to analyse these tests and it is being further developed to include the stratification effect and the material properties of each of the phases. The analytical work is carried out at the Institute of Nuclear Safety of the Russian Academy of Sciences.

The Halden Reactor Project

The Halden Reactor Project investigates fuel, material and man-machine interface. It has been in operation for the past 40 years and involves at present the participation of 20 countries. The existing three-year programme will come to an end in 1999 and the Board has already begun preparing the 2000-2002 programme. For this purpose an



Inside view of the PAKS nuclear power plant in Hungary.

enlarged Halden Programme Group meeting attended by more than 400 participants was held in Lillehammer, Norway.

Fuel and core material reliability and safety continue to be the prime motivation for the Halden experimental and analytical activities. Performance-limiting parameters are studied during normal operation and in response to operational transients. The programme places specific emphasis on high burnup fuel performance. Its in-core instrumentation programme includes single effect studies and investigates integral rod behaviour. Specific studies on rod over-pressure and dry-out scenarios are carried out, as are studies on the effect of coolant chemistry and the irradiation environment on materials mechanical properties.

Research on man-machine systems aims at increasing safety in the use of new technology by providing member organisations with the required data and insights on human factor issues. Major deliverables include methods and software products that can enhance plant

safety and availability. An extended and upgraded experimental facility, HAMMLAB, provides the technical basis for the man-machine system activities and enables development, testing and evaluation of advanced plant surveillance and operation systems. Modern, powerful simulators for pressurised water reactors (PWRs), boiling water reactors (BWRs) and VVERs are installed in HAMMLAB for future experiments. A virtual reality laboratory for training and control room design, decommissioning and maintenance planning has recently been added to the facility.

In addition, a project to develop the Plant Safety Monitoring and Assessment System (PLASMA) for VVER reactors has been started. The project goal is to develop a system to support the execution of new symptom-based emergency operating procedures, with the PAKS nuclear power plant in Hungary serving as the pilot demonstration. The project is partly financed by the Japan Atomic Energy Research Institute (JAERI) and the Science and Technology Agency (STA) of Japan.

The Pressure Vessel Lower Head Failure Project

The objective of this new project is to reduce current uncertainties in predicting the modes of failure of a reactor pressure vessel lower head during a severe accident. It is complementary to the RASPLAV project, which provides information on the behaviour of the molten core and how to retain the integrity of the reactor pressure vessel. While the pressure vessel of the Three Mile Island reactor in the United States did not fail, state-of-the-art analysis suggests that it should have. This implies that current models are not mature and that an understanding of the relevant phenomena is still incomplete. This project, conducted at the Sandia National Laboratory in the USA, has the potential to resolve this problem.

ISOE: The Information System on Occupational Exposure

The ISOE Programme, launched in 1992, has since grown significantly, both in number of participants and scope of work. The objective of the programme is two-fold: first, to collect annual occupational exposure data from commercial nuclear power plants and to analyse them for general trends; and second, to provide protection experts who collect data with a network of communications so that they can share hands-on information and experience.

The programme enjoys the participation of 383 operating nuclear power plants, and 38 in some phase of cold shutdown or decommissioning. This includes 77 utilities in 26 countries, and national authorities in 21 countries, making ISOE the largest occupational exposure database in the world. In recent years, expansion of participation has taken place in non-member countries (all NEA Member countries with nuclear power plants in operation already participate), and the number of participating national authorities continues to grow.

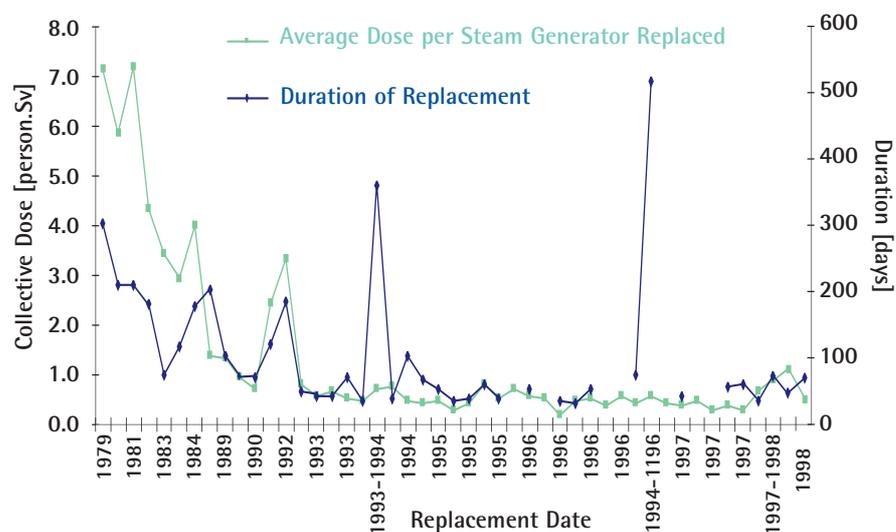
For easier data access and analysis, the ISOE database (which includes data going back to 1969) has been transferred to a Microsoft Access environment, giving participants a fast and easy route into the data combinations they may need to plan work. To further facilitate the use of the data, a user-friendly interface was created to allow push-button generation of commonly used graphs and tables.

Australian Nuclear Science and Technology Organisation, Australia



The Koongarra uranium ore deposit in Australia, chosen for the international research project on natural analogues.

Chronological Record of Steam Generator Replacements since 1979 in the OECD Area



As a follow-up to the review of the ISOE Programme carried out in 1997, specialised working groups were created; a joint ISOE Secretariat was formed with the participation of the NEA and the IAEA; and a new format for the ISOE annual report, including more policy highlights and summaries, was adopted.

Analogue Studies in the Alligator Rivers Region (ASARR)

ASARR is an OECD/NEA co-operative project to study the Koongarra uranium ore body (located in the Alligator Rivers Region, Northern Territories, Australia) as a natural analogue of nuclear waste disposal sites. The overall goal of the ASARR project is to help build confidence in predictive models of radionuclide migration through natural

analogue studies. Participants include the Australian Nuclear Science and Technology Organisation (ANSTO), the Japan Atomic Energy Research Institute (JAERI), the Korea Atomic Energy Research Institute (KAERI), the German Company for Reactor Safety (GRS) and the United States Nuclear Regulatory Commission (USNRC).

The ASARR project has been predominantly involved with identifying and quantifying processes that may be significant in retarding radionuclide migration and refining models. The technical achievements of ASARR include its application of new concepts and technologies to analogue studies and its contribution to addressing the generic issue of scale in predictive modelling of radionuclide migration. For three years ASARR has served as a forum for the exchange of information and experience, the fostering of technical progress, and the further development and training of young scientists.

The project terminated in 1998 and two major reports will be issued. The first will present all technical progress made and a complete bibliography of ASARR-related publications. The second will review the project's contribution to issues of priority concern for the performance assessment of repository systems.

Information Programme

Mission

To achieve broad recognition of the NEA as:

- an instrument for efficient, international co-operation;
- a centre of scientific and technical expertise in the field of nuclear energy;
- a source of accurate and non-promotional information for Member countries; and
- an authoritative contributor of policy advice to OECD discussions on sustainable development.



NEA Central Secretariat

From left to right: A. Meunier, S. Quarneau, C. Picot, J. de la Ferté, M. Troller, A. Pham Van.

In September, the Agency celebrated its 40th anniversary by organising an international gathering on "The Contribution of Nuclear Energy to a New Global Age". Some 150 government experts in the fields of energy and the environment attended. The main topics addressed were "Paving the way towards realistic energy and sustainable development approaches" and "Nuclear energy

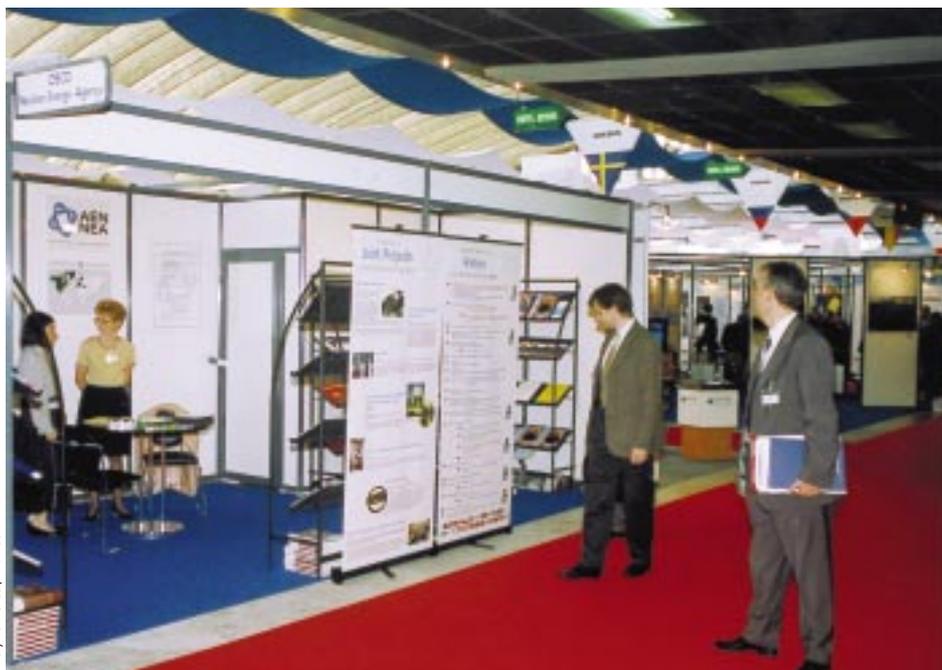
prospects and challenges into the next century: Why and how international co-operation can help".

The meeting confirmed that Member countries attach great significance to the key role that the NEA has to play in providing accurate and scientifically sound information on nuclear energy, especially to those in government bodies, industry, academic and

research institutes and the media. The three main tools used to convey this information in 1998 were NEA publications, the Web and international co-operation activities.

Publications

A total of 55 publications were produced in 1998, of which seven were conference proceedings. Thirteen of the 55 publications



The NEA set up a publications booth at the exhibit of the European Nuclear Conference (ENC '98) in Nice, France, 25-28 October 1998.



were distributed free of charge. The NEA's best-seller in 1998 in terms of number of copies sold was *Radioactive Waste Management Programmes in OECD/NEA Member Countries*; the best-seller in terms of income raised was *Uranium 1997: Resources, Production and Demand*. Other publications in large demand include *Projected Costs of Generating Electricity - 1998 Update* (published jointly with the IEA), and *Nuclear Energy Data 1998*.

Promoting publications

Efforts were made to increase awareness of the NEA and its publications through advertising campaigns in professional journals. In addition, preparations were initiated to conduct a wide survey in Member countries to identify desirable improvements in the NEA publishing policy, both as regards to diversification of contents, formats and accessibility, and reaching broader reader circles interested in NEA products.

The Web

The Agency's Web site continued to evolve, with the main primary improvement being an increase in the number of reports available free of charge by direct downloading or simple e-mail ordering. The number of full reports available on the site was 75 by the end of the year, up from 53 in December 1997.

Highlights

- A total of 55 publications were produced in 1998 covering the whole range of NEA activities.
- NEA information and publications stands were organised at several major international conferences.



■ An international gathering on "The contribution of nuclear energy to a new global age" was organised to commemorate the 40th anniversary of the Agency, and was attended by some 150 government experts in the fields of energy and the environment.

■ The NEA co-sponsored 12 international conferences during 1998.

The monthly electronic bulletin *What's New at the NEA* continued to be sent out with technical support from Data Bank staff throughout the year, and with the assistance of the administrative unit during the last quarter. By the end of the year, the number of people receiving this free bulletin reached 3 300, up from 2 400 a year earlier. Requests for information received via the Internet were running at roughly 160 per month.

A new document-retrieval facility was put in place for all NEA committee members. It works via a password-protected internet link and allows registered Members to obtain

meeting information more quickly, and in a less costly fashion, than by post.

International co-operation activities

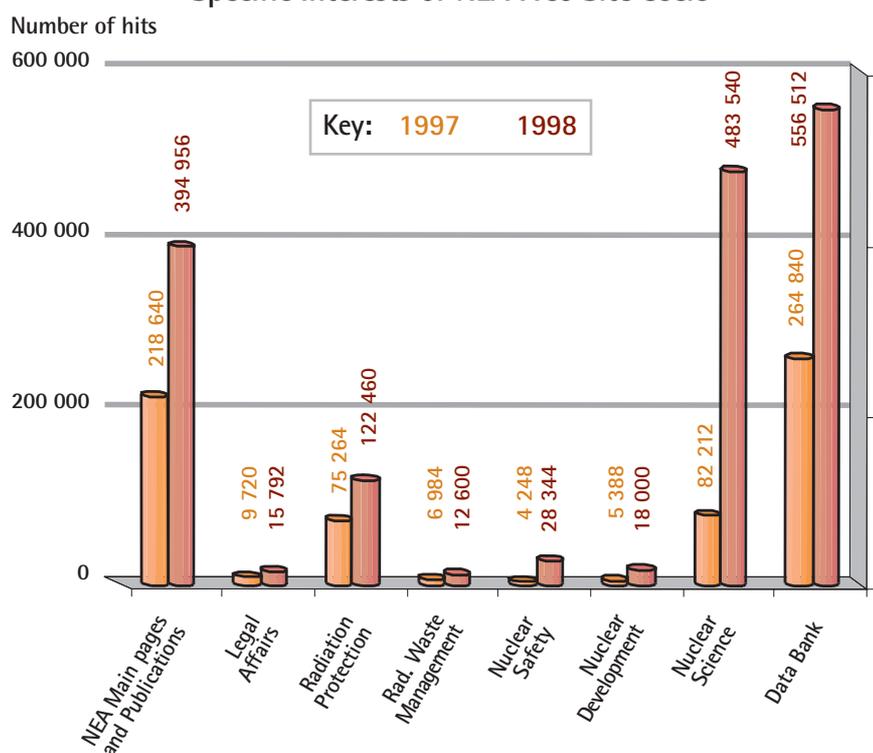
NEA information and publications stands were organised at three major international conferences. These included the 11th Pacific Basin Nuclear Conference (May; Banff, Canada); the European Nuclear Conference (October; Nice, France); and the American Nuclear Society Winter Meeting (November; Washington DC, USA).

Various activities continued to be organised in the context of the Co-operation Agreement with the American Nuclear Society. These concentrated on the co-sponsorship of conferences, and publicising each other's reports. Similar agreements were investigated with other international bodies.

A co-operation arrangement with the International Nuclear Regulators Association (INRA) was approved by the NEA Steering Committee at the end of the year. This provides for regular exchanges of information, including cross-representation at a selection of key meetings.

Co-sponsorship of 12 international conferences was organised for 1998. At conferences where co-sponsorship had previously been arranged, NEA staff members were active in presenting speeches, writing and publicising papers on the Agency's latest findings.

Specific Interests of NEA Web Site Users



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NEA Publications Produced in 1998

Publications of General Interest

NEA Newsletter

Vol. 16 Nos. 1 and 2



ISSN 1016-5398

Annual subscription
price: FF 180 US\$ 35
DM 52 £ 20 ¥ 4 000

NEA Activity Report 1997

Free on request.

Catalogue of publications 1998

Free on request.

Radioactive Waste Management Programmes in OECD/NEA Member Countries

ISBN 92-64-16033-7

Price: FF 195 US\$ 33 DM 58
£ 20 ¥ 4 150



Radioactive Waste Management

Nuclear Waste Bulletin No. 13 – December 1998

Free on request.

Fluid Flow through Faults and Fractures in Argillaceous Formations

ISBN 92-64-16021-3

Price: FF 400 US\$ 67 DM 119 £ 41 ¥ 8 100

Modelling the Effects of Spatial Variability on Radionuclide Migration

ISBN 92-64-16099-X

Price: FF 450 US\$ 74
DM 134 £ 45 ¥ 9 550



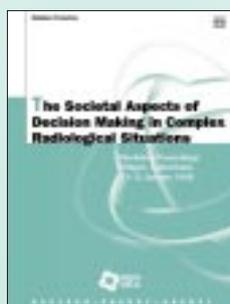
Use of Hydrogeochemical Information in Testing Groundwater Flow Models

ISBN 92-64-16153-8

Price: FF 550 US\$ 91 DM 164 £ 56 ¥ 12 500

Radiation Protection

The Societal Aspects of Decision-Making in Complex Radiological Situations



ISBN 92-64-16147-3

Price: FF 220 US\$ 36 DM 66 £ 22 ¥ 4 900

Developments in Radiation Health Science and their Impact on Radiation Protection

Free on request.

ISOE – Occupational Exposures at Nuclear Power Plants Sixth Annual Report (1986-1996)



Free on request.

Economic and Technical Aspects of the Nuclear Fuel Cycle

Nuclear Power and Climate Change

Free on request.

Uranium 1997: Resources, Production and Demand

ISBN 92-64-16050-7

Price: FF 470 US\$ 79 DM 140 £ 48 ¥ 10 000

OECD Nuclear Energy Data 1998

ISBN 92-64-05762-5

Price: FF 120 US\$ 20 DM 36 £ 12 ¥ 2 550

Projected Costs of Generating Electricity – Update 1998

ISBN 92-64-16162-7

Price: FF 400 US\$ 66

DM 120 £ 41 ¥ 9 100



Beneficial Uses and Production of Isotopes

ISBN 92-64-16953-9

Price: FF 120 US\$ 20 DM 36 £ 12 ¥ 2 800

Low-Level Radioactive Waste Repositories: An Analysis of Costs

ISBN 92-64-16154-6

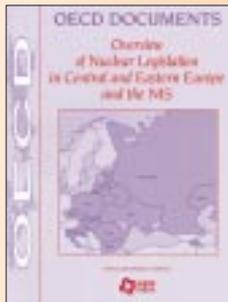
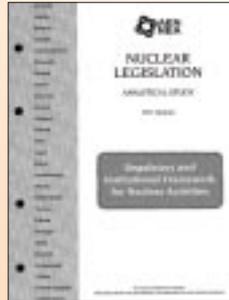
Price: FF 300 US\$ 50 DM 89 £ 31 ¥ 7 000

Nuclear Legislation

Nuclear Legislation – Analytical Study Regulatory and Institutional Framework for Nuclear Activities – 1997 Update

ISBN 92-64-16086-8

Price: FF 150 US\$ 25 DM 45
£ 15 ¥ 3 200

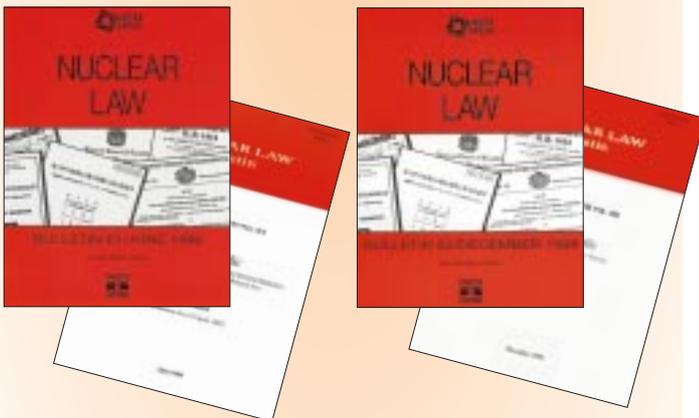


Overview of Nuclear Legislation in Central and Eastern Europe and the NIS

ISBN 92-64-16018-3

Price: FF 150 US\$ 25
DM 45 £ 15 ¥ 3 050

Nuclear Law Bulletin Nos. 61 and 62 plus supplements June and December 1998



ISSN 0304-341X

Annual subscription price:
FF 295 US\$ 58 DM 88 £ 34 ¥ 6 400

Nuclear Law Bulletin – Index 1-60

ISBN 92-64-16015-9

Price: FF 190 US\$ 30 DM 57 £ 19 ¥ 4 100

Nuclear Safety

Future Nuclear Regulatory Challenges



ISBN 92-64-16106-6

Price: FF 120 US\$ 20 DM 36 £ 12 ¥ 2 550

Safety Research Needs for Russian-Designed Reactors



ISBN 92-64-15669-0

Price: FF 80 US\$ 16
DM 23 £ 10 ¥ 1 700



A Russian version
is also available
free of charge.

Nuclear Science and the Data Bank

International Evaluation Co-operation

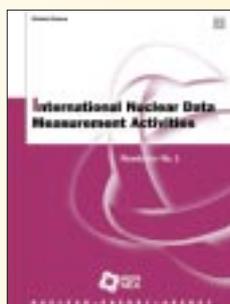
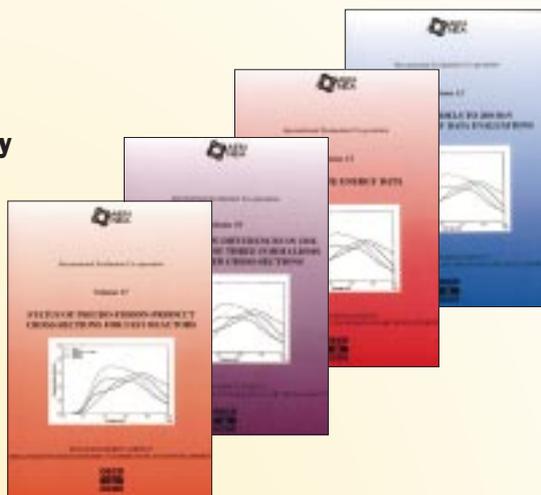
Free on request.

Volume 12: Nuclear Models to 200 MeV for High-Energy Data Evaluations

Volume 13: Intermediate Energy Data

Volume 16: Effects of Shape Differences in the Level Densities of Three Formalisms on Calculated Cross-Sections

Volume 17: Status of Pseudo-Fission-Product Cross-Sections for Fast Reactors



International Nuclear Data Measurement Activities - Newsletter No. 3

Free on request.

SATIF-3 - Shielding Aspects of Accelerators, Targets and Irradiation Facilities

ISBN 92-64-16071-X

Price: FF 365 US\$ 60 DM 109 £ 37 ¥ 7 800



Evaluation of ²⁴²Pu Data for the Incident Neutron Energy Range 5-20 MeV

Free on request.

Thermal Performance of High Burnup LWR Fuel

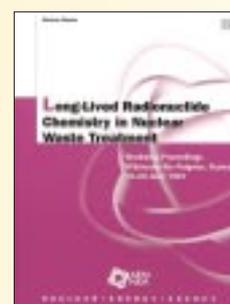
ISBN 92-64-16957-1

Price: FF 550 US\$ 93 DM 164 £ 57 ¥ 13 120

Long-Lived Radionuclide Chemistry in Nuclear Waste Treatment

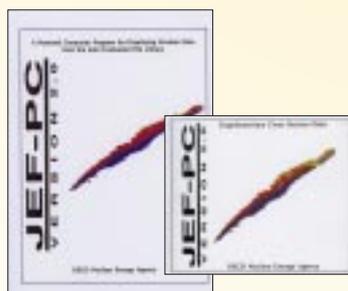
ISBN 92-64-16148-1

Price: FF 390 US\$ 65 DM 116 £ 39 ¥ 8 650



Actinide Separation Chemistry in Nuclear Waste Streams and Materials

Free on request.



JEF-PC 2.0 - A Personal Computer Program for Displaying Nuclear Data from the Joint Evaluated File Library

ISBN 92-64-15130-3 - 113-page manual, 6 diskettes and 4 CD-ROMs

Single version: Price: FF 950 US\$ 157 DM 282 £ 97 ¥ 18 500

Multuser version: Price: FF 3 800 US\$ 627 DM 1 128 £ 387 ¥ 73 900

Upgrade from JEF-PC 1.0: Price: FF 600 US\$ 99 DM 178 £ 61 ¥ 11 700

Administration

Budgetary constraints

In 1998 the Agency faced its third consecutive year of budget cuts. Not only were the internal resources of the Agency reduced by some 3.9% overall, and considerably more in certain areas, but support from central services was also curtailed. For some of them the reduction in support was partially offset by a decentralisation of funding. However, the offset was not sufficient to cover the extra operational costs, and certainly not the additional administrative burden.

To meet this challenge, the Management Support Unit continued to be active in developing new managerial and administrative tools. The first of these was NEABURS (NEA Budget Utilisation and Reporting System) which provides the Agency with precise, up-to-date budget data. This software has now become the standard for most substantive directorates of the Organisation and, in 1998, work began on adapting it to interact more directly with the OECD's central financial systems.

During 1998 work started on APRIL (Administrative Process Re-engineering and Information Liaison). APRIL will provide the Agency with enhanced capacity for controlling and monitoring real resources, as well as linking these to the underlying financial resources in a more transparent fashion. The second phase of this project will concentrate on looking more closely at methods for reaching out to clients, both old and new, with a



NEA Management Support Unit (MSU)

From left to right: A. Little, J. Hembury, J. McGrath, B. Trulin, D. Browne, F. Lamantea, R. Posca, J. Coy, S. Phelippeau, . Not represented: S. Godwin, D. Jenkins, J-F. Le Gall.

view to help improve dissemination of the Agency's work.

40th anniversary CD-ROM

An original, visiting-card size CD-ROM was designed to commemorate the 40th anniversary of the Agency. The CD-Card contained an introduction by the Director-General, a brief review of the history of the NEA since 1958, and an outline of the Agency's future. The card was sent to the members of all NEA Committees and to all those who participated in the 40th anniversary celebrations.

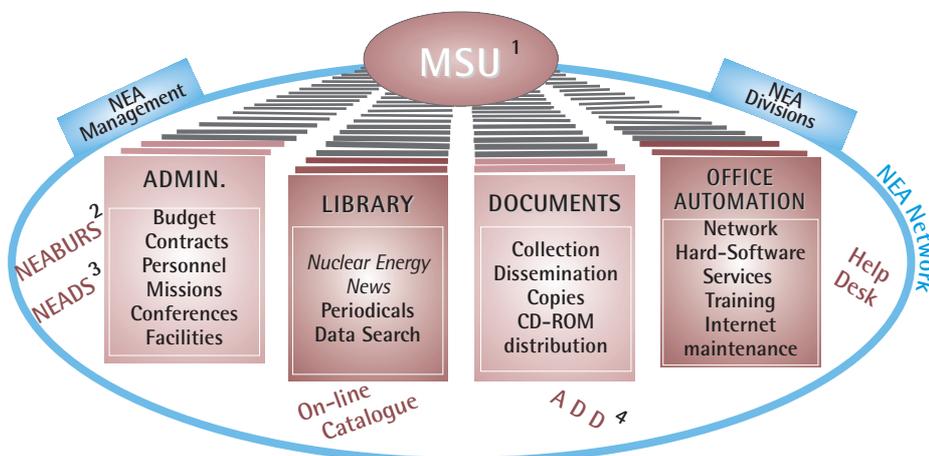
Training

All staff were actively encouraged to renew their skills and, in particular, to keep abreast of

the many productivity enhancements now becoming available in the fast-moving environment of office automation. During 1998, training was provided on site to meet ongoing requirements concerning the use of Microsoft Office software. Outside training courses were also provided to meet specific requirements.

Office automation

Administration continued to provide full hardware and software services to Agency staff, together with an internal HELP line that provided ad hoc technical assistance. The switch to MS Exchange for the Agency's e-mail was completed successfully in 1998, and was part of the on-going effort to maximise the NEA efficiency and to improve the exchange of information within the rest of the OECD as well as externally. The NEA computer network was upgraded and is now based on full-switched, fast ethernet technology. The upgrade of personal computers to meet the needs of new software was begun in the second half of the year.



1. Management Support Unit
2. NEA Budget Utilisation & Reporting System

3. NEA Administrative System
4. NEA Addresses Data System

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Main Workshops and Seminars Held in 1998

JANUARY

25-27 Workshop for the Reactor Pressure Vessel Thermal Pressurized Shock International Comparative Assessment Study (ICAS) – Orlando, Florida, USA.

MARCH

02-06 Workshop on In-Vessel Core Debris Retention and Coolability – Garching, Germany.

03-05 Seminar on Thermal Performance of High-Burnup Light-Water Reactors Fuel – Cadarache, France.

APRIL

20-23 Workshop on Living Probabilistic Safety Assessment (PSA) and Data Collection – Budapest, Hungary.

JUNE

08-11 Workshop for the Working Group on Inspection Practices – Prague, Czech Republic.

10-12 GEOTRAP Workshop: Characterisation of Water-Conducting Features and their Representation in Models for Radionuclide Migration – Barcelona, Spain.

15-18 Specialist Meeting on Nuclear Aerosols in Reactor Safety – Cologne, Germany.

25-26 Final Comparison and Interpretation Workshop on the International Standard Problem No. 40 Exercise – Joint Research Centre, Ispra, Italy.

29-01 Seminar on Best Estimate Methods in Thermo-Hydraulic Safety Analysis – Ankara, Turkey.

SEPTEMBER

15-17 Workshop on Application Research using Charged Particles (Ion and Positron Beams) – Lisbon, Portugal.

28-30 Workshop on the Physics and Fuel Performance Issues of Reactor-Based Plutonium Disposition – Paris, France.

30 40th Anniversary of the OECD Nuclear Energy Agency (NEA) – Paris, France.

OCTOBER

04-06 Workshop on Speciation Techniques and Facilities for Radioactive Materials at Synchrotron Light Source – Grenoble, France.

06-07 Workshop on the Back-End of the Fuel Cycle in a 1 000 GWe Nuclear Scenario – Avignon, France.

08-09 Workshop on ISP-43 on Rapid Boron Dilution – Rockville, MD, USA.

13-15 Workshop on Utilisation and Reliability of High Power Accelerators – Tokai, Japan.

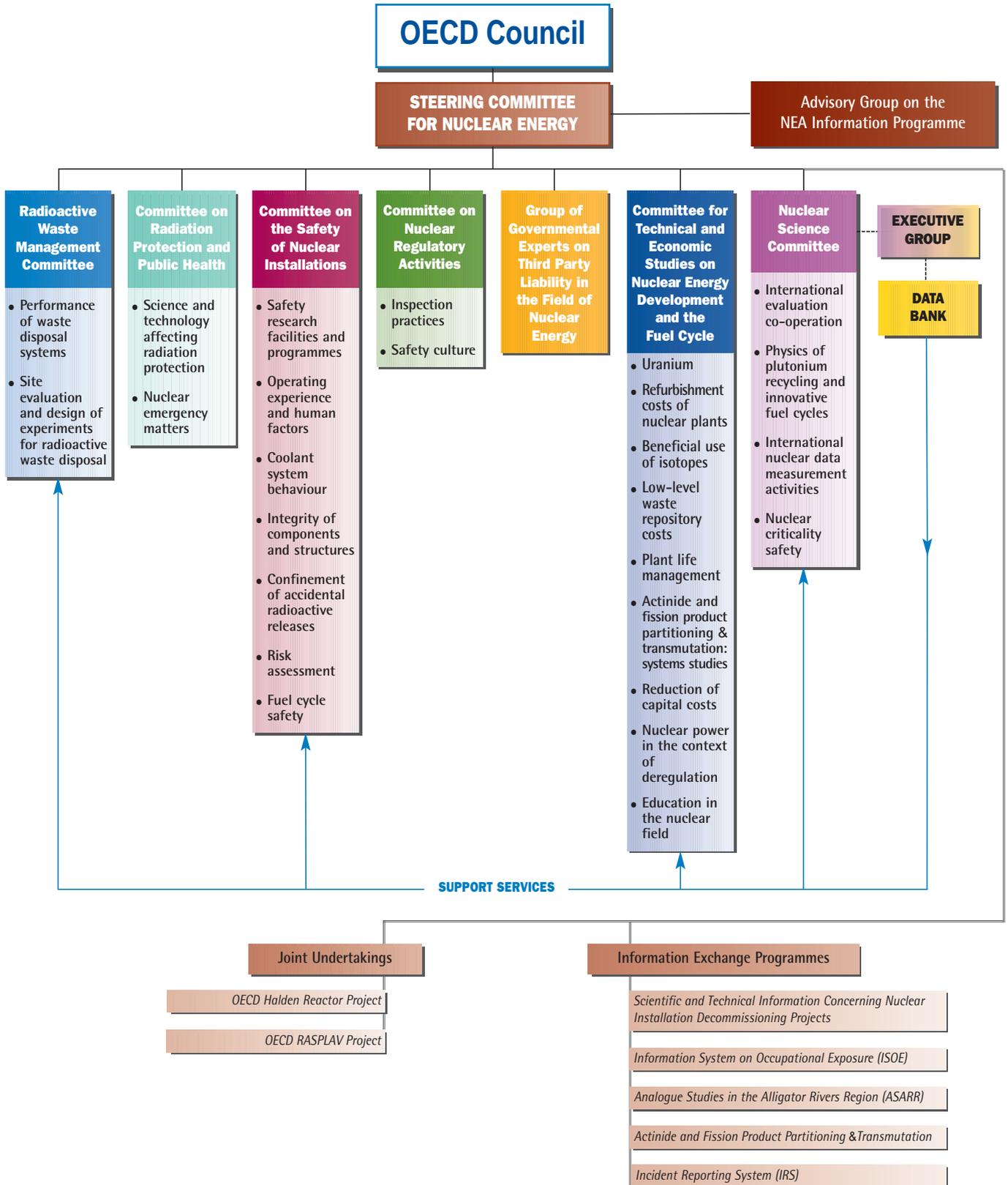
21-23 Workshop on Advanced Reactors with Innovative Fuels – Villigen, Switzerland.

29-30 Workshop on Finite Element Analysis of Degraded Concrete Structures – Brookhaven, NY, USA.

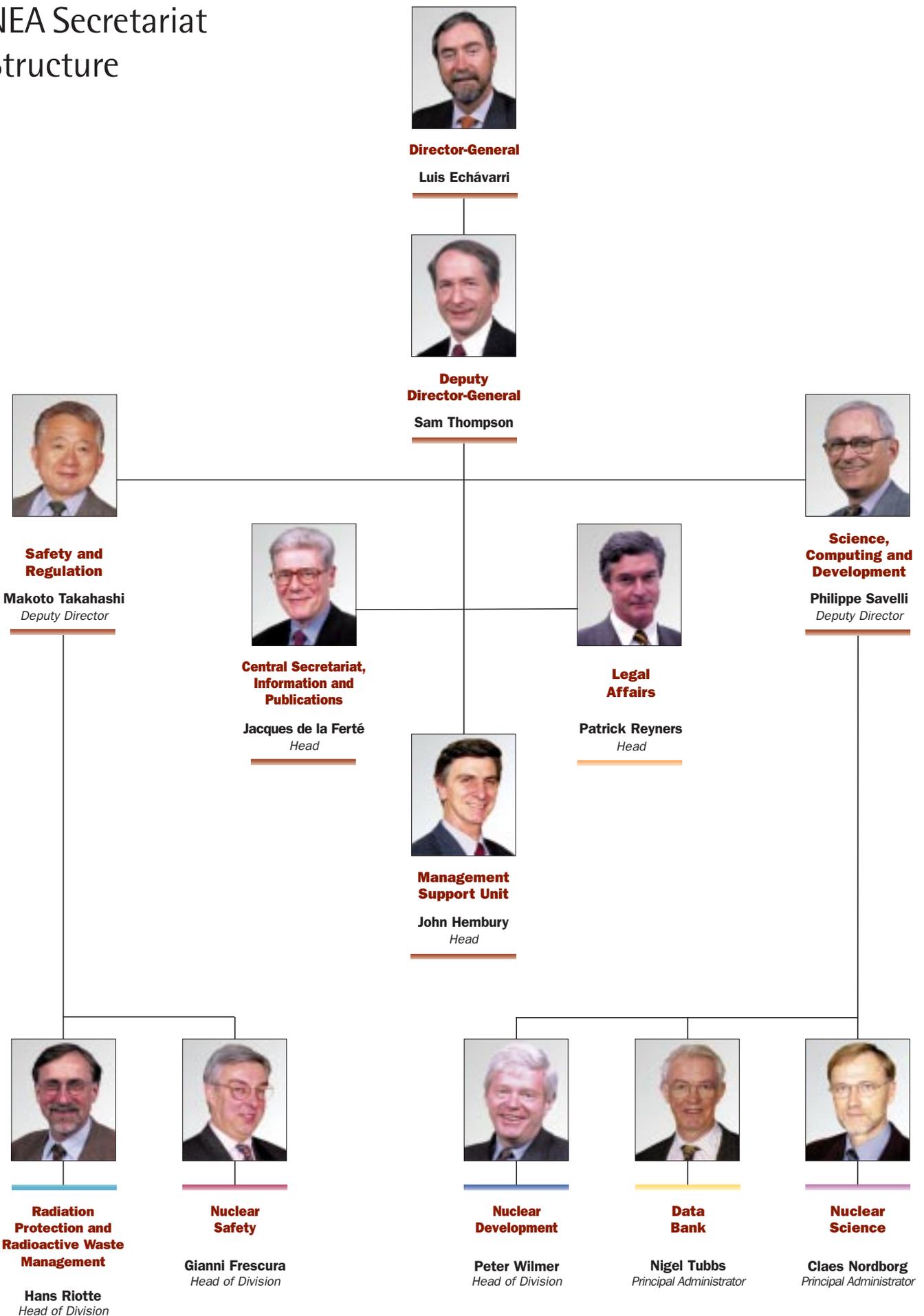
DECEMBER

02-03 Nuclear Emergency Matters: Workshop on Monitoring; Key Data; and Communication Strategies – Paris, France.

Organisation Charts of the NEA



NEA Secretariat Structure



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) and the Republic of Korea (12th December 1996). 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 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 all OECD Member countries, except New Zealand and Poland. The Commission of the European Communities takes part in the work of the Agency.

The primary objective of the NEA is to promote co-operation among the governments of its participating countries in furthering the development of nuclear power as a safe, environmentally acceptable and economic energy source.

This is achieved by:

- *encouraging harmonization of national regulatory policies and practices, with particular reference to the safety of nuclear installations, protection of man against ionising radiation and preservation of the environment, radioactive waste management, and nuclear third party liability and insurance;*
- *assessing the contribution of nuclear power to the overall energy supply by keeping under review the technical and economic aspects of nuclear power growth and forecasting demand and supply for the different phases of the nuclear fuel cycle;*
- *developing exchanges of scientific and technical information particularly through participation in common services;*
- *setting up international research and development programmes and joint undertakings.*

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

Publié en français sous le titre:

AEN – RAPPORT ANNUEL 1998

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No. 80459 1999

Design: 95 B

Portraits and group photos: Colum Pierce

Printing: Goudy-Hélio, Saint-Fargeau-Ponthierry, France