September 25, 2000

MEMORANDUM TO: John W. Craig
Assistant for Operations
Office of the Executive Director for Operations

FROM: Janice Dunn Lee, Director /S/
Office of International Programs

SUBJECT: PREPARATION FOR THE NEA STEERING COMMITTEE MEETING ON OCTOBER 12 AND 13, 2000

The next NEA Steering Committee meeting will be held on October 12 and 13, 2000. The U.S. delegation will be led by William D. Magwood. I will represent NRC. The agenda (Attachment 1) features four main subjects:

1) Accession of Poland to the NEA (Attachment 2)
2) Background Document on Nuclear Energy in a Sustainable Development Perspective (Attachment 3)
3) The 2001-2002 Program of Work and Budget (Attachment 4)
4) Review of the NEA Committee Structure (Attachment 5)

Additionally, two projects are included on the agenda for which the NRC is the lead participant among U.S. government agencies:

1) The OECD/NEA MASCA Project (Attachment 6)
2) The OECD/NEA Sorption Project - Phase II (Attachment 7)

OIP representatives will be working with the Departments of Energy and State to develop position papers on these papers. We would appreciate your assistance in providing NRC staff comments to OIP, by Friday, October 6. Copies of the attachments have been sent to the Office Directors and the General Counsel to facilitate this request. Email responses may be sent directly to Beth Doroshuk (ELD).

Attachments: As stated

cc w/Atts: S.J. Collins, NRR
A.C. Thadani, RES
W.F. Kane, NMSS
K.D. Cyr, OGC

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Attachment 2

MEMORANDUM TO: John W. Craig
Assistant for Operations
Office of the Executive Director for Operations

FROM: Janice Dunn Lee, Director
Office of International Programs

SUBJECT: PREPARATION FOR THE 101ST SESSION OF THE NEA STEERING COMMITTEE MEETING ON OCTOBER 12 and 13, 2000

The 101st session of the NEA Steering Committee meeting will be held on Thursday and Friday, October 12 and 13, 2000. The U.S. delegation will be led by William D. Magwood. I will be participating as Alternate Representative. Additional DOE and DOS representatives will be participating as Advisors. The agenda for the 101st session of the NEA Steering Committee meeting (Attachment 1) features four main subjects:

1) Accession of Poland to the NEA (Attachment 2)
2) Background Document on Nuclear Energy in a Sustainable Development Perspective (Attachment 3)
3) The 2001-2002 Program of Work and Budget (Attachment 4)
4) Review of the NEA Committee Structure (Attachment 5)

The U.S. Department of State (DOS), in coordination with the Department of Energy (DOE), will be developing position on these topics for the U.S. delegation's participation in the Steering Committee meeting. Additionally, two projects are included on the agenda for which the NRC is the lead participant among U.S. government agencies:

1) The OECD/NEA MASCA Project (Attachment 6)
2) The OECD/NEA Sorption Project - Phase II (Attachment 7)

OIP representatives will be working with DOE to develop position papers regarding these projects. We would appreciate your assistance in providing NRC staff comments to OIP, if possible, by Friday, October 6. Copies of the attachments have been sent to the Office Directors and the General Counsel to facilitate this request. Email responses may be sent directly to Beth Doroshuk (ELD).

Attachments: As stated

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ATTACHMENT 1
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Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 31-Aug-2000
Dist. : 01-Sep-2000

Or. Eng.

NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY

DRAFT OUTLINE OF THE AGENDA FOR THE 101st SESSION OF THE STEERING COMMITTEE FOR NUCLEAR ENERGY

Château de la Muette, Paris
Thursday, 12 October
and Friday, 13 October 2000

94646

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STEERING COMMITTEE FOR NUCLEAR ENERGY

DRAFT OUTLINE OF THE AGENDA FOR THE 101ST SESSION

Château de la Muette, Paris
12-13 October 2000, starting at 10.30 a.m.

Any comments or suggestions concerning this proposed agenda should reach the Secretariat by ***no later than 18 September 2000.***

In view of the formalities for admission to the premises of the meeting, ***the Secretary of the Steering Committee would like to receive in advance the names of all participants*** in this meeting.

1.	ADOPTION OF THE AGENDA	NEA/NE/A(2000)2
2.	APPROVAL OF THE MINUTES OF THE LAST SESSION HELD ON 10-11 MAY 2000	NEA/NE/M(2000)1
3.	REPORT BY THE DIRECTOR-GENERAL	Oral report

PART I - PROGRAMME OF WORK AND BUDGET

4. NEA PROGRAMME OF WORK FOR 2001-2002, AND BUDGET FOR 2001 — NEA/NE(2000)10

The Steering Committee will be invited ***to approve*** the NEA Programme of Work for 2001 and 2002, as well as the estimates of expenditure for 2001, for forwarding to the Secretary-General and the Council, in the context of the POW and budget of the Organisation as a whole.

PART II - STRATEGY

5. FINAL REPORT ON THE REVIEW OF THE NEA COMMITTEE STRUCTURE — NEA/NE(2000)11

The Steering Committee will be invited ***to endorse*** the final version of the report on the review of the NEA committee structure, including the mandates of the standing technical committees (Annex II); and ***to note*** Annex III dealing with the structure of the Secretariat.

PART III - MATTERS OF GENERAL INTEREST

6. ACCESSION OF THE REPUBLIC OF POLAND TO THE NUCLEAR ENERGY AGENCY AND ITS DATA BANK — NEA/NE(2000)12

The Steering Committee will be invited ***to take note*** of a report by an NEA Secretariat team on its visit to Poland in July 2000, providing information on nuclear and related activities of Poland, and of the analysis developed by the Secretariat in respect of its application for membership in the NEA and its Data Bank; and ***to make a recommendation*** to the Council regarding that application, pursuant to Article 17(b) of the NEA Statute.

PART IV - SPECIFIC PROGRAMME AREAS

Sustainable Development

7. BACKGROUND DOCUMENT ON NUCLEAR ENERGY IN A SUSTAINABLE DEVELOPMENT PERSPECTIVE — NEA/NE(2000)13

The Steering Committee will be invited ***to review*** this document, prepared in conjunction with the 2001 meeting of the OECD Council at Ministerial level, as revised in the light of the comments made on an earlier draft presented at the last meeting.

Radioactive Waste Management

8. THE OECD/NEA SORPTION PROJECT – PHASE II — NEA/NE(2000)14

The Steering Committee will be invited ***to take note*** of a new co-operative project in the field of safety assessment of radioactive waste disposal, established in accordance with Article 5(b) of the Agency's Statute.

The project, aimed at resolving issues in chemical thermodynamic modelling approaches, builds on the results of Phase I (1997-1998) of the Sorption Project and makes use of output of the TDB Project. Twelve organisations from ten Member countries have already indicated their intention to participate.

Nuclear Safety

9. THE OECD/NEA MASCA PROJECT — NEA/NE(2000)15

The Steering Committee will be invited ***to take note*** of a new co-operative project in the field of nuclear safety, established in accordance with Article 5(b) of the Agency's Statute.

This joint project is aimed at resolving remaining issues concerning the interaction of molten fuel with the reactor pressure vessel during a severe accident. Fifteen NEA Member countries have already indicated their intention to participate.

Radiation Protection

10. STATUS REPORT BY THE CHAIRMAN OF THE COMMITTEE ON RADIATION PROTECTION AND PUBLIC HEALTH (CRPPH) ON RECENT ACHIEVEMENTS AND FUTURE PLANS OF THE COMMITTEE — Oral report

The Steering Committee will be invited ***to note*** the report of the Chairman of the CRPPH.

PART V - OTHER MATTERS OF INTEREST

11. THE LONG-TERM NUCLEAR PROGRAMME OF JAPAN — Oral report

The Steering Committee will be invited ***to take note*** of a presentation by Prof. Yoichi FUJI-IE, Vice-Chairman of the Japanese Atomic Energy Commission (AEC), on this subject. This presentation will take place on the afternoon of 12 October at 5 p.m.

12. ACTIVITIES OF OTHER PARTS OF THE OECD OF INTEREST TO THE STEERING COMMITTEE — Oral reports

a) International Energy Agency (IEA)

b) OECD Environment Directorate

The Steering Committee will be invited ***to note*** the reports from the International Energy Agency (IEA) and the OECD Environment Directorate on their respective activities of interest to the NEA.

PART VI - PROCEDURE

13. ELECTION OF THE BUREAU

The Steering Committee will be invited *to elect* the Bureau of the Committee.

14. DATE OF THE NEXT MEETING

It is suggested that the next meeting take place on *3-4 May 2001*. It is planned to hold the Fall meeting on 16-17 October 2001.

15. OTHER BUSINESS

POLICY DEBATE ON

THE IMPACT OF DEREGULATION OF THE ELECTRICITY MARKET ON NUCLEAR ENERGY

Thursday, 12 October 2000
2.30 to 5.00 p.m.

Chairman: **Dr. Lars Högberg**, Chairman of the Steering Committee for Nuclear Energy

14:30 OPENING REMARKS
Mr. Luis Echávarri, Director-General, OECD Nuclear Energy Agency (NEA)

14:40 NUCLEAR POWER COMPETITIVENESS IN DEREGULATED ELECTRICITY MARKETS
Mr. Gunnar Ålfors, Director of Production, Vattenfall Generation, Sweden

15:00 ELECTRICITY MARKET DEREGULATION AND NUCLEAR SAFETY
Mr. Anibal Martin, Vice-President, Consejo de Seguridad Nuclear, Spain

15:20 THE IMPACT OF REGULATION ON INFRASTRUCTURE INVESTMENT
Mr. Richard Morse, Deputy Director-General, Office of Gas and Electricity Market, United Kingdom

15:40 DEBATE moderated by **the Chairman**

17:00 CONCLUSIONS

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Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 12-Sep-2000
Dist. : 13-Sep-2000

Or. Eng.

NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY

NEA/NE(2000)12
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ACCESSION OF THE REPUBLIC OF POLAND TO THE NUCLEAR ENERGY AGENCY AND ITS DATA BANK

(Note by the Secretariat)

Or. Eng.

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ACCESSION OF THE REPUBLIC OF POLAND TO THE NUCLEAR ENERGY AGENCY AND ITS DATA BANK

BACKGROUND

1. On 19 and 20 July last, a small NEA team travelled to Warsaw for discussions with senior Polish officials. This visit was a result of a) Poland's formal request to join the NEA and its Data Bank contained in a letter of the Minister of Foreign Affairs, Mr. GEREMEK, to the Secretary General of the OECD in July 1999, and b) the procedure embodied in Article 17 (b) of the Statute of the NEA with respect to an OECD Member country that requests to join the Agency. Under this Article, such a request shall be subject to approval by "the Council on the recommendation of the Steering Committee".

2. Consistent with a procedure previously endorsed by the Steering Committee, and a specific decision taken by the Committee last May, the Secretariat arranged to send a small team to Poland to obtain up to date information in order to assist the Committee in reaching a decision on Poland's application. More specifically, the objective was to gather information concerning national nuclear policy and programmes, and to evaluate the potential benefits for Poland and the Member countries of the Agency of Poland's membership.

3. It should be recalled that a preliminary visit was carried out in 1997 after Poland first indicated a strong interest in joining the NEA and issued an invitation for such a visit.

DESCRIPTION OF THE VISIT

4. The first day of the visit was devoted to a general presentation of Poland's nuclear activities by the President of the National Atomic Energy Agency (NAEA), the Director-General and other Directors of this Agency. Moreover, the team was given a presentation on Poland's energy policy by a representative of the Ministry of Economy. On the second day, the NEA team was invited to visit installations of the Atomic Energy Institute, such as the Maria Reactor and Waste Treatment Facility, and the Heavy Ion Laboratory of Warsaw University. A wrap up session with the President and his staff took place at the end of that day. Annex 1 lists all those persons with whom the NEA team met.

FACTORS TO BE TAKEN INTO ACCOUNT WHEN EXAMINING APPLICATIONS BY OECD MEMBER COUNTRIES TO JOIN THE NEA

5. As a conclusion of its policy debate in May, the Steering Committee considered that more work was needed before the Committee could reach consensus on criteria for new membership. As a guide in collecting information, the Secretariat used the list of factors outlined in document NEA/NE(2000)3, presented to the Committee last May, bearing in mind the relevant objectives of the NEA Strategic Plan. These factors, previously used when considering the applications of the Czech Republic and Hungary, are aimed at providing a basis for evaluating a) whether a country's basic perspective, approaches and objectives are consistent with those of the NEA membership as a whole, and b) whether the country is likely to be able to contribute effectively to NEA activities. The list of factors, which has been used as background for the following analysis, is set out in Annex 4.

ANALYSIS

6. The following analysis is based on the information on nuclear activities and related policies of the Republic of Poland gathered during the visit and outlined in Annex 2.

International co-operation policies and commitments

7. The Republic of Poland has long been an active member of the international nuclear community and has developed gradually a nuclear policy, the principles of which are broadly similar to those of NEA Member countries. The Republic of Poland is a member of the IAEA and party to the main treaties and agreements on the non-proliferation of nuclear weapons and on co-operation with regard to the peaceful uses of nuclear energy. It is also a Member of the Convention on Early Notification of a Nuclear Accident, of the Nuclear Safety Convention and of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Poland has also concluded numerous bilateral nuclear co-operation agreements, in particular in relation to the rapid notification of incidents, especially with all its neighbouring countries operating nuclear power plants. Polish membership in international nuclear conventions is detailed in Annex 3.

8. Polish experts previously co-operated with the NEA in three regional INEX 2 exercises, and also use the services of the Data Bank through the IAEA. Polish legal experts take part in the work of the NEA Group of Governmental Experts on Third Party Liability in the Field of Nuclear Energy, and have participated actively in the nuclear law seminars organised by the Agency.

National nuclear legislation and public information

9. Nuclear activities in Poland are currently regulated by a law issued in 1986. Early 2000 a new Polish Atomic Energy Act was approved by the Government, and has been submitted to the Parliament in accordance with the Polish legislative procedure. This law, which is expected to be passed by the end of the year, governs all nuclear activities in Poland, including medical applications, but deals mainly with safety and health protection aspects. In particular, it sets out the responsibilities and tasks of the regulatory authorities and bodies engaged in these activities. The new Act, which completes and updates the previous one, while maintaining the key aspects of the existing law, is aimed at amending provisions to bring them more into line with modern practices. It takes account of the different international commitments undertaken by Poland, provides a legal basis for fields not properly covered by the existing law and accommodates the Directives of the European Union. It also takes account of the recent evolution of the nuclear third party liability regime.

10. As regards informing and communicating with the public, the Polish Government and the NAEA have active programmes focused on education activities and disseminating knowledge about physics/radiation in general. The new Act mentions explicitly the role and responsibilities of the Regulatory Authority in normal circumstances as well as in situations involving accidents. Polls indicate that currently 33% of the population are of the opinion that energy supply problems in Poland may be solved using nuclear power while 55% oppose such a solution.

Nuclear programme and organisation, and the independence of the safety authority

11. In February 2000, the Government adopted "Guidelines for Energy Policy in Poland up to the year 2020". During this period, Poland will continue to rely almost exclusively on coal for electricity production. No new base load power plants will be built in the coming ten years. Although the initial proposals submitted by the Ministry of Economy considered that nuclear power would be needed after 2020, the final provisions adopted by the Government discard this hypothesis. This change is due to further

adjustments of electricity demand assumptions, which it was concluded had been overestimated, and in the expected results of governmental policies for efficiency and innovation, which it was believed had been underestimated. When presenting these new Guidelines for Energy Policy to the NEA team, the representative of the Ministry of Economy stressed that there is currently no ideological or political opposition to the eventual use of nuclear power. He considers that the recent decisions do not mean the Polish Government has definitely discarded the nuclear option. On the contrary, he indicated it could be considered in future plans, provided economic and environmental benefits are clearly established for Poland. It was also recognised that the environmental benefits of nuclear power are not a major incentive for Poland today since this country has no difficulty in meeting its objectives under the Kyoto Protocol. Because industrial activity in Poland significantly decreased during the 1990s and real progress in energy efficiency has been achieved, primary energy consumption is expected to be less in 2020 than in 1988 which is the reference year.

12. According to the new Act, regulatory and promotional functions will be strictly separated. The NAEA will be placed under the authority of the Prime Minister, and will be the central focus of the organisation of public authorities in the nuclear field in Poland. Currently, the NAEA implement government policy, ensuring a satisfactory level of safety for the use of nuclear energy, but has no responsibilities or budget as regards the promotion or development of nuclear power. The President of the NAEA, who will report to the Prime Minister directly, is the Head of the regulatory body for radiation protection and nuclear safety, which is responsible for granting licenses to construct, operate and decommission nuclear installations. In addition, the NAEA establishes rules governing the accounting, surveillance and physical protection of nuclear material, as well as the conditions of export, import or transit of such material. The NAEA is also in charge of the assessment of the radiation situation in Poland.

Range of activities, installations

13. The Republic of Poland has a rich scientific history in the areas of nuclear physics, radiation chemistry and radiation protection, and maintains seven major research institutes employing 3000 people in these areas. Additional resources are available through the Polish university system, where research and educational activities are carried out. The MARIA facility, a 30 MW pool-type high-flux beam reactor, has been operated since 1976 for radioisotope production and neutron physics experiments. Various accelerators and cyclotrons are also operated for research and isotope production purposes, and Polish experts and scientists participate actively in nuclear physics research programmes at major facilities throughout the world (CERN, DESY, Fermi Lab, Brookhaven Lab, Lawrence Berkeley Lab, etc.).

14. Poland has some expertise in the management of radioactive waste. While the low and intermediate waste disposal facility at Rozan has operated successfully since 1961, accumulating approximately 3400 m^3 of conditioned waste, this facility is expected to reach its capacity between 2010 and 2015. Radioactive waste management strategies for all types of waste, including spent nuclear fuel, were studied under the Strategic Government Plan (1997 - 1999), resulting in the identification of one clay and three salt dome sites that could be the object of further consideration for high-level waste disposal. In addition, 19 sites in 12 communities were identified for possible future in-situ studies for near-surface low and intermediate-level waste disposal. Thus far, no local authorities in the identified communities have given approval for such studies.

Resources

15. The Republic of Poland has shown interest in all NEA activities. However, for financial reasons, it will be obliged to establish priorities. Poland is pursuing a strict policy of public expenditure cuts in the context of its changeover to a market economy. It receives technical assistance from IAEA but is also asked to provide such assistance, using IAEA funds, to other countries. The Polish representatives were

informed that seeking direct financial assistance from Member countries or international organisations would not, in the long run, be compatible with membership of the NEA. In general, they do not consider progressive cuts in such financial resources as a major problem.

Budgetary implications

16. The contribution of the Republic of Poland to the NEA budget would be some FF 340 000 for Chapter 33 (0.59 per cent) and FF 150 000 for Chapter 34 (0.93 per cent).

CONCLUSIONS

17. The visit paid by the NEA Secretariat team confirmed that the Republic of Poland is very interested in becoming a member of the NEA and its Data Bank even though no nuclear power plant is expected to be in operation before 2020. It is recognised that Poland has made significant contributions in areas such as fundamental nuclear science, radiation protection and emergency management applications, production of radioisotopes and use of accelerators. In several of these areas, Polish experience could be a valuable contribution to NEA activities. However, in the field of reactors and the fuel cycle, activities and resources are limited and mainly focused on the needs for the MARIA and EWA reactors. As a consequence, and since the nuclear option has not been discarded for the future, Polish authorities expressed strong interest in participating in NEA activities to maintain or develop competence, particularly in areas not covered by the existing national programme of work, and to contribute to discussions in evolving areas such as radiation protection and nuclear science.

18. The Secretariat is of the views that the information obtained during the visit of the NEA team should be adequate to enable the Steering Committee to carry out its mandate pursuant to Article 17(b) of the Statute to prepare a recommendation for the Council on the request of Poland to join the NEA and its Data Bank.

ACTION TO BE TAKEN BY THE STEERING COMMITTEE

19. The Steering Committee is invited:

i) ***to recall*** that the Republic of Poland, an OECD member, officially applied for membership in the NEA and its Data Bank in September 1999, and that the Committee in May 2000 approved a proposal to send a Secretariat mission to Poland to obtain additional up-to-date information relevant to consideration of its application;

ii) ***to take note*** of the report by the NEA team which visited the Republic of Poland in July 2000, set out in Annex 2 to this document;

iii) ***to consider*** the application of Poland in light of the information supplied by the Republic of Poland and the above analysis made by the Secretariat;

iv) ***to decide*** on a recommendation to the Council on Poland's request, pursuant to Article 17(b) of the NEA Statute.

Annex 1

VISIT OF THE SECRETARIAT TO POLAND - LIST OF PARTICIPANTS

NEA Mr. Philippe Savelli, Deputy Director, Science, Computing and Development
Dr. Ted Lazo, Deputy Head, Radiation Protection and Waste Management Division

Poland

Prof. Jerzy NIEWODNICZANSKI, President
Polish National Atomic Energy Agency (NAEA)

Ms. Ewa SZKULTECKA, General Director, NAEA

Mr. Andrzej MERTA, Deputy Director, Department of Radiation and Nuclear Safety, NAEA

Dr. Stanislaw LATEK, Director, Department of Training and Public Information, NAEA

Dr. Andrzej OSTROWSKI, Head, Non-proliferation Section, NAEA

Dr. Tadeusz WOJCIK, Advisor to the President, NAEA

Dr. Wladyslaw SIKORA, Ministry of Economy

Dr. Adam SOLTAN, Director, Department of External Relations, NAEA

Prof. Stefan CHWASZCZEWSKI, Deputy Director
Institute of Atomic Energy (IEA)

Prof. Jerzy JASTRZEBSKI
Warsaw University Heavy Ion Laboratory

Annex 2

THE NUCLEAR PROGRAMME AND RELATED POLICIES OF POLAND

A. NUCLEAR FACILITIES

1. Power Reactors

Poland has never had commercial nuclear power. In 1982 the Government began the construction of a VVER 440/213 nuclear power plant at Zarnowiec; however construction was halted, in September 1990, prior to completion as a result of a new government energy policy.

2. Research Reactors

Although there are no commercial power reactors in Poland, there is a long history of scientific research, and there are two research reactors. The MARIA reactor is still in operation, and the EWA reactor is in decommissioning. Both reactors are located at the Institute of Atomic Energy (IAE), in Swierk, approximately 30 km from Warsaw. All fuel for these reactors has been supplied by Russia.

The MARIA reactor is a 30 MW, pool-type, high-flux beam reactor that began operation in 1976. From 1985 to 1993, the reactor underwent modernisation modifications and did not operate. It is planned that the reactor will be used until 2015, when decommissioning operations will begin. Until 1999, highly enriched fuel (80%) was used; however due to the lack of new fuel availability 36% enriched fuel is now being used. Neutron fluxes of up to $4x10^{18}$ n s^{-1} m^{-2} are possible. The MARIA reactor is used principally for the production of radioisotopes, for performing neutron physics experiments and for training. Plans are currently being drawn up for the construction of a boron neutron-capture therapy facility for treating solid-tumour cancer patients.

The EWA reactor began operation in 1958 as a 2 MW pool-type reactor, was upgraded to 4 MW in 1964, to 8 MW in 1967 and to 10 MW in 1972. Operated until 1995, the reactor used 10% and 36% enriched fuel. Beginning in 1995, the EWA reactor was defuelled, and decommissioning operations began. During 1999, the reactor vessel, the biological shield vessel and the separator baskets were dismantled. Waste was shipped to the Polish National Disposal Facility of Radioactive Waste, located in Rozan (approximately 100 km from Warsaw). It is planned to use the EWA reactor building as a dry-storage facility for spent fuel from both reactors. Other facilities associated with the EWA reactor will be decommissioned to green-field state; however, they will remain within the controlled environment of the Swierk site.

3. Waste Policies and Facilities

Research, medical and industrial activities in Poland generate high-, intermediate- and low-level radioactive wastes. Facilities currently exist to deal with these wastes in the short term, and the Government has recently completed a study of longer-term options.

The only high-level waste generated in Poland has been the spent fuel from the MARIA and EWA reactors. All spent fuel elements (approximately 5500) are currently stored in two fuel-storage pools

at the site of the Institute for Atomic Energy in Swierk. Because some of this fuel is 80% enriched, the storage sites are subject to periodic inspection by the IAEA under the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), Annex 3 provides a list of all conventions and bilateral agreements to which Poland is party, as well as its membership in relevant international organisations).

Some fuel has been in wet-storage since 1958. In 1997, the Government launched the three-year Strategic Government Programme (SGP) to investigate long-term solutions for the nuclear waste disposal, particularly for spent nuclear fuel. As part of this programme, the physical state of spent fuel assemblies was assessed, revealing that some of the older fuel had degraded and needed to be removed from wet storage before corrosion resulted in leaks. This led to the development of a plan to transfer all spent fuel to a dry storage facility located in the old reactor pool of the EWA reactor, which is being refurbished for this purpose. Modification work to prepare the EWA reactor pool is planned to be completed by the end of 2005 and fuel transfer is planned to be completed by the end of 2007.

Options for the final disposal of spent fuel were also investigated in the SGP. A review of the geological structure of Poland was performed, and potential sites in clay and in three salt domes were identified. Granite formations were rejected due to a great number of cracks. Further examination of the selected sites will be performed. The SGP also considers activity reduction through transmutation, and suggests that energy can also be extracted through such a process, presenting an advantage. Research in this area continues to be carried out, and the SGP notes that, while continuation of this work will depend upon additional funding, industrial scale transmutation in Poland could be possible within approximately 2 to 3 decades.

In terms of the near-surface disposal of low and intermediate level radioactive waste, the Polish National Disposal Facility of Radioactive Waste, located in Rozan, has operated since 1961. Approximately 3400 m^3 of conditioned waste has been accumulated, and it is estimated that the capacity of the Rozan facility will be exhausted between 2010 and 2015. In order to anticipate the closure of this facility, the SGP included the geological study of other possible near-surface repository sites. A total of 19 sites in 12 communes were identified for possible in situ studies, although to date no local authorities have given their approval for such investigations.

B. NUCLEAR INFRASTRUCTURE

1. Government Authorities

The structure and function of the Polish nuclear regulatory authorities is established by the Atomic Act, the current version of which dates from 1986. However, in early 2000, a new version of the Act was submitted by the Government to the Parliament. The Sejm (one of the two houses of Parliament) approved the current version of the new Act in March 2000, and it is now under consideration by a special Parliamentary Commission. It is expected that the Senate (the other house of Parliament) will approve the new Act and it will be signed by the President by the end of 2000.

The new Atomic Act will bring Polish legislation into line with current EU regulations concerning nuclear safety and radiological protection, resulting in the implementation of radiation protection concepts from Publication 60 of the International Commission on Radiological Protection (ICRP), the strict separation of regulatory and promotional functions, and the creation of a new, state-run enterprise to be responsible for radioactive waste.

a) NAEA: The National Atomic Energy Agency (Panstwowa Agencja Atomistyki - NAEA) was established under the 1986 Atomic Act and currently reports to the Minister of the Economy. However, under the new Act the NAEA will report directly to the Prime Minister, as was the case prior to September 1999. The responsibilities of the NAEA include the following:

- Regulating radiation protection and nuclear safety;
- Licensing the production, treatment, storage, transport, use and trade of nuclear materials, radioactive sources and waste;
- Licensing the siting, construction, commissioning, operation and decommissioning of nuclear installations following the assessment of all safety-related risks;
- Licensing the construction and operation of repositories for radioactive materials;
- Research into the safety of nuclear energy and its applications;
- Supervising the manufacture of nuclear equipment and radiation sources;
- Supervising radioactive waste management;
- Accounting, control and physical protection for nuclear materials;
- Informing the public on nuclear activities;
- Co-operating with other countries on the peaceful uses of nuclear energy;
- Nuclear emergency planning, preparedness and management activities, and
- The President of the NAEA is responsible for approving the appointment of the directors of various nuclear-related research institutes.

In terms of new nuclear regulations, the NAEA has the power to propose new laws to the Government. The sub-structure of the NAEA is presented in Figure 1. Two important bodies are part of this structure: the Council for Atomic Energy Matters; and the National Atomic Energy Agency Board.

b) Council for Atomic Energy Matters: The Council is an advisory body to the NAEA President and is invited to express opinions on matters falling within the scope of the Agency's mandate. It was established by decree of the Prime Minister of 8 February 1993, and consists of a Chairperson, up to three Vice-chairpersons, a scientific secretary and up to forty members. Their term of office is four years. The Prime Minister appoints the Members of the Council on the advice of the NAEA President.

c) National Atomic Energy Agency Board: The Board is a consultative body of the NAEA. It includes a Chairperson, who is also the Chairman of the NAEA, a Vice President, who is the Chief Inspector for Radiation and Nuclear Safety, and representatives from the Ministries of Economy, National Education, Defence, Internal Affairs and Administration, Foreign Affairs, Health and Welfare, Environmental Protection and Natural Resources and Forests. The aim of the Board is to resolve problems encountered in the Agency's various activities by preparing programmes of action and by studying the Agency's annual activity reports.

d) Ministry of Health: The Ministry of Health is responsible for all regulations for X-ray machines of energy less than 300 keV. Above this energy, X-ray producing devices are regulated by the NAEA.

e) Safeguards and Transportation: The President of the NAEA, in conjunction with the Ministers for Transportation and Maritime Administration, Economy, Internal Affairs and Administration, and Foreign Affairs establishes rules governing the accounting, surveillance and physical protection of nuclear materials. He also lays down conditions for the import into, export out of, and transit through Poland of nuclear materials, radioactive sources and devices incorporating such sources.

f) Radioactive Waste Management: Under the New Atomic Law, the Government will create a new, independent agency to receive, condition, store and dispose of all radioactive waste generated in Poland. Currently, these duties are carried out at the Institute of Atomic Energy and controlled by NAEA's Department for Radiation and Nuclear Safety. The group currently carrying out these functions will form the core structure for the new organisation, for which details have not yet been established.

2. Industry and the Private Sector

The electricity supply in Poland comes almost exclusively from domestic coal plants (97% of capacity), with domestic hydro plants and imports supplying the rest (approximately 1.5% each). Domestic coal is used in Polish plants, with 58% being hard coal, and 39% brown coal. Although demand for electricity has been growing, generating capacity in Poland (approximately 30 GW) still exceeded peak demand in 1999 (22.9 GW). With such an over-capacity, approximately 30%, there is no foreseen need for new base-load generating capacity of any type for the next 10 years or so. Poland is connected to the European electricity grid, and in 1999 exported approximately twice as many GWh of electricity (~6% of gross production) as it imported.

Electricity production and distribution facilities in Poland are largely owned and operated by the Government, but privatisation plans are being considered. In February 2000, the Government adopted "Guidelines for Energy Policies in Poland up to the Year 2020". These guidelines formulate a number of strategies to be implemented, including the decentralisation of energy systems, improvement of energy efficiency, and the liberalisation of power grid markets. They will be accomplished through restructuring, privatisation, deregulation and the encouragement of competition.

Government provisions under these guidelines, however, do not foresee the need for nuclear power before 2020. The Ministry of the Economy is responsible for preparing economic and industrial growth projections used for the preparation of guidelines, and for periodically providing updates. The report, submitted in late 1999 by the Ministry of the Economy to the Government (through its Council of Ministers), originally contained the provision that nuclear power would be needed after 2020. However, readjustment of figures for the projected growth in electricity demand during discussion with the Council of Ministers resulted in the elimination of the need for nuclear power in this provision. The next updated provisions will be prepared by the Ministry of the Economy, and submitted to the Council of Ministers in 2002. It should be noted, however, that there is currently no philosophical or political opposition to the eventual use of nuclear power in Poland.

With regard to commitments under the Kyoto protocol, Poland is an Annex 1 country and has made commitments to reduce carbon emissions with respect to their level in Poland in 1988. Because industrial activity in Poland significantly decreased during the 1990s, even if Poland continues to produce virtually all of its electricity with coal, these goals can be met until 2020 under the above-mentioned energy policy guidelines.

3. Other Authorities and Institutions

In addition to the Ministries and Agencies mentioned above, the Polish Government maintains seven significant research institutes in the area of nuclear technology, totalling approximately 3000 employees. These institutes are funded independently from the NAEA, through mainly the Committee for Scientific Research and the Ministry of the Economy. However, the President of the NAEA is responsible for approving the nomination of the directors of these institutes. The NAEA funds research in radiation and nuclear safety at many of these institutes, although it does not have influence over their programmes of work.

All the institutes mentioned below pursue broad international co-operation.

a) The Institute for Nuclear Studies - INS (Swierk): The INS carries out basic research in the fields of low- and high-energy physics, elementary particle physics, cosmic radiation and plasma physics. In the area of applied science, work is carried out in the areas of accelerator physics and techniques, material studies, radiation measurement techniques and development, and nuclear electronics. Much of the research performed by the INS is in partnership with other institutions (CERN, PSI, GSI Darmstadt, DESY, FZK, etc.). INS facilities include a Van de Graff accelerator, a cyclotron, and plasma-physics equipment.

b) The Institute of Atomic Energy - IEA (Swierk): The IEA carries out basic and applied research in nuclear reactor physics and technology, nuclear power, renewable energy sources, pro-ecological fossil fuel combustion, material physics, technology and diagnostics, nuclear methods in condensed matter studies, ionising radiation dosimetry, nuclear and industrial facility hazard assessment, spent nuclear fuel management and radioactive and toxic waste management and disposal. The most important facilities at the IEA are the two research reactors (MARIA and EWA), the spent fuel storage facilities and the radioactive and toxic waste conditioning and management facilities. The MARIA reactor, one of the few operational high-flux beam reactors left in the world, is used for fundamental research into neutron cross-sections.

c) Radioisotope Centre POLATOM - OBRI POLATOM (Swierk): The POLATOM Centre leads research, development and services and training activities concerned with radioactive components, radio-pharmaceuticals and isotope medicines, immuno-diagnostic units, labelled compounds, and calibration sources and solutions. Work is performed in the areas of radiochemistry, analytic chemistry, medical biochemistry, ionising radiation meteorology, radiopharmaceutical production, radiation spectrometry and absolute methods of activity measurement.

d) Institute of Nuclear Chemistry and Technology - INCT (Warsaw): The INCT carries out basic research in the fields of radiochemistry and isotope chemistry, analytic chemistry, radiation chemistry, biochemistry and radiobiology. Applied areas of research include the use of electron accelerators for SO_2 and NO_x extraction from coal power station combustion gases.

e) Institute of Plasma Physics and Laser Micro-fusion - IPPLM (Warsaw): The main activity at the IPPLM involves basic research in the areas of plasma physics and high-power laser physics and technology, including laser-produced plasma physics, high magnetic field influence on plasmas produced by laser pulses, interactions of ultra-short laser pulses with matter, high-power laser physics and technology, theory of magnetic plasma containment and dense magnetised plasma physics. The most important equipment at the institute includes generators of the Plasma-Focus type, neodymium lasers and plasma research chambers.

f) Central Laboratory for Radiological Protection -CLRP (Warsaw): The CLRP is active in radiological protection, scientific research and standardisation, and participates in background work for the preparation of legislative proposals. In particular, the CLRP serves as the Polish Emergency Services Centre and as the contact point for the Conventions on Early Notification of a Nuclear Accident and on Assistance in the Case of a Nuclear Accident or Radiological Emergency. The CLRP also maintains laboratory facilities and field equipment and teams for the monitoring of samples and the environment in case of a radiological emergency.

g) Institute of Nuclear Physics - INP (Krakow): The INP carries out basic research studies in high-energy and elementary-particle physics, nuclear structure and hyper-fine interactions. Applied research work is related to nuclear methods applications in geophysics, radiochemistry, medicine, biology, environmental protection and material studies.

C. INTERNATIONAL NUCLEAR POLICY

1. International Commitments

Poland has a long tradition of international co-operation in the nuclear area, and is party or signatory to all major treaties and conventions relating to nuclear energy and nuclear weapons. Annex 3 provides a list of Polish international commitments and bilateral agreements.

It is worth noting that Poland has signed but not yet ratified the 1997 Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage. The Polish Government is considering whether it might at some later date accede to the Paris and Brussels Conventions, in conjunction with its anticipated membership in the European Union.

2. Bilateral Agreements

In terms of bilateral agreements, Poland has Agreements on Early Notification of a Nuclear Accident, and Exchange of Information and Co-operation with Denmark (1987), Norway (1989), Austria (1989), Ukraine (1993), Belarus (1994), Russian Federation (1995), Lithuania (1995) and the Slovak Republic (1996). Bilateral agreements with Germany, Sweden and the Czech Republic are in an advanced stage of negotiation.

Poland has also established an Additional Protocol to its Safeguard Agreement with the International Atomic Energy Agency pursuant to the NPT.

3. Membership in International Organisations

Poland joined the International Atomic Energy Agency (IAEA) on 31 July 1957 by signing the IAEA Statute. Poland became a member of the OECD in 1996. It is also a member of the Nuclear Suppliers Group and the Zangger Committee. The Polish Power Grid Company is a member of the World Association for Nuclear Operators (WANO).

In addition, because Poland is "surrounded" by nuclear power plants (12 reactors within 150 km, 25 reactors within 300 km), the NAEA is concerned with nuclear emergency planning and management. Consequently, Poland has participated in three of the four INEX 2 series exercises organised by the NEA.

D. DOMESTIC NUCLEAR LAW

As mentioned previously, the NAEA has prepared a new draft Atomic Act (replacing the 1986 Act currently in force) that is expected to be signed into law by the President during the remainder of the year 2000. The impetus for this proposal came mainly from the necessity to transpose the relevant EU regulations concerning nuclear safety and radiological protection into the Polish legal framework. In particular, new radiological protection principles have been formulated (the need to justify activities involving the use of ionising radiation, the obligation to optimise protection against exposure, the obligation to stay within the dose limits). The employer's responsibilities in the field of radiation protection for occupationally exposed workers have been detailed. The concept of external workers (under short-term contract) has been introduced with the provision that they will be radiologically protected to the same degree as those employed permanently.

The proposed Act expands the scope of the 1986 Act to cover the activities conducted in conditions of enhanced (by human activities) exposure to natural ionising radiation, and also the activities undertaken within Poland in case of radiation emergencies, including emergencies of foreign origin with possible impact within Polish territory.

Although the final English translation of the approved act will not be available for analysis before being signed by the Polish Prime Minister, which is foreseen in October 2000, preliminary drafts suggest that the law is largely in line with other modern radiation protection and nuclear safety regulations.

E. PUBLIC INFORMATION

The NAEA has an active programme in public information, focusing on education activities. Activities have included the development of materials for teaching the young (through elementary and high school) about radiation, risk and nuclear energy. A teaching guide prepared by the EC has been translated into Polish for this purpose, and teacher-training courses are held. In a country where 60% of the population does not pursue education beyond high school, the Polish Government feels that such efforts will be of great value in the long run. In addition, the Polish Government recently took advantage of the centennial of the discovery of radium and polonium by Marie Curie (of Polish origin) to hold scientific meetings, and to launch an information campaign to spread knowledge about physics/atoms in general, and of radiation and risk specifically. The NAEA also has a complete Web site, and encourages public visits to nuclear institutes with permanent exhibitions and visitor centres. Finally, the NAEA co-organises the Festival of Science in Warsaw each year, assists in "open door days" at various nuclear institutes, has participated in a European campaign to promote physics ("Physics on Stage") and prepares press booklets for Polish press, radio, TV and newspapers.

F. EXTERNAL FINANCIAL ASSISTANCE

Poland has participated in IAEA technical co-operation activities since the 1960s, both as a recipient and donor country. This has resulted in many projects in Poland being co-funded by the IAEA. Funding in this context is in several formats, including:

- National, regional and international projects (provision of equipment, fellowships, scientific and technical visits, etc.);
- International, regional and national training courses;
- Grants for participation in conferences, symposia and seminars; and
- Research contracts.

As a donor, Poland organises fellowships, scientific visits, training courses, seminars and workshops for participants from developing countries. During 1999, 12 projects were co-funded by the IAEA. The list of ongoing projects is as follows:

- Human resources development and nuclear technology support;
- Comparative studies on natural gas and nuclear power;
- Radioisotopes with improved chemical purity;
- Establishment of a radiotherapy planning system;
- Industrial scale demonstration plant for electron-beam purification of flue gas;
- Control laboratories for radiation processing;
- Biomaterials produced and sterilised by radiation processing;
- New polymeric materials for use in medicine and pharmacy;
- Calibration facilities for radiation protection measurements; and
- Improvement of control/protection system of the MARIA research reactor.

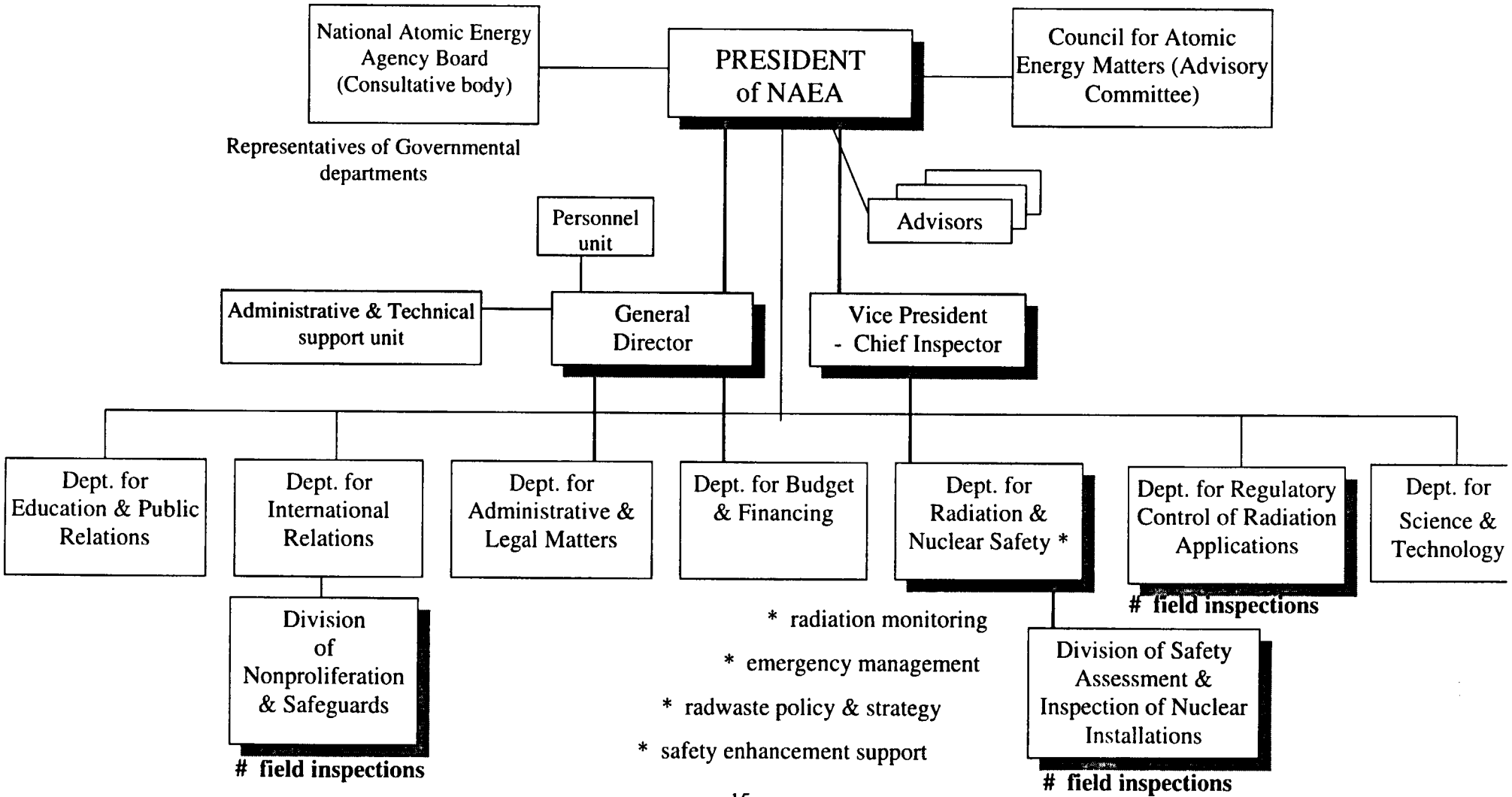
From 1989 to 1999, the value of aid from the IAEA to Poland has steadily increased, and over the past few years has averaged approximately $1 500 000. It should be noted that the industrial-scale electron-beam prototype facility was funded during the last four years from extrabudgetary funds through the IAEA. This represented a significant increase in funding over the annual average.

For the coming biennium (2001 - 2002), Poland has submitted six new proposals for IAEA assistance that are expected to be approved by the Board of Governors session in December 2000. These include:

- A dry storage facility for spent fuel from the MARIA and EWA reactors;
- Assurance of further operation of the MARIA reactor;
- Accreditation of a laboratory for the use of nuclear and nuclear-related analytical techniques in medicine, industry and environmental protection;
- Upgrading of the secondary standard dosimetry laboratory for radiotherapy and mammography in Poland;
- Improvement of radionuclide purity control for sources and solutions prepared at the Radioisotope Centre POLATOM; and
- Application of modern nuclear techniques for the investigation of hormonal control of domestic animal reproduction.

Figure 1

NATIONAL ATOMIC ENERGY AGENCY OF POLAND



Annex 3

POLISH MEMBERSHIP IN INTERNATIONAL NUCLEAR CONVENTIONS

Nuclear Third Party Liability

- 1963 Vienna Convention on Civil Liability for Nuclear Damage:
  - acceded to on 23 January 1990,
  - entered into force on 23 April 1990.

- 1988 Joint Protocol on the Application of the Vienna Convention and the Paris Convention:
  - acceded to on 23 January 1990,
  - entered into force on 27 April 1992.

- 1997 Protocol to Amend the Vienna Convention:
  - signed on 3 October 1997.

Others

- 1960 Convention concerning the Protection of Workers against Ionising Radiation:
  - ratified on 23 December 1964,
  - entered into force on 23 December 1965.

- 1963 Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space and under Water:
  - ratified on 14 October 1963,
  - entered into force on the same date.

- 1968 Treaty on the Non-Proliferation of Nuclear Weapons (NPT):
  - ratified on 12 June 1969,
  - entered into force on the same date.

- 1971 Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Sea Bed and the Ocean Floor and in the Subsoil thereof:
  - ratified on 15 November 1971,
  - entered into force on 18 May 1972.

- 1979 Convention on the Physical Protection of Nuclear Material:
  - ratified on 5 October 1983
  - entered into force on 8 February 1987.

- 1986 Convention on Early Notification of a Nuclear Accident
  - ratified on 24 March 1988,
  - entered into force on 24 April 1988.

- 1986 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency:
  - ratified on 24 March 1988,
  - entered into force on 24 April 1988.

- 1994 Convention on Nuclear Safety:
  - ratified on 14 June 1995,
  - entered into force on 24 October 1996.

- 1996 Comprehensive Nuclear-Test-Ban Treaty:
  - ratified on 25 May 1999.

- 1997 Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management:
  - ratified on 5 May 2000.

Annex 4

FACTORS TO BE CONSIDERED IN EVALUATING PROSPECTIVE MEMBERS OF THE NEA

The factors outlined below are aimed at providing a basis for evaluating a) whether a country's basic perspective, approaches and objectives are similar to and consistent with those of the NEA membership as a whole, and b) whether the country is likely to be able to contribute effectively to NEA activities.

I. POLICIES

A) International Commitments

1. Treaty on the Non-Proliferation of Nuclear Weapons (NPT) or Treaty of Tlatelolco.
2. All civil nuclear facilities subject to IAEA safeguards.
3. Nuclear Liability Conventions.
4. Nuclear Safety Convention.
5. Convention on Physical Protection of Nuclear Material.
6. Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management.
7. Nuclear Suppliers Group, Nuclear Supplier Guidelines.
8. Convention on Early Notification of a Nuclear Accident.
9. Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency.

B) International Co-operation

1. Membership in Other Organisations.
2. Co-operation Agreements.
3. Observership in NEA Committees and Participation in NEA Groups.
4. Participation in International Projects (Halden, IRS, ISOE, RASPLAV, Co-operative Programme on Decommissioning, INEX, data exchange, Red Book).

C) Domestic Nuclear Legislation

D) Approach to Public Information

II. NUCLEAR PROGRAMME

A) Organisation

1. Distribution of Responsibilities.
2. Independence of Safety Authority.
3. Role of Government and Private Sector.

B) Range of Activities

1. Regulatory and Licensing.
2. Safety Research.
3. Radiological Protection.
4. Waste Management
5. Nuclear Science.

C) Facilities

1. Nuclear Power Plants, Type of Plants.
2. Other Fuel Cycle Facilities.
3. Research Centres.
4. Technical Universities.

III. RESOURCES

A) Technical Capability
B) Financial Strength
C) Dependence on External Assistance

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Organisation de Coopération et de Développement Economiques
Organisation for Economic Co-operation and Development

OLIS : 15-Sep-2000
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Or. Eng.

NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY

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NEA DOCUMENT ON NUCLEAR ENERGY IN A SUSTAINABLE DEVELOPMENT PERSPECTIVE

(Note by the Secretariat)

95287

Or. Eng.

NEA DOCUMENT ON NUCLEAR ENERGY IN A SUSTAINABLE DEVELOPMENT PERSPECTIVE

1. This document has been prepared by the NEA as a contribution to the OECD three-year project on sustainable development. Its main objectives are:

- to help governments to assess the extent to which nuclear energy is compatible with the goals of sustainable development; and
- to identify areas in which nuclear energy could contribute to sustainable development.

The document does not prejudge the policies of individual Member countries toward nuclear power. Its primary target audience is policy makers within the OECD Member country governments.

2. This document was prepared by the NEA Secretariat, with the assistance of external consultants. It was developed under the auspices of the Nuclear Development Committee (NDC) and has been supported by all relevant NEA Standing Technical Committees. The text has also benefited from the comments and suggestions of experts of other OECD directorates, including the International Energy Agency, the Environment Directorate, the Economics Department and the Directorate of Science, Technology and Industry, as well as from the International Atomic Energy Agency (IAEA).

3. A preliminary draft was made available to the Steering Committee in May 2000 to serve as a reference document for the Policy Debate which the committee held at its Spring 2000 session on *Sustainable Development and Nuclear Energy*. Members were invited to provide comments before 15 June 2000. The present document incorporates those received, to the extent feasible.

4. It is understood that the contents of this document is without prejudice to the policies of individual Member countries toward nuclear power, and this point is included in the proposed decision by the Committee.

Action by the Steering Committee

5. The Steering Committee is invited to:

i) ***review*** the document entitled "Nuclear Energy in a Sustainable Development Perspective" [NEA/NE(2000)13];

ii) ***endorse*** its transmission to the OECD Secretary-General as a contribution to the OECD Project on Sustainable Development, on the understanding that such endorsement is without prejudice to the policies of individual Member countries toward nuclear power.

NUCLEAR ENERGY
IN A SUSTAINABLE DEVELOPMENT PERSPECTIVE

TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. This document is a contribution from the Nuclear Energy Agency (NEA) to the OECD Project on Sustainable Development. It provides information on nuclear energy relevant for policy-making within a sustainable development framework. In this context, the specific characteristics of nuclear energy are reviewed from the economic, environmental and social viewpoints of sustainable development. The report deals with nuclear energy, and provides data and analyses on the nuclear option that policy-makers may use, together with information on alternative options, to support their assessments taking into account their specific context and priorities.

2. The intent of the document is not to arrive at judgements as to whether or not nuclear energy can be considered a sustainable technology in particular situations or countries as this will depend on a wide range of factors, many of them specific to local situations. The intent is to identify the main impacts of nuclear energy in a sustainable development perspective, to outline some of the factors that should be considered in assessing the contribution that nuclear energy can make to sustainable development goals, and to underline the challenges that must be overcome in order to make the contribution of nuclear energy positive.

3. The concept of sustainable development was elaborated in the late 1980s and defined by the Brundtland Report as "a development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In a broad sense, sustainable development incorporates equity within and across countries as well as across generations, and integrates economic growth, environmental protection and social welfare. A key challenge of sustainable development policies is to address those three dimensions in a balanced way, taking advantage of their interactions and making relevant trade-offs whenever needed.

4. A central goal of sustainable development is to maintain or increase the overall assets (natural, man-made and human or social assets) available to future generations. The development of nuclear energy broadens the natural resource base useable for energy production, and increases human and man-made capital. The framework of regulatory, institutional and technical measures already in place in OECD countries aim at ensuring that the use of nuclear energy does not reduce irreplaceable natural assets significantly. Maintaining this framework is essential to address social and environmental concerns. To the extent that these concerns are addressed successfully, the nuclear industry, and the scientific knowledge and institutional infrastructure that support it can represent an asset for present and future generations.

5. Technology is critical to support economic development but needs careful control and monitoring to be consistent with the social and environmental goals of sustainable development. In the energy field, services are needed to support economic development and increase social welfare but energy production and use, by any source or technology, have the potential for negative impacts on human health and the environment. Environmental and social burdens have to be minimised in order to achieve sustainable development goals.

6. Economic competitiveness is a prerequisite for a technology to contribute to sustainable development. Assessments of competitiveness, ideally, should be based upon comparisons of full costs to society including social and environmental costs. Most existing nuclear power plants are competitive by current standards, including those of deregulated electricity markets, since their marginal costs of production are low as compared with fossil-fuelled alternatives. This competitive position is robust from a sustainable development perspective since most health and environmental costs of nuclear energy are already internalised. For example, electricity consumers are paying for nuclear safety and insurance against nuclear accidents, decommissioning of nuclear facilities, and radioactive waste disposal.

7. New nuclear units will have to compete with a broad range of alternatives, including fossil fuels, renewables and demand management, on the basis of full generation costs, i.e., capital, operation, maintenance and fuel costs. The large capital costs of nuclear power plants create financial risks, especially in deregulated markets, and make its competitiveness very sensitive to the discount rate applied when selecting investments. Ongoing R&D efforts to lower capital costs of nuclear power plants should be pursued to achieve significant results. Low discount rates are more favourable to capital intensive projects such as nuclear energy facilities and reflect a preference for the future that may be considered to be in line with the goal of sustainable development. The future competitiveness of nuclear energy will be affected by values placed in each country on environmental resources, such as global climate and local air quality, and social objectives, such as diversity and security of energy supply. However, technology choices in the energy sector will be based largely on market competition and the value of different energy sources for sustainable development will need to be recognised by adequate policy measures.

8. Nuclear energy has an ample resource base. Current reserves are large enough to support nuclear fuel production for decades. Since the cost of nuclear fuel is a small proportion of the cost of nuclear electricity, higher fuel prices could make much greater resources available without materially affecting the competitive position of nuclear power. Furthermore, the resource base for nuclear energy can be extended through recycling of fissile materials and implementation of advanced fuel cycles that convert fertile uranium and thorium into fissile materials. In broadening the base of natural resource capital, nuclear energy is consistent with the objectives of sustainable development related to the creation and effective use of natural assets and their preservation for future generations.

9. Finding effective policies to respond to climate change is one of the challenges to sustainable development. Nuclear energy is essentially carbon-free and contributes to reducing anthropogenic emissions of greenhouse gases that induce global warming as well as local atmospheric pollution. Although there are a number of technical options and policy measures available to alleviate and/or mitigate the risks of global climate change, stabilising carbon dioxide concentration in the atmosphere is likely to require comprehensive policies taking advantage of a range of technologies and economic and regulatory measures. Including the nuclear energy option in the basket of tools aiming at addressing climate change issues is consistent with the precautionary principle and sustainable development objectives.

10. The record in OECD countries after several decades of commercial use of nuclear energy suggests that, in normal operation under independent and effective regulation, nuclear power plants and fuel cycle facilities have relatively small health and environmental impacts. Radiation protection regimes based upon the "as low as reasonably achievable (ALARA)" principle have been generally effective in limiting the impacts of radiation, to workers in nuclear facilities and to the public, to levels below regulatory limits, which are set conservatively.

11. Radioactive releases from nuclear facilities are very small in routine operation and significant threat to worker and public health may occur only under accident conditions. Severe accident is a major concern that is addressed by nuclear safety regulations and measures. Nuclear safety objectives, based upon the precautionary principle, have been strengthened progressively and the lessons learnt from the two severe accidents that have occurred with nuclear reactors – Three Mile Island in 1979 and Chernobyl in 1986 – have led to significant improvements. The potential hazards from nuclear accidents and the probability of such accidents can be further reduced by technological modifications, manpower qualification and training, accident management measures and enhanced regulatory effectiveness.

12. Radioactive waste from the nuclear energy sector represents small volumes that can be isolated from the biosphere at acceptable costs but raise significant public concern. Repositories for the disposal of short-lived radioactive waste are in operation in many countries. For long-lived radioactive waste, the nuclear industry has always had the goal of containing them safely over the very long periods of time

during which they may present a hazard. This ambitious goal, which is consistent with the objective of sustainable development, is seen by experts as technically and economically achievable. For several decades, adequate safe interim storage is in place. For the long term, several options may be considered but geological disposal has been recognised as a strategy responsive to fundamental ethical and environmental considerations in several OECD countries. The implementation of repositories, in ways discussed with and accepted by the public, will be a major step towards meeting sustainable development goals.

13. The risk of nuclear weapon proliferation is a major concern raised in connection with peaceful applications of nuclear energy although the international non-proliferation and safeguards regime has proven to be highly effective so far. Moreover, since proliferation of nuclear weapons is driven primarily by political incentives and concerns, the goals of non-proliferation must be achieved primarily through political means. It should be noted that most countries who choose to acquire nuclear weapons did so through dedicated, often clandestine, military facilities rather than through diversion from civilian nuclear power programmes, that are mostly under international safeguards. Nonetheless, diversion from civilian programmes is one possible route to the acquisition of fissile material, a crucial technical step towards weapons. Accordingly, the non-proliferation regime must be extended to ensure a very high likelihood of detecting, and hence deterring, any such diversion. This is particularly important as nuclear power programmes spread to new regions and countries.

14. Nuclear energy is based upon major scientific developments of the 20th century that add to the stock of man-made, human and social capital available to future generations. Because much of the cost of nuclear facilities is embodied in science and technology, rather than resources, nuclear energy is amenable to continuous improvement in performance and safety through R&D and through developments in information, technology and effective training. The scientific and technical knowledge, industrial experience and regulatory framework and institutions that ensure quality in design, operation and regulation of nuclear activities constitute a valuable human and social capital. In countries where nuclear energy is used, it provides opportunities for highly qualified employment and enhances diversity and security of energy supply.

15. Addressing public concerns is essential to meet the social objectives of sustainable development. For this purpose and in the light of the widespread public concern about nuclear risks, it is necessary to include the public in a democratic decision-making processes through which it gains confidence that its concerns are being heard and addressed. The implementation of nuclear energy projects requires a participation of the public at the national and local level, and the exchange of a broad range of information and perceptions covering scientific, technical, economic and social aspects. It is important to allow the public to put social, ethical and political issues related to nuclear energy into perspective with the issues raised by alternatives, including the different liabilities passed to future generations such as long-lived radioactive waste, climate change or resource exhaustion. It is the responsibility of governments to create the conditions for decision making processes to be consistent with inter-generation equity and the social objectives and environmental protection goals of sustainable development.

16. Nuclear energy contributes nearly a quarter of the electricity consumed in OECD countries and with several decades of industrial experience has reached commercial maturity. There are some 350 nuclear units connected to the grid in OECD countries, most of which will stay in operation for more than one decade. In the medium term, energy and electricity demand will grow mainly in non Member countries and nuclear energy development will increasingly occur in those countries. Governments of OECD Countries will have an important role to play with regard to technology transfer, technical assistance and co-operation in the nuclear energy field to ensure that sustainable development goals are taken into account.

17. Sustainable development policies in the energy sector will rely on comparative assessment of alternative options taking into account their economics, health, environmental and social impacts, at local, regional and global levels. While the NEA may assist Member countries through systematic and in-depth work on indicators applicable to nuclear energy from a sustainable development perspective, broader horizontal work within OECD would be required to establish a comprehensive framework to assess and compare energy alternatives. It would also provide guidance on internalising external costs in a consistent way, so as to allow market mechanisms to be consistent with sustainable development.

18. National policy decisions result from trade-offs within each dimension of sustainable development and between those dimensions. Trade-offs are based upon factual data but reflect specific socio-economic and political conditions of each country. The overall energy context, environmental sensibility historical and cultural evolution and political approaches are different from country to country and will affect trade-offs and decisions.

1. INTRODUCTION

19. This document is a contribution of the OECD Nuclear Energy Agency (NEA) to the OECD three-year project on sustainable development. Its main objectives are: assessing to what extent nuclear energy is compatible with the goals of sustainable development and how it can best contribute to them; and identifying areas where, and means whereby, nuclear energy must overcome challenges in order to contribute more effectively to sustainable development. The document intends to raise relevant issues in order to facilitate discussions of nuclear energy in the overall policy-making framework and should help to establish the linkages between nuclear energy and sustainable development.

20. The present chapter introduces the report and situates nuclear energy in the context of electricity and energy capacity and growth in the world today. Chapter 2 presents briefly the framework and key concepts of sustainable development that are addressed in more detail in the OECD Analytical Report. Chapter 3 outlines the characteristic features of nuclear energy and their links to sustainable development goals in terms of economic, environmental and social dimensions. Chapter 4 outlines key issues and findings.

The OECD project

21. The OECD three-year horizontal project on sustainable development was launched by OECD Ministers in April 1998. OECD Ministers called for the elaboration of the Organisation's strategy "in the areas of climate change, technological development, sustainability indicators and the environmental impact of subsidies". They also asked the OECD to "enhance its dialogue with non-member countries and to engage them more actively" [1]. The project offers an integrated framework to address policy issues of interest to governments of OECD countries, including their interactions with the industry and non-member countries. It aims at substantive outputs for the meeting of OECD Ministers in 2001. The project outcomes will include a Policy Report to Ministers, an Analytical Report and a series of Background Reports, such as this one, based on the work of various OECD Directorates and affiliates.

22. The OECD project aims at making the sustainable development concept operational for public policies and should help Member countries to address fundamental sustainable development issues [2]. The sustainable development framework referred to within the OECD project will integrate economic, social and environmental factors in a way that will meet society's concerns at the lowest cost, and will highlight the linkages and trade-offs between these areas. This framework also reflects the need for equity within and across countries, as well as intergenerational equity.

23. In this context, the traditional emphasis of the OECD and its Member countries on economic growth will have to be balanced by concerns for environmental and social factors. The OECD project emphasises the need to integrate policies horizontally across a range of sectors and disciplines. It will investigate the key role of energy services in social and economic development and the integration of health and environmental concerns in energy supply strategies contributing to meet sustainable development goals. As noted above, this document is the contribution of the NEA to that effort.

Audience, objectives and scope

24. The primary audience for this document is policy makers within the OECD and in Member country governments. Governments still have an essential role in setting overall policies, establishing health and environmental regulation, and looking at the long-term implications of current decisions and actions, even though their role may be declining as the world moves to greater reliance on market forces.

The document will also be of interest to the nuclear, energy and environment policy communities, as well as to a broader public of interested and affected parties. In order to provide readers, including those who are not experts in nuclear energy matters or not familiar with sustainable development concepts, with a stand-alone document, a broad range of information is given with emphasis on policy issues but covering technical and economic aspects whenever relevant.

25. The document aims at reviewing nuclear energy in the light of sustainable development goals. It will be relevant primarily for those governments that wish to consider nuclear energy within their portfolio of options for future supply. However, other Member countries may also find the document interesting, as nuclear issues have many international and trans-boundary implications.

26. The intent of the document is not to arrive at judgements as to whether or not nuclear energy can be considered a sustainable technology in particular situations or countries as this will depend on a wide range of factors, many of them specific to local situations. The intent is to identify the main impacts of nuclear energy in a sustainable development perspective, to outline some of the factors that should be considered in assessing the contribution that nuclear energy can make to sustainable development goals, and to underline the challenges that must be overcome in order to make the contribution of nuclear energy positive.

27. The concepts of sustainable development that are described in this document are intended to reflect the OECD approach. They are based mainly upon OECD publications, on-going work, and contributions from OECD directorates and affiliates that were provided through discussions and comments on successive drafts of the report. Other authoritative published work and expert views have been used to complement the OECD documentation. The introduction of those concepts serves as a backdrop for assessing the major characteristics of nuclear energy in terms of sustainable development goals and criteria, with respect to economic, environmental and social factors.

28. All the major aspects of nuclear energy and their links to sustainable development are reviewed, however briefly. The analysis of nuclear energy per se is supported essentially by work carried out within the NEA, but other sources have been used also when relevant. The sources of the information included in the document are quoted either in references or in the bibliography. The analysis is not supported by original research but relies on available information and contributions from Member country experts and policy makers who were consulted throughout the elaboration of the report.

29. Work on indicators of sustainable development is on going and may lead eventually to aggregated indicators applicable to all activities and industrial sectors. Several organisations, including the OECD, are actively involved in the elaboration of harmonised indicators and a framework that could serve as a basis for analyses and assessments in various sectors. The assessment of nuclear energy from a sustainable development perspective eventually will have to be based upon a set of indicators applicable to the nuclear sector agreed upon within an overall harmonised framework. In the meantime, indicators specific to the nuclear sector have been used in this document to illustrate, in so far as feasible, trends towards sustainable development.

30. Although alternative energy options must be assessed comparatively in a sustainable development context, this document does not embark on comparative assessment in the light of the NEA's limited expertise in broad energy technology and policy. If the OECD and the IEA would undertake such comparative studies of benefits, costs, risks and impacts, the NEA could contribute on relevant nuclear issues and this document could be a preliminary contribution to such an undertaking.

Sustainable development and energy

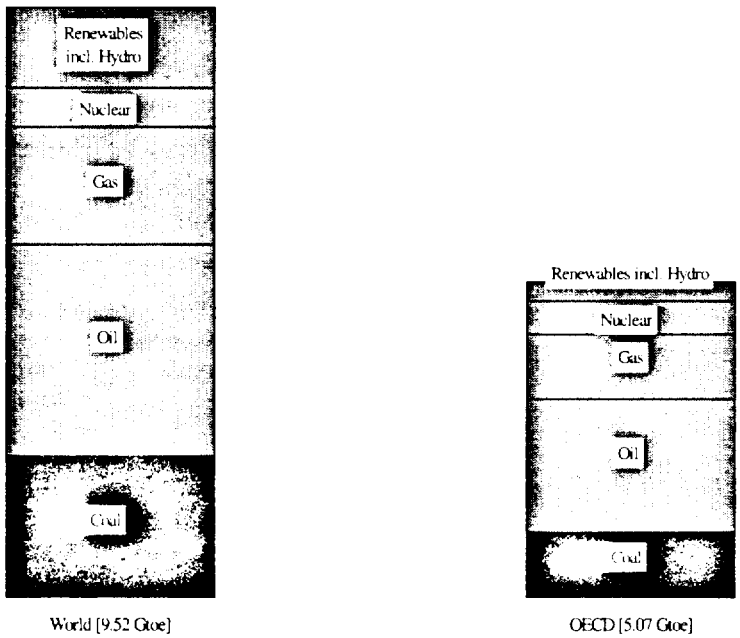
31. Energy has links with the three dimensions of sustainable development – economic, environmental, and social. Energy services are essential for economic and social development. As energy use will continue to grow, its health and environmental impacts will have to be controlled, alleviated or mitigated in order to achieve sustainable development goals. The main challenge of sustainable development in the energy sector is to extend the benefits of energy services to the world as a whole, and to future generations, without undermining the essential life support systems or the carrying capacity of the environment. Energy supply technologies, such as nuclear, have a role to play in this context.

32. Energy is the physical driving force, the lifeblood, of modern civilisation. Energy services are essential for human welfare, and contribute to enhanced social stability through improved standards of living. Energy is a critical input to economic development and prosperity. Although the energy intensity of modern economies is decreasing progressively, large amounts of energy will be needed to improve standards in the developing countries. The energy sector itself is an important part of the world economy in terms of jobs, income and trade.

33. Citizens of the OECD countries consume the bulk of the energy. More than half of the primary energy consumed in the world is used in OECD countries and access to electricity services is even more unbalanced with more 60% of the electricity generated being use in OECD countries [3]. Two billion people have no access to electricity, and two billion others cannot afford amenities such as refrigeration and hot water [4; 5].

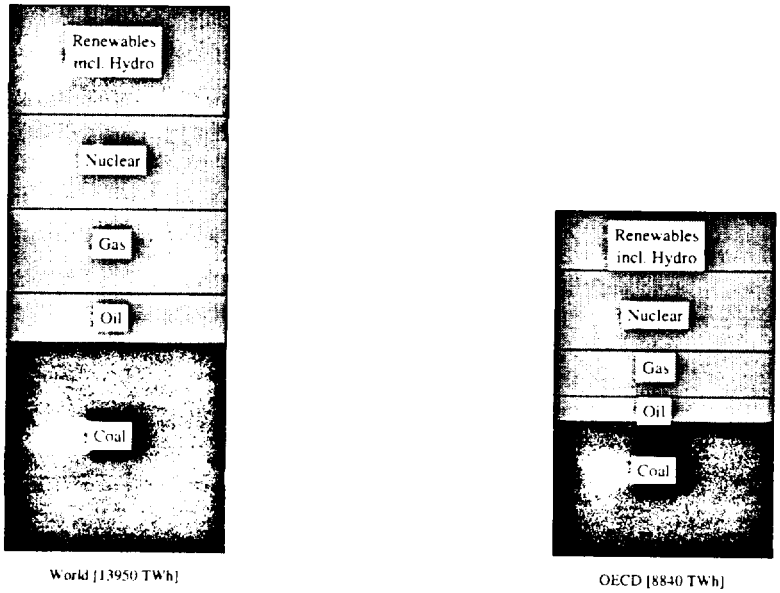
34. Fossil fuels are by far the most important source, supplying about 80% of the world's primary energy consumption, as shown in Figure 1.1, while nuclear energy provides some 7% of the total. On average, each person on the planet uses about 1.3 tonnes of oil equivalent (toe) of fossil fuels each year, for a total of 7.6 billion toe. In OECD countries, the respective shares of fossil fuels and nuclear energy are 83% and 11%. The share of fossil fuels in primary energy supply is expected to increase even further over the next few decades under business as usual scenarios [6].

Figure 1.1 **Primary energy consumption by source in 1997**
[Source OECD/IEA Energy Balances of Non-OECD countries – 1999 Edition]



35. Electricity generation represents about 37% of total primary energy use in the world and 39% in the OECD countries. The average electricity consumption in OECD countries is around 7 500 kWh per capita but only 2 200 kWh per capita worldwide, and less than 1 200 kWh in non member countries. As shown in Figure 1.2, in the world, fossil fuels provide about 63% of the electricity (38% from coal, 16% from gas and 9% from oil), nuclear power 17% and hydropower and other renewable sources around 18%. For OECD countries, the shares are not strikingly different, although the contribution of nuclear power is higher and the share of fossil fuels as a whole is lower.

Figure 1.2 **Electricity generation in the world in 1997**
[Source OECD/IEA Energy Balances of Non-OECD countries – 1999 Edition]



36. A total of around 430 nuclear power plants are in operation worldwide, representing some 350 GWe, that produced 2 400 TWh in 1999 (see Table 1.1). In the OECD, 16 countries have nuclear power plants in operation. The nuclear share in total electricity generation in OECD countries varies from 4% to 75%, and averages nearly a quarter. The nuclear fuel consumption in the world amounts to around 50 000 tonnes of uranium a year in OECD countries and some 10 000 tonnes in non member countries.

Table 1.1 **Nuclear energy in 1999**
[Source: NEA, Nuclear Energy Data 2000 & IAEA, PRIS 2000]

	World	OECD
Number of countries generating nuclear electricity	31	16
Number of nuclear units in operation	434	348
Nuclear capacity (GWe)	349	296
Nuclear electricity generation (TWh)	2 401	2 075
Nuclear share in electricity generation (%)	17	24
Uranium requirements (tonnes)	60 000	50 000
Spent fuel arisings (tonnes)	9 600	8 260
Carbon dioxide emissions avoided* (Mtonnes CO_2)	1 920	1 660
(share of 1990 emissions in the region)	9%	16%

* *Estimated assuming that each kWh fossil emits 800 g CO_2*

37. In OECD countries, population stability, efficiency gains and the shift to less energy intensive economies are likely to limit energy demand growth. In the next half-century or so, most of the energy demand growth will occur in non-member countries. Starting from a lower base and driven by population and economic growth, the demand for energy services will increase rapidly in those countries, leading to a continued increase in total world primary energy consumption [7].

38. Despite gains in the efficiency of electricity use, electricity demand is likely to grow significantly during the next two decades, at rates of about 3% per year world wide and 5% or more in the developing countries according to business as usual projections [6]. By 2020, this will necessitate a doubling of the current world generating capacity of about 3 000 GWe beyond the replacement of about 600 GWe of obsolescent plant capacity. Most of the growth will take place in the developing countries. In the business as usual scenario, the OECD share of primary energy, electricity and nuclear energy consumption will decline to 42%, 46% and 72% respectively by the year 2020.

39. Energy production and use give rise to significant health and environmental impacts. Energy involves large volumes of material flows, and large-scale infrastructures to extract, process, store, transport and use it, and to handle the waste. The flows of many of the world's large rivers are dammed or diverted for hydropower. Besides commercial energy sources, large volumes of non-commercial wood and other biomass are burned for energy supply, especially in non-OECD countries. Acid gas and particulate emissions from fossil fuels degrade local and regional air quality. Some radioactive substances have very long active lives, as do other natural and man-made hazardous materials. On a global scale, the possibility of significant climate change, largely caused by greenhouse gas emissions from fossil fuel burning, especially carbon dioxide, presents a fundamental challenge to the goals of sustainable development, and to the future of human civilisation.

40. The ways in which energy is supplied largely determine the health and environmental impacts of the sector. The efficiency and quality of energy forms will be important factors in their growth. Electricity production is likely to increase its share of the increasing global primary energy consumption. Its convenience, versatility and cleanliness at the point of use, along with its role in the information economy, ensure its desirability and its future demand growth. The variety of sources from which it can be produced allows for a range of supply options with different implications for sustainable development. For instance, the role of nuclear energy in avoiding carbon dioxide emissions is evident from Table 1.3.

41. In the interest of bringing basic living standards to the world's people, it seems reasonable that sustainable development goals must accommodate significant growth in global electricity demand. Most of that growth will occur outside the OECD. The energy infrastructure to be built in non-OECD countries over the next two decades of expected rapid growth largely will determine the global sustainability of energy supply and use beyond that period. OECD countries will play a significant role in this regard, as the source of much of the technology and financing. Both sets of countries can benefit from co-operation in areas of institutional development such as policy, regulation and the use of economic instruments, notably with respect to sustainable development.

2. CONCEPTS FOR SUSTAINABLE DEVELOPMENT

42. Sustainable development was defined by the Brundtland Report as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [8]. The report notes that the sustainable development definition relies on two key concepts: one is "needs", "in particular the essential needs of the world's poor, to which overriding priority should be given"; the other is "the idea of limitations imposed by the state of technology and social organisation on the environment's ability to meet present and future needs."

43. The definition of needs is dynamic. It will vary with time and with different groups and cultures. Certainly our forebears would have been amazed to see some of the current needs that people have developed with increased incomes, and disappointed to see that for many, basic needs have not been met. However, the present generation still has an obligation to pass on a range of options to help future generations meet their needs, especially the basic ones.

44. Sustainable development is more like a direction for a journey than a destination. The immediate goal is to take steps in the right direction that enhance the range of available options rather than foreclose any of them. Along the road, further choices and trade-offs will be required.

Capital assets

45. A useful elaboration of the concept of sustainable development is the idea of non-declining per capita well-being. One can think of passing on capacity to future generations in the form of a stock of capital assets – man-made, natural, human and social. Man-made assets include buildings, machinery and infrastructure in the form of roads, ports and airports, water supplies, pipelines, electrical networks. Natural assets include the environment, which in turn includes both renewable and non-renewable resources. Human and social assets include education, health, knowledge and understanding of science, technology, culture and human behaviour, capacity for creativity and innovation, ability to store and communicate knowledge, institutions and social networks.

46. One may use up assets of one type but pass on more of another type, as long as they are fully substitutable. This concept of allowing substitution and trade-offs between classes of assets is known as "weak sustainability". In this concept, some environmental burdens may be passed on, or assets used, as long as this negative inheritance is compensated by passing on adequate wealth and capacity to deal with it. Historically, humans have used or transformed some natural assets, converting forests and grasslands to agriculture, or minerals and energy to man-made assets. In so doing, they have added to the store of knowledge and made advances in science and technology, and in the arts and civic life, which have allowed possibilities for human fulfilment undreamed of even a hundred years ago. On the whole, the OECD countries have increased both their wealth and their populations, with great gains in welfare and in the range of options available to individuals and societies. Most non-member countries have also experienced great gains in welfare in recent decades, and many are undergoing unprecedented growth and social change, but they began later, from a lower base, and are still beset with many challenges.

47. Can continued increase of population and economic growth be sustained, or are there limits beyond which the loss of environmental assets begins to reduce, perhaps drastically, the total stock of assets passed on? Clean air and water are in short supply in many parts of the world. Increased concentrations of greenhouse gases in the atmosphere could cause irreversible changes in climate. Biodiversity and habitat for many species are threatened. The concept known as "strong sustainability" recognises that some environmental amenities may be essential and irreplaceable, that their loss may be permanent, and that there is no possible substitute or compensation for them. This concept places definite

limits on using or degrading environmental resources in order to avoid undermining basic life support systems. It calls for preserving critical ecological systems and respecting air, water and other environmental goods that are essential to human life and cannot be replaced.

Risk and uncertainty

48. Sustainable development requires decisions and actions across a very broad spectrum of human activities, each with its own risks and uncertainties that increase as we look further into the future. Methods for the assessment and management of risk will be essential tools for policy-makers aiming at reducing and/or mitigating negative impacts, avoiding disasters, ensuring continuity of life support systems, and maintaining or increasing the overall capital stock.

49. Investments in R&D can reduce uncertainty by improving our understanding of natural and man-made systems. Maintaining a diversity of options, in the energy sector and elsewhere, can help to avoid disruption when one option encounters limits on its use. Innovations in products and processes can represent steps in the direction of sustainable development. To date, innovations have generally served humanity well, but in some cases their impact has become so broad that their overall future benefits are difficult to assess. Some innovations may constitute open-ended experiments with the biosphere. For developments that could have major, irreversible consequences, but whose occurrence is uncertain, it would seem prudent to take some preventive mitigating actions. This is the essence of the precautionary principle – that one should not wait for scientific certainty that a major risk will materialise before taking action to prevent or mitigate it.

Equity and participation

50. Equity is a key objective of sustainable development. A society that respects the principles of sustainable development requires a greater degree of equity than currently prevails in the world [9]. Worldwide, people aspire to a standard of living that at least meets basic needs. The desire to care for future generations and for the environment that supports humanity implies an equal devotion to the people living now. Equity, within OECD countries as well as between Member and non-member countries, needs to be addressed in order to achieve sustainable development goals.

51. The OECD Member countries, with a population of about one billion, i.e., less than 20% of the world's population, own 80% of the wealth. Over the next few decades, almost all the population growth and much of the economic growth will take place in non-member countries, with an increasing impact on the global possibilities for sustainable development. Yet the OECD countries possess some of the key resources needed to address these growth challenges: funds, science and technology, knowledge and skills, and institutions. Thus, OECD Member countries will have an increasing interest in decisions taken by non-member countries from the perspectives of both self-interest and global responsibility [10]. This argues for close co-operation between the OECD and the non-member countries, for significant resource transfers to achieve greater equity and for joint work to meet health and environmental goals. The transfer of institutional expertise, such as effective regulation, will be an important factor.

52. The concept of sustainable development has a profound resonance because it provides a common vision for people with widely differing views. Sustainable development implies an equal emphasis on quality and on quantity of growth and, thereby, recognises the concerns of advocates for economic development, social welfare and environmental protection all together. The links among these three dimensions of sustainable development can create synergy and may provide some opportunities for win-win measures. However, it will be difficult to meet all the goals of sustainable development at the

same time: caring for the present generation, the environment and future generations will require trade-offs between conflicting goals.

53. The social dimension of sustainable development requires not only social cohesion, but also co-operative actions at all levels of social organisation, from the local to the global scale. Politically, this will not be easy. Although some initiatives may produce net gains for all parties, others will require sacrifices by some for the sake of others. Also, sustainable development issues, that are seen as inherently global and long-term in nature, may not provide strong incentives for urgent local action. Before risking their own immediate welfare, most people will want reassurance that the transfers involved are equitable, that they make a real contribution to the overall goals, and ideally that they bring some benefits back home. In order to make the often difficult choices that will be required, individuals and groups will need a good understanding of the implications of their decisions, not only for the long-term goals of sustainable development, but for the short-term trends in their local communities. Therefore, education and participation will be key to the success of sustainable development policies.

Natural resources

54. Natural resources are an essential asset for sustainable development. They come in a great variety of forms, from clean air and water to minerals and energy, to agricultural land and soil, to different forms of landscape and wilderness. While the natural world may have non-use values, natural entities generally become broad economic resources only as a result of demand, which arises from finding uses for the resource. The uses depend in turn on technology and taste. The world's beaches, wilderness rivers and snowy mountain slopes were not much valued before people began wanting to spend holidays there, and obtained access by planes, trains, and automobiles. Uranium became an energy resource only after the discovery of nuclear fission in 1939. Waste materials that can be recycled are now seen as resources. Thus, resources have to be seen in a dynamic and ever-changing context.

Non-renewable resources

55. Non-renewable resources, while finite, do not generally seem to have an availability problem at the front end of the product cycles. Although proven economic reserves of many non-renewable commodities represent only a few decades of supply at current rates of consumption, this is only a snapshot of resources discovered as a result of active searching. It is not economic to spend a lot of money looking for resources that will not need to be developed for many decades, so the short-term nature of the reserve picture is not surprising. As more resources are needed, exploration and development will be funded, and more reserves will be defined. Technology is constantly improving the ability to find and develop lower grade or more remote deposits, and to use resources more effectively. Prices for many commodities are at or near their historic lows, suggesting that scarcity is not imminent, although geographic distribution and politics may affect the price or availability of some commodities, such as oil. The main problem with non-renewable resources in the short and medium term is at the back end of the cycle, with the capacity of the environment to absorb the waste they create.

56. While cost and availability may not be a problem today, increasing consumption in a finite world has to take its toll. Extracting lower grade resources in more remote areas involves higher energy costs and more waste material but also the opening up of new areas to modern development. More extensive conversion of primary fuel resources into increasingly higher quality products for end-use may lengthen the transportation chain and lower the overall efficiencies of the complete fuel cycle. Decreasing the use of materials and energy by reduced consumption or by greater efficiency, in both production and end-use, can only help the environment. Resource efficiency and productivity thus are key factors in sustainability.

Renewable resources

57. Sustainability of renewable resources can be defined in different ways. Maintaining the economic output of an ecosystem (e.g. in a commercially exploited forest) is one option and maintaining the integrity of the whole ecosystem (e.g. in an old-growth forest) is another possibility. In addition to the immediate value associated with its economic outputs, the ecosystem that supports the resource flows may have option values for possible future uses, and existence values simply because people value its continued existence. Ecosystems have information value as working models of complex interacting life-sustaining systems, about which we still have much to learn. Option and existence values are less tangible and more difficult to measure than the immediate economic output, but may be of comparable importance, especially in a long-term perspective.

58. Renewable resources are subject to a variety of stresses, often more powerful than those acting on non-renewables. They are inexhaustible in the sense that they can be continually recycled, but this does not mean they are infinite in amount and does not prevent their degradation. Renewable resources, including air, water and land, are subject to pressures for different uses, which may be incompatible. Air and water are particularly susceptible to pollutants because of the ease with which they can be used as open-access resources for receiving and disseminating waste. Habitat for plant and animal species may be very sensitive to environmental impacts, and easily destroyed. Thus renewable resources should be seen as finite and vulnerable to pressures.

59. For example, a river system can be dedicated to a variety of purposes: power generation, drinking water, irrigation, industrial use, sport and commercial fishing, recreation in various forms such as rafting and canoeing, swimming, sailing or motor-boating on lakes and reservoirs, scenery for hikers and campers, sites for resorts or cottages, or pure wilderness. Once dedicated, it cannot be used again, without disturbing the constituencies that use its features and whose property values depend on them. Some of these uses may degrade the quality of the water, or spoil it for other uses. In some cases, so much water is withdrawn for various uses that not much reaches the sea or ocean – the Nile and the Colorado are in this condition at times. This in turn can have an impact on coastal currents and water quality, salinity of water in the delta, etc. Policy for renewable resources, including pricing policy, should reflect their scarcity value, multiple uses, and susceptibility to degradation or irreversible loss.

Research, development and innovation

60. Science and technology are a vital part of the human and social capital that people have developed over the past centuries. Innovation will be essential in moving toward sustainable development. R&D can contribute to both the scientific understanding and the technological innovation that will be needed to meet sustainable development goals. It can extend the existing resource base and create new categories of resources by finding new and more efficient ways of using raw materials. Also, R&D can reduce uncertainty by providing better scientific understanding of technologies and their impacts. Because the issues involved in sustainable development are inherently complex and comprehensive, much of the R&D required will be interdisciplinary in nature and international in scope.

61. Governments have traditionally embraced the rationale that they should carry out or sponsor fundamental R&D as a public good while leaving applied and commercially oriented R&D to industry. With budget pressures, however, governments have been less inclined to sponsor long-term research that lacks immediate payoff and may leak to other countries, and have tended to invest, often in partnership with industry, in strategic but nearer-term R&D that makes a direct contribution to short-term national policy goals. Sustainable development will require sustained R&D support backed by a long-term vision that may require changes to current policies.

62. Beyond R&D, governments can also do much to create the framework and the infrastructure for successful innovation. They can provide a range of incentives for innovations that help to protect the environment for example. Designing new products, processes and systems on a life cycle basis, with health, safety and the environment kept in mind from the beginning, is one of the best ways to achieve sustainable development goals. This is particularly the case for energy systems that have large-scale potential impacts and very long lifetimes.

63. Because of the importance of energy to sustainable development, and the need to meet increasing demand for energy services while reducing overall environmental impacts, R&D will be essential in this field. Innovative developments largely will determine the impact of energy on economic, environmental and social goals over the next decades and indeed well beyond. In a recent report on Climate Change and Nuclear Energy, the Royal Society calls for an international research effort building up to $25 billion per year to explore all the different options for meeting the demand for energy, including nuclear energy, while reducing the likelihood and impacts of climate change [11].

Valuation and comparison – the search for indicators

64. In order to compare the different impacts of human activities, it is useful to assign values to them, similar to giving a monetary value to marketed goods and services. While it is desirable to use a common indicator, or unit of measurement, in order to compare impacts, it is difficult to assign values to entities that have no markets. Those include natural assets like clean air and water, ecosystems such as wetlands, coastal zones, rainforests, mountains, and deserts and also social assets like institutions, participation in democratic debate, and access to information. The task of finding a common indicator for valuing those entities is not an easy one and economic methods might not capture the real significance for society, in a sustainable development perspective, of goods and services for which there is no market at present.

65. The search for common indicators is complicated by the variety of economic, social and environmental impacts to be considered. Impacts may be local, regional or global, affect population, ecosystems or macro-economic systems, and have short-term or long-term consequences; they may affect workers or the public. Impacts can occur under routine or accident conditions. Events with low probabilities and high consequences, such as severe nuclear accidents, may require a different treatment from those with high probabilities and low consequences, such as routine releases of pollutants, even though both result in increased mortality and morbidity. Impacts may be valued differently by different groups according to their social and cultural background and sensitivities.

66. For electricity generation, alternative sources will lead to different health and environmental burdens that are difficult to compare on a level playing field. Fossil fuels generate atmospheric emissions of greenhouse and acid gases, and particulate. Nuclear energy produces radiation and radioactive waste. Hydropower results in the dedication of river systems to dams and power production, changes in streamflow and in many cases the flooding of vast areas for use as reservoirs. For other renewable sources, the dedication of large or unique areas to energy gathering systems may be a concern. Units of measurement for such a broad range of impacts vary widely.

67. Although it is difficult to measure different impacts with a unique unit and express their values with a single indicator, individuals, firms and governments do make decisions implying that they carry out some kind of implicit valuation of these impacts, however simple or intuitive. The goal of explicit valuation is to make the factors going into decision-making more transparent. Using a common unit, or a few summary indicators, forces to look at the different impacts in a common framework. Decisions may then be made in a coherent and systematic way, with the hope that they would lead to better overall outcome.

68. Monetary units are well understood and already functional where markets exist. They have the advantage of reflecting real preferences, which provides a useful basis for extending them to non-market entities. They can take into account time preferences, risks and uncertainties. Valuing impacts is a means to eventually internalise their costs and enhance the efficiency of market mechanisms for supporting sustainable development.

69. Working with a range of indicators also has its advantages. They can be more precisely matched to the characteristics of impacts and receptors. A recent IEA study shows how looking at disaggregated indicators along the energy chain can inform policy on carbon emissions [12]. For example, indicators adapted to each sector of activity may be tailored to measure progress towards sustainable development and trends in a specific industrial branch for example.

70. The OECD and other international bodies are working on an approach that builds a pyramid of indicators [2, chapter 6]. At the bottom are indicators that describe the impact of developments and policies at the sectoral level, e.g., for energy, agriculture and transport, expressed in physical or monetary terms. Above them are the resources indicators, which describe the accumulation and depletion of the different forms of capital. These may be used to develop green national accounts, where environmental and possibly human and social indicators can be included with the traditional economic ones to produce a broad view of genuine savings. This is a measure of changes in the overall capital stock, and hence of progress towards sustainable development. Although human and social factors are difficult to measure precisely, work to date indicates that they represent the largest share of national wealth in most countries, and are areas in which investment is highly productive [13]. Above these are outcome indicators in the economic, environmental and social dimensions. At the top are summary indicators, which provide a broad picture of the current path towards sustainable development.

71. The indicators used by the NEA, and more generally by the nuclear community, are mostly specific to energy, electricity and nuclear power. They include some economic indicators expressed in monetary units that can be compared and integrated within a global framework covering all sectors of activity. Other indicators related to health and environmental impacts, e.g., collective doses or volumes and activity of waste, are specific and work remains to be done to integrate them in an overall assessment of various energy sources. As the efforts to develop more aggregated sets of indicators evolve, the indicators used in the nuclear energy sector will provide a useful basis for further integration. In the meantime, multi-criteria analysis may be relied upon to identify key strategic issues and to allocate resources and take actions appropriately.

Values over time – The discount rate

72. Sustainable development goals include taking the needs of future generation into account and, thereby, require valuing explicitly future activities and assets within a very long-time perspective. The discount rate that measures how much more we value things right now than in the future [14] is an important policy tool within a sustainable development framework. A zero discount rate implies that present and future are valued equally. Sustainable development essentially tells us that all our activities have long-term implications, and they should all be managed with an eye to the future. Giving equal priority to present and future generations may require lower discount rates than those derived from market mechanisms.

73. Governments and other public agencies with responsibilities for the long-term social and environmental consequences of decisions taken today may use low discount rates to reflect the priority placed on the welfare of future generations. However, specific political issues and level of economic development will have a drastic influence on those choices that will vary from country to country. In order

to capture the benefits of investments whose payoff is in the long term, governments may apply a low discount rate to the assessment of such investments, or they can assign a high value to those benefits, so that even after discounting, their present value remains significant.

74. High discount rate implies a strong preference for the present. Decisions taken today based upon a high discount rate are almost not influenced by costs and benefits that will occur beyond a few decades. Poor people struggling for survival will use implicitly a high discount rate since their preference goes to improvements in the very short term. Private investors who look for short pay back periods use explicitly high discount rates.

75. The introduction of commercial competition into the electricity sector worldwide, along with other sectors, implies increased pressures toward higher discount rates in the assessment of projects. Projects with high capital costs and long development periods, like nuclear power plants, become less attractive in those conditions. Within a sustainable development policy framework, mechanisms and measures should be sought in order to capture the potential future benefits of capital intensive options when they are considered to meet broad public policy goals.

Policy and economic instruments

76. In its approach to sustainable development, the OECD emphasises policy and economic instruments. Policy instruments include R&D, traditional command and control regulation of health, safety, and environmental impacts, as well as broader approaches such as environmental assessment; education, information and participatory processes; and voluntary measures, along with programmes such as product labelling and awards. Economic instruments include taxes, subsidies, and tradeable permit schemes, as well as traditional economic regulation, and measures to internalise the external costs of health and environmental impacts.

77. Regulation is a core function of governments, both to ensure health and safety, and to ensure fairness and effectiveness of market mechanisms. The challenge is to meet these objectives without burdening the economy or inhibiting the beneficial effects of innovation. In terms of safety and environmental impact, the regulatory challenge is also to balance the risks and benefits across a range of activities. Regulation often tends to be piecemeal, in that there are separate agencies and regulations to deal with different risks such as toxic chemicals, radiation, natural hazards, crime, disease, and so on. Regulators tend to focus on their specific risk responsibilities while integration might enhance the overall effectiveness of regulation. For example, nuclear safety regulation is an essential aspect of energy policy. A coherent approach to risk across society would allocate resources most efficiently, ideally equalising the marginal benefit from any incremental expenditure on health, safety, and the environment.

78. Education, information and participation are essential components of a sustainable development policy, and often offer opportunities for cost effective policy measures. A better understanding of sustainable development and a broader participation in key decisions should lead to a greater social willingness to take steps toward it. There would probably be benefit, in many countries, in a more active public information on energy issues covering all available options. Involving all interested and affected parties in decision making would facilitate reaching agreement on the possible role of alternative options, including nuclear energy, in sustainable development strategies.

79. Governments employ a range of economic instruments, including taxes, subsidies, and emission trading schemes, that provide incentives to move toward certain goals without necessarily telling the actors how to get there. This leaves the actors free to choose their own paths, which may be more innovative and cost-effective than those imposed by a regulator. Economic instruments help to get prices right, in

reflecting the value that society places on the full range of impacts over time. They can help to create markets where none existed before, and hence provide a forum for valuation.

80. Subsidies often have had negative impacts where they have been used to support inefficient industries or ill-conceived regional development schemes. They have led some resource industries to create capacity exceeding market needs or environmental carrying capacities. Support to traditional activities in some regions has postponed the need to diversify and modernise, hampering the development of the economy. There is general agreement that subsidies need to be reformed, in the energy sector, including the nuclear field, as elsewhere. However, transparent subsidies supporting public policy goals and closely targeted to those goals - such as development of cleaner energy sources, more efficient processes, or public transportation - can contribute to sustainable development.

81. Taxes and emission trading can complement subsidies and can be revenue-neutral. The economic penalties on damaging activities, such as pollution, can be used to support environmental or social protection. For instance, green taxes can discourage specific polluting activities, in accordance with the polluter pays principle, and fund compensating activities. Taxes have a direct influence on price, but an indirect effect on the amount of pollutant emitted. By contrast, emission trading can set direct limits on emissions, but its impact on price will be indirect. Both instruments effectively place a value on pollutants, thus helping to internalise their health and environmental impacts. The valuation of these costs, and their internalisation, are important factors in getting prices, and policies, right. As with subsidies, the challenge is to achieve the policy goal at the least overall cost to society.

Climate change

82. Climate change is one of the most challenging issues to be addressed by sustainable development policies. Anthropogenic emissions of greenhouse gases and their concentration in the atmosphere are increasing. Although there remains some statistical uncertainty in the assessment of the nature and likely extent of the impacts of those emissions are not definitive, policy-makers are increasingly concerned by climate change and have decided to apply the precautionary principle in this instance.

83. A major international effort is underway to understand the scientific aspects of climate change, and to identify alleviation, mitigation and adaptation measures. The United Nations Framework Convention on Climate Change (FCCC) is a major step towards controlling and limiting greenhouse gas emissions. Within the FCCC, the Kyoto Protocol of December 1997, imposes binding commitments on the developed countries to reduce their greenhouse gas emissions below 1990 levels by 2008-2012. Although it is recognised that meeting the Kyoto targets will be a challenge for many countries, further reductions will be required beyond 2012 in order to stabilise atmospheric concentrations of greenhouse gases at acceptable levels.

84. The main greenhouse gases are carbon dioxide and methane. The burning of fossil fuels resulted in about 6.4 billion tonnes of carbon emissions as carbon dioxide in 1998, or about one tonne per capita for the world population, while the burning of forests caused emissions of an additional billion tonnes or more. Currently more than half of the carbon emissions from fossil fuels comes from OECD countries. In the coming decades, however, most of the growth in energy consumption, and of carbon emissions, will take place in non-member countries. Energy demand growth for electricity and transport will be especially rapid, despite gains in efficiency. Transport will continue to be largely based on oil, but electricity has a range of options including coal, natural gas, nuclear energy, hydro, biomass, solar and wind.

85. Clean sources of electricity will be important for large cities, where industry and transport will be driving growth in fossil fuel use and gaseous emissions of all kinds. Electricity should contribute to

alleviate the risk of global climate change. Building electricity capacity on the scale required will be a major challenge, not because of the need for fuel resources, but rather for financing, institutions, infrastructure, and technology to meet the economic and environmental requirements.

86. From a sustainable development perspective, it would seem essential to ensure that impacts that could lead to climate change as well as other environmental impacts are internalised as much as possible in the costs of the activities that produce those impacts. The current situation, where there is no charge, or a very small one for carbon emissions, sends the wrong signals, encourages emissions and discourages non- or low-carbon alternatives. In effect the absence of a value for carbon emissions represents a very significant subsidy for fossil fuels. Finding an appropriate way of dealing with carbon emissions is a major part of getting the price right for energy sources, and of meeting commitments for Kyoto and for further reductions beyond.

87. While some value will undoubtedly be placed on carbon emissions through taxes or permits over time, large values will be resisted by governments eager for rapid development and by producers and consumers of energy. Because of their importance in the economy of every country, it seems unlikely that fossil fuels will be priced out of the electricity market, and fossil fuel technology will continue to improve. Non-carbon sources such as nuclear and renewables can make a vital contribution to reducing emissions, but they will have to compete in markets where fossil fuels are likely to be abundant and relatively low cost. Beyond their advantages in emissions, nuclear and renewables will have to be competitive under prevailing conditions and, in the case of nuclear energy, safe and publicly acceptable.

3. SUSTAINABLE DEVELOPMENT AND NUCLEAR ENERGY[1]

88. The present situation of nuclear energy is outlined in Chapter 1. There are over 400 nuclear power plants operating in 31 countries, representing about 350 GWe of capacity. The nuclear industry represents a large asset comprising several forms of capital. A measure of the man-made capital may be given by the replacement value of nuclear power plants in operation, which is about USD 700 billion. Technologies for peaceful uses of nuclear energy are proven, and benefit from extensive experience drawn from the design and operation of reactor and fuel cycle facilities as well as the regulation of civil nuclear activities. The cumulative experience relative to nuclear power plant operation amounts to about 9 000 reactor-years.

89. More than 80% of the nuclear capacity is in the OECD countries. Non-member countries, especially those with large urban and industrial sectors, will experience high electricity demand growth and the development of nuclear energy over the next few decades is likely to occur primarily in those countries. In order to ensure that nuclear power growth remains compatible with sustainable development goals, the OECD countries have a co-operative role with respect to technology transfer, training, exchange of experience, and institution building.

90. Looking at nuclear energy from a sustainable development perspective implies analysing its characteristics in terms of their economic, environmental and social impacts, both positive and negative, in order to assess to what extent and under which conditions nuclear energy may contribute to meeting the goals of sustainable development. The following analysis is intended to cover those aspects and to provide policy-makers with elements that could be used to assess how nuclear energy compares with alternatives.

Indicators

91. Indicators of sustainable development in the energy sector are the subject of ongoing work within OECD and the IEA. They can take the form of sectoral and resource indicators, and outcome and summary indicators that measure progress toward sustainable development [2, chapter 6]. Some subjects relevant to the energy sector that may be addressed by indicators include:

- Resource availability and geographical distribution (noting that the definition of a resource is a dynamic one).
- Trade.
- Intensity of energy use and material flows (per capita, per unit GDP, or per unit of end product, e.g. kWh of electricity, passenger-miles of transport), including those to the environment (e.g., carbon emissions).
- Health impacts on different groups (e.g., assessed through dose/response functions).
- Critical environmental load limits for given materials and receptors.
- Land use and impact on natural habitat.
- Potential for causing major and irreversible environmental impacts.

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1. The term "nuclear energy" encompasses a wide range of activities including reactor design, construction and operation and fuel cycle service supply (see Annex 1). These activities are carried out in many countries with different technologies and institutional infrastructures, and various levels of performance. This term is used throughout this document for the sake of convenience and simplicity, but it is recognised that there is considerable variety within the nuclear energy sector and in the approach to nuclear energy taken by different countries.

92. Indicators are often listed for different groups of environmental impacts: biodiversity, climate change, winter and summer smog, biological oxygen demand in lakes and rivers, toxic chemicals, etc., Other less tangible subjects will also be important for sustainability: government policy on education, training, financial support and R&D; marketing and consumer values; valuing of health and the environment and how those values are expressed; quality of health, safety, environmental and economic regulation; effectiveness of institutions.

93. At the present level of scientific knowledge, it seems relevant to begin with indicators appropriate for each activity and impact, and then work toward aggregating them in appropriate units. A key challenge at this level is to identify the most important elements and focus attention on them.

94. The task of assessing progress toward sustainable development and comparing it across different energy sources (including efficiency as an equivalent source), is a difficult one. Indicators would be useful in the context of making electricity generation choices once energy and electricity needs are better understood in a sustainable development perspective. This suggests that indicators should be developed for the purpose of eventual comparisons.

95. Taking the OECD framework of economic, social and environmental dimensions, a number of indicators relevant for nuclear energy may be identified and measured (Box 3.1). The examples given in Box 3.1 are intended to be illustrative and some of them, e.g., doses and waste activity, will not apply to other energy sources. On the other hand, land use is less relevant for nuclear energy or fossil-fuelled electricity than for hydro, solar and wind power. Health and environmental detriments caused by different pollutants, e.g., SOx, NOx, greenhouse gases and radioactive emissions, are difficult to compare in a quantitative way.

Box 3.1 **Sustainable development indicators**
(Illustrative list applicable to nuclear energy)

Economic indicators	Social indicators	Environmental indicators
Capital cost ($/kWe)	Dose to the public (Sv/kWh)	Volume of solid waste (m^3/kWh)
Marginal cost ($/kWh)	Employment (man/kWh)	Activity of solid waste (Bq/kWh)
	Education (no. of university cursus)	Fuel use (tU/kWh)
		Activity of liquid & gaseous effluents (Bq/kWh)

96. Recognising that progress in the development of generic indicators for energy and more globally may take time, it seems relevant for the nuclear sector to identify key indicators and focus its efforts on measuring those indicators in order to assess trends towards sustainable development. This effort has been undertaken already at the national and international level, and data series are collected, harmonised and published on a regular basis.

Economic dimension

97. Economic efficiency is one component of sustainable development and competitiveness is a relevant indicator insofar as market prices reflect the full costs for society of a given product or activity. The economic aspects of nuclear energy are reviewed and presented below from this perspective, taking into account the criteria applicable to market competition, externalities and subsidies.

98. The inclusion of nuclear energy into a national supply mix increases technical and fuel diversity and creates potential competition with alternative sources in electricity markets. This has the potential to increase the overall effectiveness and efficiency of energy systems to the benefit of consumers.

Competition

99. With respect to competition with new fossil plants, existing nuclear plants can be put into three categories, depending on their production costs [15; 16]:

- A first group will be able to compete with new fossil plants even when full capital costs of the nuclear plant are included. They will be prime candidates for life extension.
- A second group will be able to compete on the basis of marginal cost (fuel, operating and maintenance costs), but will not recover their full capital costs, which remain as stranded debt. Nonetheless since their capital costs have already been incurred, it may pay to continue operating those plants, recovering at least some of the investment. Where there is an interest in their continued operation from an energy security or emissions perspective and/or to maintain nuclear expertise and a nuclear option for the future, supportive measures may be considered.
- A third group cannot compete on marginal cost, and will likely close if their performance cannot be improved. However, its seems that the current spread in marginal costs for nuclear plants, for example in the United States [17], is due mainly to individual plant management, implying opportunities for the more expensive plants to lower their marginal costs.

100. Most existing nuclear plants are expected to continue functioning to the end of their design lives. Life extension likely will be cost-effective for many nuclear power plants. Refurbishment to extend plant life will improve performance, help to meet increasingly stringent safety standards and offer opportunities for plant upgrade. This will provide additional electricity generation capacity at lower investment costs than most alternatives.

101. The bulk of existing plants came into service in the 1970s and 80s. Assuming a 40-year design life, they would nominally be replaced by 2030. Although many lifetime extensions of 10 years or more are expected, new reactor designs, whether evolutionary or more innovative, will be needed eventually. They will have to compete with other sources of electricity on a full-cost basis with no compromise in safety standards. They must be cheaper and quicker to build, and easier to maintain, than current plants. While this will be a major challenge, it is a necessary precondition for the long-term viability of nuclear power.

102. New nuclear plants to replace those reaching the end of their useful lives, and to meet electricity demand growth, will compete with a range of generation options. Natural gas plants (combined cycle gas turbines) now look like the technology of choice that will set the standard for competition for new generating capacity for the next few decades in areas where gas is readily available. In many non-member countries coal likely will be the strongest competitor for nuclear power.

103. The total levelised cost of generating nuclear electricity by new units to be ordered in the coming years would range between 2.5 and 6 cents per kWh at 5% discount rate and between 4 and 8 cents per kWh at 10% discount rate [18]

104. Cost estimates that serve as a basis for decision-making depend strongly on the discount rate adopted. Low discount rates that reflect a high value for the future, as may be called for by sustainable

development goals, enhance the competitiveness of capital-intensive technologies such as nuclear energy. With a 5% discount rate, nuclear power plant of current generation would compete favourably with alternatives in a number of OECD and non-member countries, but in a competitive and deregulated market a 10% discount rate is more likely to prevail.

105. Nuclear energy is characterised by high capital costs and low marginal costs of generating electricity. Nuclear power plants are generally large in scale and they come in billion-dollar packages. According to the table 3.1, drawn IEA/NEA study on projected costs of generating electricity [18], at 5% discount rate, the share of capital investments, including interest during construction, in total nuclear electricity generation cost is around 60% while O&M take some 25% and fuel around 15%.

Table 3.1 **Nuclear electricity generating costs**

	Discount rate	Investment (%)	O&M (%)	Fuel (%)	Total cost (cent/kWh)
Canada	5%	67	24	9	2.5
	10%	79	15	6	4.0
Finland	5%	59	21	20	3.7
	10%	73	14	13	5.6
France	5%	54	21	25	3.2
	10%	70	14	16	4.9
Japan	5%	43	29	27	5.7
	10%	60	21	19	8.0
Rep. of Korea	5%	55	31	14	3.1
	10%	71	20	9	4.8
Spain	5%	54	20	26	4.1
	10%	70	13	17	6.4
Turkey	5%	61	26	14	3.3
	10%	75	17	9	5.2
United States	5%	55	27	19	3.3
	10%	68	19	13	4.6

106. Capital costs of nuclear power plants vary with design, component suppliers, construction methods, labour and management skills and relations, quality assurance, and regulatory and approval processes. Total investment costs, including provision for decommissioning and interest during construction, for nuclear plants using currently available designs, range between USD 2 000 and USD 2 500 per kWe. For a 1 GWe plant, this means an investment exceeding 2 billion USD. Designers and manufacturers of new reactors are aiming at significant capital cost reductions of 25% or more for the next generation of nuclear plants [19].

107. Safety and decommissioning costs are included in the capital costs of nuclear power plants and amortised by the plant owner over the lifetime of the unit. The prices paid by electricity consumers include decommissioning costs and there is little or no financial liability left behind to future generations. The electricity generators set aside liability funds to cover expenses in due course [20]. Decommissioning cost estimates are based mainly on experience acquired with research facilities or small reactors but with increasing feedback experience, the uncertainties on those costs are progressively reduced. The undiscounted costs span a range between 10 and 20% of initial capital costs but when discounted contribute only a few per cent to the total investment cost since major expenses will be incurred several decades after the closing down of the plant [21].

108. The share of capital cost in the overall cost of generating electricity varies considerably from plant to plant and with the discount rate, capital weighing more at higher discount rates. To date, it has always been higher for nuclear than for fossil fuel alternatives. For coal-fired power plants, capital costs generally range between USD 1 000 and USD 2 000 per kWe; for gas-fired power plants, capital costs are even lower in the range USD 500 to 900 per kWe. Also, construction times are shorter for gas-fired plant, 2 to 3 years, and for coal-fired plants, around 5 years, than for nuclear units, 5 to 7 years. For coal-fired power plants, the breakdown is about 35% capital investments, 20% O&M and 45% fuel. For gas-fired power plants, capital costs represent around 20%, O&M 10% and fuel 70% [see table 3.1 and 18].

109. Once operating, a nuclear plant offers stability of production costs. The cost of uranium ore itself constitutes only a few percent of the overall cost of electricity from nuclear energy and, therefore, even a significant price increase for uranium would not have much impact on the cost of generating nuclear electricity. On the other hand, the cost of fuel accounts for large proportion of total generation costs for fossil-fired electricity plants, in particular for gas-fired power plants (around 70% or more). Thus the prices of fossil fuels, that have been highly volatile in the past, will have an important influence on the competitive situation.

110. Nuclear power may be competitive with alternatives in deregulated electricity markets in countries where large programmes based on standardised units have been implemented and where plants are operated and managed efficiently. If a nuclear plant runs at a higher-than-planned capacity factor, or for a longer period then planned without major refurbishment, it can earn a significant return. In countries where the electricity market has been deregulated nuclear units have been performing rather well in general and have contributed to low and stable electricity prices.

Subsidies

111. The removal of inappropriate subsidies is essential to achieve sustainable development goals in a deregulated market. Subsidies to be considered in the nuclear field include support to R&D beyond basic and fundamental research, export financing and governmental guarantees covering financial liabilities and third party liabilities in case of severe accident. As the nuclear industry progressively reached commercial maturity, export financing and government financial guarantees for liabilities have been reduced significantly. Support to R&D for a given technology has to be assessed in the light of the overall national policy goals, including security of energy supply and environmental protection.

112. Financial support from governmental export development agencies, that often was provided in connection with nuclear power projects undertaken in non-member countries, is not unique to nuclear projects. OECD countries engaged in nuclear exports have agreed on rules that have evolved to the point where any government financing is now almost entirely at commercial rates, although there is some flexibility in training, technology transfer, warranties and other areas. To the extent that government-backed financing, even at commercial rates, is seen to represent a subsidy, it would have to be looked at in terms of public policy goals such as reducing global emissions, and in terms of trade promotion practices for other products and services.

113. A central goal of sustainable development is to avoid the transfer of large burdens through time to future generations. Future financial liabilities associated with facility decommissioning and radioactive waste disposal could require subsidies if adequate provisions were not set aside by the nuclear industry. Since decommissioning and waste disposal occur long after nuclear electricity is generated, the economic actor responsible for the facility and its waste may not exist when the funds will be needed. In OECD countries, the cost of decommissioning nuclear power plants and disposing of radioactive waste is largely included in the generation costs [18, Annex 7] and passed on to current electricity customers. Schemes in

place in OECD countries for covering future financial liabilities from nuclear activities ensure that funds will be available to finance decommissioning expenses costs when they will occur [20].

114. Nuclear liability insurance regimes provide many guarantees to both the industry and potential victims of accidents, and the coverage of damages is increasingly taken on by nuclear operators. Nuclear energy has been a pioneering field in setting up liability regimes and in looking at long-term liabilities. Pressures are increasing on other industries to cover their external costs and future liabilities, as is done by the nuclear industry. To the extent that limited liability of the companies operating nuclear facilities can be seen as a subsidy to the nuclear industry, it should be compared with liability regimes in other areas.

115. Government-funded R&D, including the building and operation of equipment such as research reactors will likely constitute the main subsidy to nuclear energy, as it has in the past. A vigorous R&D effort is required to conceive and develop designs that will meet more stringent safety standards, have enhanced technical performance and compete successfully with alternatives. Governmental support to R&D should be justified by the expected contribution of the outcomes to public policy goals, such as social welfare, environmental protection and sustainable development. It should be allocated to a range of options according to their respective potential contributions to the shared goals of the country, and the rationale for the approach adopted should be fully transparent. In this connection, the share of nuclear R&D in the overall technology and energy R&D budget should be adapted to the role foreseen for nuclear energy in the national policy.

External costs and benefits

116. The costs of health and environmental impacts from residual emissions and burdens represent negative externalities. Norms, standards and regulation are reducing the impacts from electricity generation chains and de facto internalising the costs corresponding to environmental and health protection. Remaining external costs are supported by society as a whole through taxes, health or environmental degradation, and burdens passed on future generations. The non-internalised costs may be considered as a subsidy to producers and users of the technologies that cause the impacts. In so far as those costs are not reflected in market prices, they prevent market mechanisms from supporting sustainable development.

117. The nuclear industry is operating under regulations that impose stringent limits to atmospheric emissions and liquid effluents, and is committed to contain its waste and isolate it from the biosphere as long as it may be harmful for human health and the environment. Thus the industry has accepted the full long-term responsibility for its emissions, effluents and waste and has internalised the corresponding costs, which are borne by the consumers of electricity. This internalisation extends fully to waste management, waste disposal and plant decommissioning. It also applies to the liability in the event of a major accident although this is capped and governments carry the residual risk.

118. A number of studies have examined the impact of different fuel cycles on human health and the environment, and provide some information on progress towards recognition, valuation and internalisation of external costs. The most ambitious studies are those that have tried to aggregate the indicators for different kinds of impacts in a single unit, usually monetary. These studies use preferences revealed by market values where they are available. Where market values do not exist, researchers try to obtain equivalent values through other ways of discovering preferences.

119. Valuation is a controversial area and there is no consensus on the feasibility and relevance of assigning a monetary value to every good, commodity and service, let alone to human life. It is difficult to reduce the variety of environmental impacts to a single unit, and to agree on the monetary value of some assets. However, the approach has some merits in making preferences as transparent as possible and

subjecting them to a systematic assessment, where the higher priority impacts can be identified and compared.

120. A thorough study of the health and environmental impacts of several fuel cycles for electricity generation, using specific technologies and sites, was carried out by the European Commission [22]. The methodology and results have been further refined but the 1995 conclusions remain essentially valid. Other studies differ in some of the specific numbers, but many of their conclusions are similar.

121. Under routine operation, nuclear energy has low impacts, comparable to natural gas and renewables. These are valued within the ExternE study, assuming a zero discount rate, at less than 1 mECU per kWh, except for a longer-term global impact from reprocessing of 2 mECU. The latter valuation is based upon multiplying very small exposures by very large number of people that could be exposed over the next 100 000 years. Such broad extrapolations of low-level impacts are controversial. They are most useful when applied to specific populations over shorter time periods.

122. The external cost of a severe nuclear accident, calculated with a probability of 5×10^{-5} per year for core damage, was estimated by the ExternE study at about 0.1 mECU. Other estimates of external costs of severe accidents show fairly large discrepancies and are considered controversial. The results obtained for nuclear power plants with good safety standards in operation in OECD countries show low quantifiable contributions of severe accidents to external costs of nuclear power [23]. However, while economic estimates are of interest in this context, they cannot reflect adequately the strong public aversion to accidents involving large numbers of people, even if their probability is very low. Valuing the impact of low-probability high-consequence events raises the issue of the additional weight that individuals tend to assign to those events. The full assessment will involve the probability, consequences, and emotional weight that each person assigns to these events, and their beliefs in the possibility of avoiding or mitigating the negative effects while still enjoying the benefits. This aversion is reflected in the special approach of governments to large accidents as opposed to small ones, for instance in setting up emergency preparedness organisations or special regimes like those for nuclear liability.

123. The biggest impacts from routine operation of the fossil fuel cycles are climate change and the public health effects of the coal and oil cycles, mainly due to respiratory diseases caused by particulate and other contaminants. According to the ExternE study, these are of the order of 10 mECU per kWh. The public health impacts of the natural gas cycles are an order of magnitude smaller. Occupational health impacts from the coal fuel cycles are also significant, mainly from pollution (dust and radon) in underground mines but they are largely internalised through wages and would be much reduced for open pit mines.

124. A further important dimension of external costs is that of energy security, including the value of diversity within an electricity supply system. Nuclear energy creates a new and abundant energy source that would not exist otherwise, extending the world's energy resource base and providing greater security and diversity through its unique characteristics. Although security of supply is not perceived as a major issue for most countries, the reserves of conventional oil, the most essential fossil energy resource, are concentrated in the Middle East, which could cause problems in the event of political instabilities there, even if the market is seen today as functioning well. Some countries depend on imports from distant sources for their natural gas supply. Diversity and security of supply are designated as a policy priority in the shared goals of IEA Member countries.

Environmental dimension

125. The core indicators for the environmental dimension of sustainable development include criteria related to natural resource management, climate change, air and water quality, and biodiversity and landscapes. Environmental hazards arising from nuclear energy mainly result from radioactive emissions and waste. The nuclear industry in OECD Member countries has undertaken great efforts to ensure that the environmental risks from nuclear energy are kept within socially acceptable levels established by independent regulatory agencies.

126. The nuclear electricity generation chain does not release gases or particle that cause acid rains, urban smog or depletion of the ozone layer. Carbon dioxide emissions from the entire nuclear fuel cycle are negligible. A single large nuclear power plant of 1 GWe capacity offsets the emission of about 1.75 million tonnes of carbon each year if it displaces coal, about 1.2 million tonnes if it displaces oil, and 0.7 million tonnes if it displaces natural gas. The actual figures will vary with capacity factors, thermal efficiencies of fossil-fuelled plants, fuel properties, etc. A nuclear plant will also offset the emission of SOx, NOx and particulate, thereby contributing significantly to local air quality.

Natural resource management

127. Efficiency of resource use is a key indicator of sustainable development in the energy sector. Nuclear power plants of the present generation operated once-through extract more than 10 000 times more energy per unit mass from uranium than other technologies do from fossil or renewable fuels. This very high energy density is a measure of resource efficiency. A much smaller amount of material is extracted, processed, stored, and transported for each kilowatt-hour of electricity produced than for other sources, and the waste volumes are also proportionately smaller.

128. Uranium has no significant use other than nuclear energy production. Producing electricity with uranium extends the overall resource base available for human use, provides greater diversity of choice and allows the use of other resources, such as hydrocarbons, where they are most effective, e.g., transportation or petrochemicals.

129. The world's nuclear power plants consume the equivalent of about 60 000 tonnes of natural uranium per year. Known uranium resources represent more than 70 years of present consumption [24]. Uranium reserves, proven and economically exploitable, represent nearly 40 years of current consumption. The ratio of reserves to consumption is similar for uranium and oil [25]. As for any mineral resource, current reserves represent only what has been found because it has been looked for, with a fairly short-term economic return in mind. There is not much incentive to explore for uranium now if it will not be brought to market for many decades. It is known, however, that uranium is abundant in the earth crust and conventional resources are estimated to represent some 250 years of current consumption.

130. Uranium resources and reserves are distributed among many countries in different regions of the world, providing diversity and security of fuel supply. They occur in rock formations that are generally different from those yielding fossil reserves, so there is a geological diversity as well. The high energy content of the fuel, the stability of its ceramic form and the low share of fuel in total nuclear electricity generation cost make it feasible and cost-effective to maintain strategic inventories at reactor sites that provide a high level of security, allowing ample time for any interruptions of supply to be resolved.

131. Furthermore, nuclear fuel supply may continue to be sought from various sources other than newly mined uranium, including recycled materials and thorium. The capacity for recycling of nuclear fuel is a unique feature that distinguishes it from fossil fuels which, once burned, are largely dispersed into the environment in gaseous or particulate forms. The used fuel from the once-through nuclear fuel cycle

contains fertile material that can be converted to fissile plutonium in adequately designed reactors. The current once-through nuclear fuel cycle uses mainly the fissile ^{235}U that constitutes less than one per cent of natural uranium. The resource base can be extended by a factor of about 30% by reprocessing the fuel and recycling the fissile material as mixed oxide fuel (MOX) in light water reactors. This technology has been developed and utilised to a significant extent in Europe and is being deployed in Japan.

132. By converting the bulk of the uranium resource to fissile material in fast neutron breeders or other types of advanced reactors, it is possible to multiply the energy produced from a given amount of uranium by 60 times and more, as compared with present reactors using the once-through fuel cycle. A decision to move to this type of reactors and fuel cycles could transform the used fuel repository or storage facility into a veritable mine of nuclear fuel. That is part of the interest in maintaining a capacity for retrieving the spent fuel, seeing it as a potential resource rather than waste. Because such fuel cycles would permit so much value to be extracted per unit mass of natural uranium or thorium, much lower grade ores of both elements could become economic. This would make nuclear energy a long-term energy source that could supply a large part of an increasing world energy demand. This recycle capacity contributes to an even higher level of overall resource efficiency and productivity, and to sustainable development goals.

Radiological protection

133. Radiological protection is essential to ensure that nuclear energy is compatible with sustainable development. Though the risks associated with radiation are among the most extensively studied hazards known to man, several factors increase public anxiety about radiation. It is invisible, unfamiliar, difficult to understand, and probabilistic in its effects, which to the public means uncertain. Radiation from nuclear fuel cycle facilities is produced by complex technologies, controlled and regulated by institutions that may appear remote from local experience. However, nuclear energy is not unique in this regard.

134. Since the beginning of the nuclear industry, OECD countries have established infrastructures for radiation protection including legislation, expertise, regulation and an awareness of radiation safety issues [26]. The principles that support the radiation protection approach and system are consistent with the goals of sustainable development. The effectiveness of these systems may be measured by the status and trends in radioactive emissions from nuclear facilities and the exposure of the public and workers to radiation.

135. The International Commission on Radiological Protection (ICRP), a non-governmental body of experts, makes recommendations for the protection of people from the harmful effects of ionising radiation that are reflected in national regulations. The latest recommendations of the Commission for a system of radiological protection were published as ICRP Publication 60 in 1991 [27].

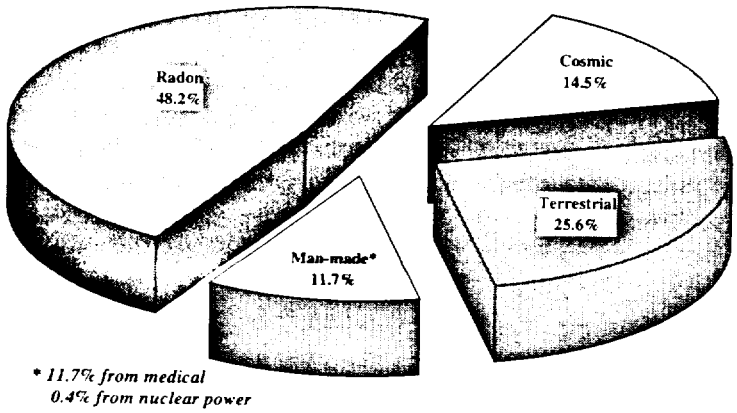
136. The primary aim of radiological protection, as stated by the ICRP, is to provide an appropriate standard of protection for mankind without unduly limiting the beneficial practices giving rise to the radiation exposure. Standards and recommendations are based on limiting by all reasonable means the risk of health effects, adopting a precautionary approach, but not on eliminating that risk entirely. Three principles form the framework for protection concerning practices that involve exposure: justification of the activity; limitation, i.e. keeping individual doses within regulatory limits; and optimisation, i.e. keeping doses as low as reasonably achievable (ALARA), economic and social factors being taken into account.

137. Regulatory standards for radiation apply to those human activities which cause public and/or worker exposure. The dose limits recommended for these activities are 1 mSv[2] per year for exposure of the

2. The Sievert (Sv) is the unit of radiation dose. Since it is a large unit, doses are reported usually in milli (mSv) or micro (μSv).

public, and 20 mSv per year for exposure of workers. These limits can be compared with the average dose from natural background radiation of about 3 mSv per year, noting that actual figures vary widely with location. The natural variation in background radiation results in some regional populations being exposed to as much as about 10 mSv per year, with small populations being exposed to even higher natural doses. No effects have been identified in these cases. Figure 3.1 illustrates sources of exposures from radiation.

Figure 3.1 **Average shares of annual exposures to radiation from natural and artificial sources**



138. The driving force in operational radiation protection being the ALARA principle, the public and most workers generally receive only a small fraction of the regulatory limits as a result of activities undertaken within the nuclear energy sector. Typically, for populations living around nuclear power plants, the annual doses from the plant to the most highly exposed members of the public range from 1 to 20 μSv [28, §146], that is, between 50 and 1 000 times less than the annual limit. Conservative estimates for the most highly exposed individuals living near fuel reprocessing plants can range from 200 to 500 μSv [28, §146], or less than half the annual limit for the public. The average annual dose to workers in all nuclear fuel cycle activities is around 3 mSv [28, Table 3], which is comparable to the natural background or to the 2 to 3 mSv [28, §163] of occupational exposures received annually by air crews due mostly to cosmic radiation at high altitudes.

139. Occupational exposures at nuclear power plants, and within the fuel cycle in general, have been dropping for the last ten years or so, such that current levels of annual collective dose per reactor in 1998 are less than half what they were in 1987 [29]. At present, the dose commitment from the entire nuclear power industry is around 300 times lower than the natural background, and there is a trend of decreasing radioactive emissions per kWh [28]. Further progress is expected with improvements in operating procedures, plant design changes and fuel cycle developments.

140. Radiation protection is a dynamic field. It benefits from continuing R&D. Research into biological susceptibility to radiation may help to target protection standards. Other promising areas include continuing epidemiological studies and research on the effects of different kinds of radiation, doses and dose rates; the synergy of radiation with other health impacts, and the role of radiation in the multi-step process of cancer inducement [30]. Radiation protection will also improve further with new developments in instrumentation and in the management of radiation in the workplace.

141. In the case of radiation protection, public concerns seem to be more associated with the institutions and processes, and less with the actual risks and hazards, than for other energy sources or industrial activities. Thus the social aspect of these concerns must be addressed. The factors affecting

public concern include the perceived benefits associated with the activities leading to the additional dose received, the need for those activities, their advantages over alternatives and the degree of control over the decision [31]. Policy and processes are key factors in this regard, although education and information about the hazards of radiation, the radiation protection regime, and risks in general, have an important role to play. Processes will be required, depending on the specific situations, that give equal importance to two sets of criteria without sacrificing the importance of either: the scientific nature of the risks involved; and the democratic right of citizens to participate in decisions that affect them, and to have their legitimate concerns taken fully into account.

Safety

142. If nuclear energy is to play a role in sustainable development policies, the health and environmental impacts of nuclear facilities and transport of nuclear materials, that are very small in routine operation, should remain below socially acceptable limits even in accidental cases. It means that the probability of a severe accident leading to off-site releases must be kept very small and that the consequences of such releases, should they occur, must be limited. In the OECD countries, nuclear power plants and fuel cycle facilities, operating under independent and competent regulatory regimes supported by a robust infrastructure of legislation, regulation, and standards, have achieved good safety record.

143. The amount of fuel to be transported for generating nuclear electricity is small owing to the high energy density of nuclear fuel. However, transport of nuclear fuel to and from nuclear power plants requires adequate packaging and regulatory measures to protect humans and the environment from being exposed to hazards from radiation. Physical security of sensitive materials should also be ensured. Regulations for the safe transport of radioactive material were published for the first time by the IAEA in 1961 and are revised and updated on a continuing basis. This regulatory regime has proven its effectiveness by the record established in the last 30 years in which there has been no known case of significant injury due to radioactivity in the transport of civil radioactive material.

144. Since nuclear facilities, and in particular reactors, are complex systems with a large inventory of radioactive materials, they have the potential to cause significant damage and require comprehensive safety systems. The basic technical approach to reactor safety is the defence in-depth concept representing five successive barriers. Careful implementation of this concept in nuclear power plant designs has resulted in a number of control, limiting and protection systems including multi-redundant stand-by, active and passive engineered safety features. Also, at various stages early in an accident sequence, a reactor protection system will intervene to stop the chain reaction and human actions will complement the prevention of an accident.

145. The risk of an accident leading to core damage has been estimated to be below 10^{-4} per plant operating year for reactors in operation in OECD countries. Taking into account the containment measures along with severe accident management and mitigating measures, the probability of a major external radioactive release should be further reduced by a factor of at least ten. This implies that for the individual member of the public living close to existing plants the risk of exposure to a significant radiation release would be less than 10^{-5} per year. Since the mid-1980s, improvements to design and operating procedures have lowered significantly the risk of accident and indicators for reactor safety, as well as for radiation protection, show continuing progress.

146. The target for new designs is to lower the risk by a factor of ten as compared with current designs [32]. Both accident prevention and accident mitigation will be improved. Accident prevention will be enhanced by reducing the frequency of equipment failures and of human errors through improved man-machine interfaces, additional use of information technology, and self-testing protection systems.

Accident mitigation will be enhanced by introducing specific design features for severe accidents which will practically eliminate large early radioactive releases and thereby limit off-site consequences so that off-site emergency plans, including evacuation of the public, will not be necessary, even in the case of an accident with severe core damage.

147. The reactor design and quality of construction, along with sound operating practices, are not the only means of ensuring safety. The analyses of causes and consequences of the two accidents that occurred with nuclear power reactors – Three Mile Island in the United States in 1979 and Chernobyl in Ukraine in 1986 – have led to significant improvements in reactor safety. In particular, they highlighted the need for more attention to human factors, including training and procedures at the operator level and stressed the importance of a safety culture.

148. Safety culture means an overriding priority to safety issues, extending from national legislation at the top, through the regulatory processes, to the senior management of the operating organisation and further to each individual having the potential to affect safety. It also includes ensuring feedback from the bottom to the top, learning from the experience of the global nuclear industry, and understanding the root causes of events that could lead to accidents. The independence of regulatory bodies is of high importance in this regard. Regulators are developing methods to assess the safety culture at operating organisations and tools for early intervention to correct deficiencies [33].

149. Regulatory oversight focuses on ensuring that the reactor does not reach a condition where any threat to the integrity of safety barriers occurs. If the regulator has any cause to believe otherwise, the reactor will not be allowed to operate. Governments have the responsibility to ensure that effective legislation exists and that the regulatory agency is independent and competent, and has all the resources needed to fulfil its responsibilities. While the prime responsibility for safety rests with the operator of the facility, a regulator is essential to monitor the operator's performance against accepted standards. It must have the authority and means to implement safety measures, including the ultimate authority to shut plants down. Regulators, operators and governments should be on guard against complacent attitudes that could reduce the priority for safety, especially in an era of ageing reactors and increased competitive pressures.

150. Another challenge is to engage people in a process of comparative assessment of risks and benefits from various human activities, so as to achieve an optimal allocation of resources in support of sustainable development. People tend to be more concerned about low-probability high-consequence events than about more probable events with smaller consequences, even though the total impact of the latter may be greater [34]. For example, plane crashes get more attention than car accidents, although the latter claim more lives in total. Perceptions of the acceptability of risks also varies greatly with factors such as the degree of participation and control, the benefits, uncertainty about the likelihood or consequences of events, trust in the institutions that are involved, familiarity with the risks, fear of the consequences [35]. A comprehensive and consistent approach to risk management would contribute to enhance the effectiveness of control and mitigation systems and measures including nuclear safety.

151. With increased competition and privatisation, governments are withdrawing from their traditional role of supporting nuclear R&D. To the extent that safety research can be seen as a public good, like safety research in other regulatory areas such as food, medicine, and air quality, governments could consider some level of support for nuclear safety R&D. International co-operation on operations, regulation and safety research is an efficient way to share costs and facilities. International co-operation on safety matters is vital to ensure high safety standards throughout the world especially if nuclear energy is to be used in a growing number of countries.

Third Party Liability

152. The third party liability regime is unique to nuclear energy and addresses a number of relevant issues in the context of sustainable development. While traditional insurance deals with high-probability low-consequence events, the regime established for nuclear energy deals with low-probability high-consequence events. There are increasing pressures for insurance regimes to deal with events of comparable scale arising from real natural and environmental disasters, which have become very costly in recent years.

153. Although the high safety standards of the nuclear industry mean that the risk of an accident is low, the magnitude of damage that could result to third parties from such an accident is potentially considerable. It was thus recognised from the very inception of the nuclear power industry that a special legal regime would need to be established to provide for the compensation of victims of a nuclear accident; the ordinary rules of tort and contract law were simply not suited to addressing such a situation in an efficient and effective manner.

154. If the ordinary law applied, victims would likely have a great deal of difficulty determining which one of the many entities potentially involved in the nuclear accident was actually liable for the damage caused. Also, without a limit on the amount of liability imposed upon the liable entity, that entity would not be able to obtain financial security, such as insurance, against that risk. In addition, accounting principles dictated that the operators of nuclear installations and the suppliers of nuclear goods and services simply could not carry such potentially large liabilities on their books, regardless of how unlikely a severe accident might be.

155. The nuclear liability regimes result from a reconciliation of several goals: providing adequate protection to the public from possible damage; ensuring that the growth of the nuclear industry, from which this same public benefits, would be protected from excessively burdensome liabilities; marshalling international insurance market resources to ensure that sufficient financial security is available to satisfy potentially large claims; and ensuring that liability and compensation mechanisms address the trans-boundary nature of nuclear damage. This led to a system, reflected in both national and international regimes, that is based upon the following principles: a nuclear operator's strict and exclusive liability; limitations upon the time and amount of a nuclear operator's liability; and the nuclear operator's obligation to financially secure its liability.

156. National regimes are implemented through legislation in most OECD Member countries, and progressively in non-member countries. The international regimes are reflected in two Conventions: the 1960 Paris Convention on Third Party Liability in the Field of Nuclear Energy which was established under the auspices of the OECD and to which 14 OECD Member countries from Western Europe are Contracting Parties; and the 1963 Vienna Convention on Civil Liability for Nuclear Damage which was established under the auspices of the International Atomic Energy Agency, which is worldwide in character and to which four OECD Member Countries[3] are Contracting Parties. The two Conventions are themselves linked by a Joint Protocol.

157. Since the Chernobyl accident, the international nuclear community has recognised that the special regimes established as early as the 1960's were in need of extensive revision. Those revision efforts are expected to be completed in 2001. The amounts of liability covered by the industry are being increased by various means in different countries; so are the time periods within which claims for personal injury may be brought and the scope of damages which may be recoverable. The international conventions are

[3]. The Czech Republic, Hungary, Mexico and Poland each acceded to the Vienna Convention prior to becoming Member Countries of the OECD.

adopting higher limits or permitting unlimited liability, and various pooling schemes have increased the total amounts available for a given accident. The significant increases either being implemented or currently envisaged for operator liability amounts go a considerable way towards internalising fully the costs of nuclear accidents and reflecting sustainable development goals.

158. The liability limit imposed upon nuclear operators under national legislation varies considerably between OECD Member countries. These variations result from the differing limits imposed under the two international Conventions, from the extent to which countries utilise nuclear power for energy production and from other political and economic factors. It should be noted as well that several OECD Member countries have adopted national legislation providing for the unlimited liability of their nuclear operators for nuclear damage, albeit with corresponding financial security amounts that are, of necessity, limited.

159. The argument against limiting the liability of the operator is that the operator is subsidised by not having to face the full value of an accident, and will have less incentive to ensure safety, thus making an accident more likely. On the safety issue, governments have argued that the operator and the operating staff have a strong self-interest in plant safety, and that the operator is strictly regulated by a competent independent organisation.

Radioactive waste management

160. From a sustainable development perspective, waste management practices are intended to ensure the confinement and disposal of waste materials in a way that minimises harmful impacts on humans and the environment at any time. Radioactive waste can be short- or long-lived depending on its intrinsic rate of decay. The main challenge for nuclear energy is long-lived waste that remains hazardous in the very long term. However, this characteristic is not unique to radioactive waste. Other types of toxic waste remains in the biosphere indefinitely, or cause enough impact in the near term to permanently influence the longer term. Waste arising from the use of nuclear energy represents small volumes, typically less than 1% of the overall toxic waste in countries with a nuclear energy industry, and they can be isolated from the biosphere at affordable costs using available technologies.

161. The estimated cost of waste management and disposal represents a few per cent of the overall cost of nuclear generated electricity [18]. This cost is accounted for by nuclear electricity generators and reflected in the prices paid by consumers, i.e., internalised. In most OECD countries, funding for the repository is obtained from a charge to the consumer on the electricity whose production results in the waste. The funds accumulated and set aside will then be used when needed to cover waste disposal expenses. While the overall cost of waste management and disposal is rather high in absolute value, it does not add significantly to nuclear electricity costs once spread over the large amount of electricity generated.

162. Lightly contaminated materials, or materials whose radioactive contamination is relatively short-lived, that constitute the bulk of the volume of radioactive waste, present relatively low hazards. All OECD countries treat, transport and store such waste routinely, and methods for its management and disposal are well established. Its radioactivity decays to background levels in a few hundred years and does not create any major health or environmental problem. It can be disposed of in shallow or ground-level repositories that are in operation already in many OECD and non-member countries. There is a trend to reduce the volumes of this type of waste per unit of electricity generated, in order to reduce costs and to lower environmental burdens [36].

163. Uranium mining and milling activities generate tailings, which are radioactive at a relatively low level for very long periods and occupy surface areas of many hectares. The tailings have the same kind of volumes, depending on the ore grade, as tailings from other mining activities. Assessments of current

tailings practices for licensed facilities in OECD countries have shown that the tailings can be effectively managed over long periods with minimal long-term health and environmental impacts. Future uranium mining developments in OECD countries will undergo close environmental scrutiny before being allowed to operate [37].

164. Long-lived waste, mostly solidified high-level waste conditioned through reprocessing or – for countries which have decided not to recycle – spent fuel, represents only a small fraction of the overall waste volume. The amount of spent fuel produced annually in the world is about 10 000 tonnes. The high-level waste may remain hazardous over many thousands of years and needs to be isolated from the environment over commensurably long time scales. However, the most intense part of the radioactivity and heat output is actually short-lived. It initially decays rapidly, making handling, further processing and disposal easier as time goes by. In OECD countries with nuclear power programmes, spent nuclear fuel and long-lived waste produced under licence are stored in safe and reliable pools or in dry storage canisters. The interim storage may be carried on safely and economically for many decades.

165. Although there is no environmental, technical or economic incentive for early disposal, interim storage is not a permanent solution, and progress toward final disposal is viewed as the best approach to minimise burdens for present and future generations. It is generally agreed that the best way to achieve long-term isolation is deep underground disposal in stable geological formations, a concept that is over 40 years old. Repository designs are based on a multiple-barrier approach ensuring isolation of harmful waste from the biosphere.

166. Assumptions used to assess the safety of repositories have been tested in nature. Over a billion years ago in Gabon, a natural nuclear reactor functioned on and off for several million years, moderated by natural water flow through a uranium ore deposit. The fission products from the nuclear reactions that took place did not move more than a few centimetres from their location of origin [38]. Also, other phenomena important for geologic disposal, as diverse as metallic corrosion, evolution of clay properties, solute migration in different media, chemical sorption and long-term climate change, have been studied in natural analogues, thus allowing a check of the understanding of processes that are too slow, or too large in scale, to be directly measured in the laboratory or the field.

167. Scientists and experts consider that nuclear waste can be handled safely and isolated from the environment for thousands of years and more until they become harmless. Technology for constructing and operating repositories is now mature enough for deployment, based upon experience gained world-wide that covers underground research laboratories and, in several countries, underground facilities for disposal of radioactive waste, including waste containing longer-lived radioactive components. The first purpose-built geologic repository of long-lived waste, that started operation in March 1999 in the United States, will provide additional industrial experience.

168. The nuclear industry has accepted its long term responsibilities with regard to containing its waste over its active lifetime. It set up standards for waste management in the long term at a time it was less common to do so in other sectors involving hazardous materials. However, radioactive waste has given rise to more public concern than most other types of toxic waste that also require adequate management and disposal policies [39]. The public does not necessarily share the high level of confidence of the scientific and technical community in the long-term safety of nuclear waste management. The inevitable uncertainties that arise in dealing with projections over thousands of years lead to reservations about committing to a course of action whose consequences cannot be fully assessed.

169. The process of finding a site for high-level waste disposal, developing a repository, putting waste in it, and closing it will take the better part of a century. The repositories now being planned are not expected to begin receiving waste until 2020 or later, and will remain open for many decades. The waste

will remain retrievable, at least during the initial phases of the repository, and even beyond at an increasing cost. Monitoring and surveillance can be continued beyond the closing period. There will be many steps, and at each step the opportunity for regulatory action and for public participation in decisions. In particular, there is time to engage in comprehensive processes to decide on future steps, including the siting process. There will be opportunities to alter direction, or to benefit from new technologies. This approach guarantees that future generations will be given opportunities to make their own choices.

170. There is a need for coherent policy and a strict regulatory framework, with identified decision points that allow for public dialogue and participation. As for other controversial projects, universal support is not a realistic aim. On the other hand, society must be assured that every decision taken is a well-considered one. The process of step-wise decision-making should allow opportunities for input from all affected groups, on topics of their choice, and should include rigorous technical reviews as well. The technical information will be an essential input to the discussion but not the only one. Politically, the public concerns are as important in the process of decisions about long-term waste management as the confidence of the scientific community. Ultimately, governments are responsible for making decisions that achieve both an appropriate level of public support and an acceptable level of safety. If the challenges to radioactive waste management are social and political, the solution, while based on good science and technology, must be social and political as well. Sustainable development is about equity and participation as much as it about science and technology.

Social dimension

171. The human and social dimension of sustainable development comprises human capital in the form of knowledge, education and employment opportunities, human welfare, equity and participation, and social capital in the form of effective institutions and voluntary associations, the rule of law, and social cohesion. From these viewpoints, nuclear energy, like a number of other advanced technologies, is characterised by a net contribution to human and social capital and a challenge in terms of public acceptability and widely varying perceptions of the risks and benefits.

Human capital

172. Nuclear energy is one of the great scientific discoveries of the 20th century, and represents a valuable component of intellectual capital to be passed to future generations. It has a strong foundation in science and technology. It is an energy source based more on knowledge, and less on materials, than most others, and so should be amenable to greater improvement through gains in the gathering, processing and communication of information. It provides high-tech jobs and outlets for creativity at the highest levels. Nuclear science and technology interact productively with other fields such as medicine, robotics, sensors and control systems, materials sciences, and information technology.

173. The human capital for nuclear energy includes the highly qualified manpower that is essential for the design, construction and operation of complex facilities within the fuel cycle chain, including uranium mining and radioactive waste management, and for regulatory activities and R&D. These skills are an important part of a modern society's overall range of scientific and technological resources. Renewal of this human capital, and of nuclear R&D capacity, will ensure that nuclear energy continues to contribute to scientific knowledge and technological opportunities in and beyond the nuclear fuel cycle.

174. To create a competitive electricity source from a breakthrough in fundamental science, extensive R&D programmes were necessary. According to the statistics published by the IEA, total government budgets for nuclear fission R&D in IEA Member countries during the period 1974-1995 ranged between 4 and 9 billion USD per year [40]. Now, nuclear energy has reached industrial maturity and R&D in

commercial support of existing reactors may be taken up by industry, or even reduced to some extent. However, in order for nuclear energy to contribute effectively to sustainable development goals, R&D oriented to the longer term may be required. Governments can contribute particularly to R&D that supports public policy goals in areas such as safety, regulation, and environmental impact including waste management. International co-operation in these areas helps to make efficient use of human resources, funds and facilities.

Institutional framework

175. The institutional framework established around peaceful nuclear activities is unique in many ways. Nuclear fission was discovered in 1939 and its first major application was the development of nuclear weapons. Given national security implications, governments of countries that developed peaceful applications of nuclear energy did so at the highest political levels, through institutions dedicated to that end. In the nuclear weapons states, these institutions were often dual-purpose, with both military and civilian goals. National nuclear institutions usually preceded the establishment of broader energy institutions. The same is true internationally – the formation of the IAEA and the NEA predated by many years the creation of the IEA and other bodies looking at energy in a broader context. Today, nuclear energy remains an issue generally considered at the highest levels of government in most countries.

176. The existence of nuclear-specific institutions, with separate funding and in many cases dedicated national laboratories, was initially beneficial to a development of nuclear energy consistent with governmental policy objectives. However, in retrospect this isolation of the nuclear institutions might have been detrimental to its integration in the basket of options considered within the broader energy policy debate. Also, the sheltered situation of the nuclear industry did not facilitate its timely adaptation to market competition. Moreover, the public perception of nuclear energy has been negatively influenced by the impression of secrecy associated with the separation of nuclear institutions from other governmental bodies.

177. The original nuclear institutions generally were not independently regulated, as national security was the priority at that time, rather than safety and environmental protection. Activities that were not independently and adequately regulated have been the sources of many of the more serious safety and environmental problems that have occurred in the nuclear industry. While the responsibility for safety rests with the operator, effective and independent regulation, backed by strong legislation, makes an essential contribution to nuclear safety and to a safety culture. It also builds confidence in nuclear energy.

178. Independent regulatory bodies now in place play a key role in ensuring that nuclear energy activities are carried out in compliance with high safety and radiation protection norms. In OECD countries, nuclear regulatory bodies have established high standards of expertise and independence, and have helped to ensure a track record on reactor safety, waste management and radiation protection that has generally been very good. The key attributes of an effective regulator may be easier to achieve in democratic systems, where publicly acceptable standards of safety are achieved through legislation enacted by an elected parliament, and where institutions are more likely to be both trustworthy and trusted. Continued support for effective, independent regulatory bodies is essential for nuclear energy to contribute to sustainable development policies, as is the encouragement of effective regulation in countries outside the OECD.

179. In most countries with nuclear energy activities, there are strict legislative requirements in place to ensure the health, safety and security of workers and the public, and the protection of the environment. However, not all countries have comprehensive nuclear legislation in place and, even where the legislative requirements extend explicitly to the goals of sustainable development, there can be gaps in how those

requirements are administered. Nuclear regulatory authorities need sufficient resources, legal authority and incentives for compliance to be able to administer the regulations under their jurisdiction. Institutions for the long-term management of nuclear wastes will require careful attention in their design, regulation and funding.

Non-proliferation

180. In order to contribute to sustainable development goals, nuclear energy should not contribute to the proliferation of nuclear weapons. It is a major concern for policy-makers and the public that sensitive nuclear materials, in particular highly enriched uranium and plutonium, as well as technology and equipment developed and used for civilian activities, could be diverted to military or terrorist purposes. However, the potential proliferation of nuclear weapons is not a danger stemming from the peaceful uses of nuclear energy: renouncing nuclear energy would not eliminate the risk of nuclear weapon proliferation.

181. The proliferation threat must be seen in the political context of international security and the overall strategic role of nuclear weapons. The basic political challenge is to improve international relations, and the understanding of the consequences of nuclear war, to the point where countries do not see nuclear weapons as legitimate instruments of defence or diplomacy. The threat of a nuclear exchange between the superpowers has receded with the end of the Cold War. Isolated countries confronted by powerful adversaries and countries in regions with great tensions are the most likely candidates to perceive nuclear weapons as attractive. Finding other solutions to their security problems may reduce their incentives to acquire such weapons.

182. The most important instrument for discouraging the production or diversion of weapon-grade materials is the permanent Treaty on the Non-Proliferation of Nuclear Weapons (NPT) of 1970 that commits 187 countries and carries an explicit commitment by the non nuclear weapon States to receive the benefits of peaceful nuclear technology in return for agreeing to forego nuclear weapons. The compliance with the latter commitment is being verified by an international safeguards regime, administered by the International Atomic Energy Agency (IAEA). Through its safeguards system the IAEA can verify that nuclear activities in non nuclear weapon States party to the NPT are being used exclusively for peaceful purposes. Most countries are parties to the NPT and accept international safeguards on their nuclear programmes. The effectiveness of safeguards controls has been strengthened recently in order to enable the IAEA to provide credible assurances about the non-diversion of declared nuclear material and the absence of undeclared nuclear material and activities.

183. Basic knowledge of nuclear weapons technology is fairly widespread, although many aspects related to fissile material and weapons production remain closely guarded. With the political will and the commitment of adequate funds, a country with a sufficient level of scientific and industrial know-how will be able to develop weapons. If a political decision is taken, nuclear weapons can be acquired independently of any civilian nuclear power programme. In fact, historically, most countries possessing nuclear weapons acquired them before they developed peaceful applications of nuclear energy. They have used dedicated facilities and staff for military activities, including the production of weapons-suitable fissile material, rather than civilian power programmes.

184. A number of technical difficulties must be overcome in order to use a nuclear power programme as a source of materials for weapons. In particular, plutonium from reactor-grade fuel produced under normal operation for power generation is much less suitable for weapons than that from dedicated facilities with low fuel burn-up. Moreover, in countries having signed comprehensive safeguards agreements, all nuclear facilities are subject to peaceful use commitments verified by international controls. Civilian nuclear power programmes under international safeguards are not very attractive for use in a clandestine

nuclear weapon programme, since a misuse of material under safeguards would have a high probability of being detected. A country that takes the political decision to embark in a military programme would likely use dedicated, and probably clandestine, facilities under separate military control.

185. Controls also encompass research facilities and facilities handling highly enriched uranium or separated plutonium since such fissile materials may be used for developing nuclear weapons. Technologies that enrich uranium or separate plutonium are considered sensitive as they could contribute to a weapons programme. They are used by a limited number of countries. The enrichment of uranium requires a complex physical process to separate the different isotopes of the same chemical species. Plutonium, which is created in nuclear reactors, can be separated chemically from the used fuel, an easier process, though one still fraught with technical problems and hazards. Generally, "dual-use" technologies that can have critical applications for both civilian and military goals must also be carefully monitored. Dual-use aspects should be and are an important focus of the international non proliferation regime. Monitoring dual-use and other proliferation-sensitive activities also takes place through national technical means.

186. Just as nuclear power programmes everywhere in the world must be safe, they must also be secure against the threat of proliferation. In spite of significant improvements, concerns remain about inadequate controls over nuclear weapon materials in some countries, illicit trafficking in fissile materials, the possibility of clandestine activities by some countries in violation of their NPT commitments, and the activities of countries that remain outside the NPT. Continued international efforts are necessary to deter and prevent the diversion of sensitive materials. This is a key objective from a sustainable development perspective and has to be ensured through policy measures and technology progress, e.g. reactor designs and fuel cycle processes that integrate non-proliferation criteria, including safeguards requirements. The Convention on the Physical Protection of Nuclear Materials and the IAEA programme aimed at preventing illicit trafficking are already serving as effective tools to address the issue.

Public participation and political aspects

187. Public participation in policy making and public acceptance of processes and decisions are central to meeting the social goals of sustainable development in terms of equity and transparency. In democracies, public concerns and political aspects have to be addressed by policy makers. For nuclear energy, as for a number of other technologies, most concerns arise from the public perceptions of the risks involved. Achieving acceptability will require an understanding of risk perception and communication, and the development of processes and institutions that involve greater participation by the public. While such participation might limit momentarily the use of nuclear energy, it is a key to the social acceptance required for any technology to contribute effectively to sustainable development.

188. Risk assessment, communication and management is a rather new discipline, still in a period of evolution. Initially, it was believed that frequent differences between expert and public perceptions of risk arose because the experts were right and the public was wrong, due to lack of education or information about the risks. The challenge was to educate the public so that it would understand the risks and, by implication, come to agree with the experts. More recently, it has been argued that the public is not wrong, and that its concerns must be addressed on its own terms [41]. What is needed is not just a one-way flow of information to the public, but rather more dialogue and participation.

189. The dissemination of accurate information is essential, but it does not seem to be enough by itself. Communication is a two-way street, and trust in the communication process often seems to be more important than specific information on technical matters. Authoritative information can be offensive if the implication is that the audience must take the information on faith, and that its fears are due to its own ignorance. Also, while comparisons of options are essential in making good policy decisions, pointing to

other activities that cause greater harm does not of itself inspire confidence. Risk comparisons in a controversial context may be perceived as a means to trivialise anxieties and hide problems. The context and criteria for comparisons have to be accepted before the results are given credibility. The role of governments is essential on those very sensitive issues.

190. Many factors affect the way risks are perceived. A major factor is whether risks are seen as voluntary or imposed. Voluntary risks, such as those taken by driving a car, are far more readily accepted than those which are perceived as imposed, such as those associated with nuclear energy [42]. Another important factor is the perceived benefits that balance the risk. In the case of nuclear energy, the benefits are largely diffuse and perceived as obtainable by other means. Nuclear energy is not a consumer product or activity that builds brand loyalty like a car, or which gives people a sense of participation, like energy-efficient windows. Often, nuclear energy is an unseen part of the electricity supply mix, therefore, its risks seem to be perceived as more immediate and dramatic than its benefits. Where the need and the benefits are clear, or where nuclear facilities are familiar and seen to be properly managed, the risks tend to be more accepted.

191. Nuclear risks are also seen as more acute than other energy-related risks such as climate change or even local air pollution. A potential accident at a local nuclear plant may not affect the long-term future of the earth, but will be seen as having a very direct negative impact on the lives of nearby people. If a project is seen primarily as bringing a risk to a community, its messages are not likely to be well received. The proposed siting of a nuclear facility may not be the most propitious occasion for educating the local public about nuclear issues. It is important that the information be provided on an ongoing basis, and that the process of decision allow the time and opportunity for a thorough discussion to be carried out. Credibility takes time to establish. Once lost, it is hard to restore.

192. Other factors affecting risk perception include: the degree of control, the familiarity of the technology, the degree of uncertainty or controversy surrounding an issue, the fear of consequences, the perceived interests and power of the participants, the degree of trust in institutions, the process of consultation or decision-making, and the ideas and values of the immediate community in which people live. The impact of previous experience and the treatment of this and similar events in the media, as well as broader social and political phenomena involving the participants, can all condition people's perceptions and determine their positions on issues and their response to specific messages. Plans for communications and processes must keep in mind the mindset and the attitudes of those involved.

193. The acceptability of nuclear energy will depend partly on a better understanding of nuclear matters, nuclear safety in particular, at the level of the public. This is part of the broader issue of public attitude towards new technologies and technical development. In many cases, as noted above, there is a large gap between the understanding of risk issues by scientists and experts, on the one, hand, and the lay public, on the other. This gap is often filled by the media or by special interest groups. If the authorities are not seen as providing full and accurate information, or responding to people's concerns, they will lose credibility and other sources will fill the gap. Thus it is important for the authorities to provide accurate and timely information and to respond to the public's concerns as they arise. Public education on nuclear energy issues will have to be addressed to all social categories and all ages.

194. Governments wishing to consider maintaining the nuclear energy option as a contribution to sustainable development may want to devise processes that give people a better sense of participation in nuclear decisions. Public hearings and debates can enhance confidence in the relevance of a decision about continuing with nuclear energy. Even though some of the players may use the occasion to rehearse well-entrenched arguments, it is important for the public to see that its concerns are thoroughly debated in the specific context of the decision at issue. Building trust seems to be one of the keys to acceptability. Trust requires listening carefully to people's views and acting on them. This is not to say that decisions should be

based on perceptions rather than science. One has to have both the science and the trust. Once trust is established the process becomes easier.

195. Societies have to develop a consistent and broadly acceptable approach to risk management across the whole range of human activities and to implement processes for doing so. Sustainable development demands a comprehensive long-term global approach. It will also depend on many near-term actions and decisions at the local level. Nuclear energy must demonstrate its effectiveness on both sets of scales. Dealing with public concerns and negotiating acceptable solutions will be a challenge. The role of governments will be crucial in setting out the processes and acting as a source of objective information, and as the ultimate decision maker. Governments will have to dedicate adequate resources for this purpose.

International co-operation

196. Nuclear activities in any country have an impact on programmes in other countries. As with other contaminants, radioactive releases can have transboundary impacts. There is already a well-established international co-operation framework in the nuclear energy field covering R&D, regulations and legal aspects, exchange of information, technology transfer and material trade. The implementation of nuclear energy policies consistent with sustainable development goals may be achieved more efficiently with an increasing degree of international co-operation.

197. While most of the world's nuclear electricity is currently generated within the OECD area, most of the growth in the next few decades will most likely occur outside it, in developing and transitional countries. They will need co-operation and assistance on training, institution building, legislation and regulation, as well as a full exchange of information on operating experience, to ensure safety and good performance. Nuclear energy has a strong institutional base in OECD member countries, which can share their information and experience with other countries.

198. The International Convention on Nuclear Safety is a relevant example of trends towards more effective international co-operation in developing institutional frameworks. It has been ratified by about 50 countries and has entered into force recently. This and other conventions – the Convention on Early Notification of Nuclear Accident and the Convention on Mutual Assistance in Case of a Radiological Accident – are basic elements of the current international nuclear safety regime. States Parties to the Nuclear Safety Convention have agreed to submit on a regular basis their National Reports for mutual peer review. In these reports they are supposed to report on the status of implementation of all obligations specified in the Convention. The first review meeting took place in April 1999. This practice will be one more instrument to encourage countries to develop and strengthen the relevant institutions and the required safety culture.

199. Considerable progress in nuclear safety has been made in Eastern Europe and the former Soviet Union, but there are still some concerns among safety experts about some of the Russian-designed reactors, such as the Chernobyl-type RBMK reactors and the older Soviet-designed pressurised water reactors. Design changes and system improvements have been made. Reactor operations, along with in-service inspections and maintenance, have also improved, but more needs to be done to encourage a pervasive safety culture. Legislation is largely in place in those countries and regulatory agencies are acquiring the necessary independence and authority, but they still lack resources in many cases. Western organisations, including the OECD/NEA, are co-operating with the authorities in the Former Soviet Union and Eastern Europe to improve safety standards, and to promote modern legislative and regulatory regimes. Satisfactory responses to those issues are essential from a sustainable development perspective.

200. International co-operation in nuclear R&D is especially relevant to enhance the overall efficiency of national efforts and facilitate technology development. Governments and industries could benefit from

pooling resources and carrying out studies jointly instead of separately. As national nuclear R&D budgets are shrinking, co-ordinated strategies on investments in capital-intensive R&D equipment would facilitate technology progress and safety enhancement. Given their experience in co-operation and joint projects, international organisations like the NEA can play an important role in this regard. One of the challenges of international co-operation in a competitive environment, for nuclear energy as for other advanced technologies, will be to integrate the work of companies and business associations to the governmental efforts.

4. KEY ISSUES AND ROLE OF GOVERNMENTS

201. The data and analyses included in chapter 3, based on the experience accumulated on in the peaceful uses of nuclear energy, give insights on the relevance and potential contribution of nuclear energy to sustainable development goals and policy. Nuclear energy is one of several supply options. Its benefits, costs and risks should be analysed and compared with those of other options, including demand management. Since the information given in this report covers nuclear energy, it should be complemented by similar data and analyses on alternatives in order to provide a robust basis for policy making. Furthermore, as for any technology, the use of nuclear energy within national energy policies will be decided on the basis of criteria and trade-offs that will vary from country to country depending on specific domestic situations and priorities.

202. While economic deregulation will place emphasis on market mechanisms, governments will maintain a central role in ensuring the framework conditions for technology development. Governments will assess nuclear energy in the context of their overall policy on energy supply, environment and sustainable development. The outcomes will differ depending on domestic energy resources, present and past reliance on nuclear energy as well as public acceptance and political aspects. In the light of the transboundary issues raised by nuclear facilities, all governments will have interest and responsibilities in the field of radiation protection, safety, third party liability and non-proliferation. The role of government includes ensuring transparency across boarders in the field of nuclear safety.

203. The analysis of nuclear energy characteristics within a sustainable development framework shows that the approach adopted within the nuclear energy sector is fairly consistent with sustainable development goals of passing a range of assets to future generations while minimising environmental impacts and burdens. In this connection, the statistical data series compiled by the nuclear sector on a regular basis provide a sound preliminary approach to the establishment of indicators on sustainable development trends. Governments and governmental organisations should pursue their efforts in maintaining a consistent framework to measure progress in this regard.

204. Other characteristics of nuclear energy create challenges for its future contribution to sustainable development policies. The economic competitiveness for new nuclear power plants will remain an issue, even if a more level playing is established, and public concerns about nuclear risks and their management may limit the use of nuclear energy. The role of governments is important in this regard since they are responsible for getting the prices right to get the right technologies in place, and for providing the regulatory framework that may enhance public confidence in the ability to control and manage technological risks.

205. Existing nuclear power plants are economically competitive in most cases and perform well in deregulated electricity markets. Those plants represent an asset for utilities and governments, in connection with policies to address global climate change in particular. New nuclear units, however, are seldom the cheapest option in present markets and require high investments, that will need more than two decades to be amortised. A significant reduction in capital costs of nuclear power plants will be necessary and research and development efforts in that direction, such the Generation IV initiative in the United States, need to be continued.

206. From a sustainable development viewpoint, however, the competitiveness of different supply options should be assessed on the basis of the full costs to society, taking external costs into account and removing inappropriate subsidies, as well as integrating their contributions to alleviating the risk of global climate change and to the security and diversity of supply in a world energy system largely based on fossil fuels. Comprehensive studies on the comparative health and environmental impacts of alternative options,

at the national and international level, would be helpful in this regard. International bodies such as the OECD, the IEA and the NEA may assist governments in this field. Eventually, governments will be responsible for designing and implementing policy measures that aim at getting the prices right while meeting other public policy goals.

207. Governmental support to nuclear energy R&D and infrastructure should be assessed in the light of public policy objectives and in conjunction with the need to support other options that offer opportunities to meet those objectives. Government funded R&D should not substitute for industry supported R&D but complement it in the fields that are under the main responsibility of the government such as basic sciences, safety and environmental protection as well as innovative concepts for long-term development. Enhanced international co-operation in those R&D fields could improve the efficiency of national efforts through synergy and joint projects.

208. In OECD countries, nuclear energy in routine operation has low impacts on health and the environment. Its high standards of radiation protection and reactor safety ensure a low probability of accidents or releases that could lead to significant health and environmental impacts. Most indicators of radiation protection, reactor safety, and environmental impact show improving trends. In order to make a continuing contribution to sustainable development goals, nuclear energy will have to maintain its high standards for safety in spite of increasing competition in the electricity sector, ageing reactors, and the expansion of the industry to new countries and regions. The effectiveness of international regimes will need to be ensured through improvements in international agreements and controls whenever necessary.

209. Radioactive waste management policies in place aim at containing all hazardous substances throughout their active life. Safe interim storage is the current practice for long-lived radioactive waste that will eventually be disposed of in repositories. Geological disposal has been identified as a technically safe solution that can be implemented without affecting the competitive position of nuclear energy. While there is no technical urgency to implement long-lived waste repositories, it is important to construct and commission such facilities to fulfil the goals of sustainable development, including social acceptance of nuclear energy.

210. The role of governments is essential in formulating regulatory frameworks and policies that will allow a coherent step-by-step approach towards decommissioning of nuclear facilities and final disposal of all types of radioactive waste. They are responsible for decisions on long-lived waste disposal strategies and measures to ensure that adequate funds, collected from the users at the time they benefit from nuclear energy, will be set aside and guaranteed to cover in due course expenses associated with decommissioning of facilities and disposal of waste.

211. Effective regulation and high safety standards should be maintained in the nuclear energy field but those standards and norms should be put into perspective. It is important that governments support a consistent approach to risk management and regulation across society's activities, taking into account available resources, possibilities for improvement, and perceptions of risk. Societies should allocate their scarce resources for dealing with risks in ways that produce the best results.

212. The potential links between peaceful uses of nuclear energy and the proliferation of nuclear weapons merit special attention. Diversion from peaceful nuclear energy programmes is one possible route, although not the most likely one, to the acquisition of essential technology, equipment, or fissile material for weapons by countries or groups who seek them. Since proliferation is essentially a political problem, governments should seek political solutions, including confidence-building between countries and enhancing regional security.

213. An international non-proliferation and safeguards regime has been put in place to address this risk. This regime is regularly reviewed and adapted to keep pace with a wider access to nuclear technologies throughout the world. National export controls should be consistent with the aims of international agreements in this area. Non-proliferation concerns should be integrated into the development of new nuclear facilities and processes.

214. The national and international institutional frameworks that support nuclear energy are well established, especially in OECD countries that operate nuclear energy facilities. Nuclear energy has a tradition of exchange of information and experience and of international co-operation, through governmental agencies such as the IAEA and the NEA, that is worth pursuing. Nuclear laws, safety regulation, safeguards systems and liability regimes form a comprehensive institutional infrastructure that governments should maintain in OECD countries and contribute to establish in non-member countries that embark on nuclear energy programmes.

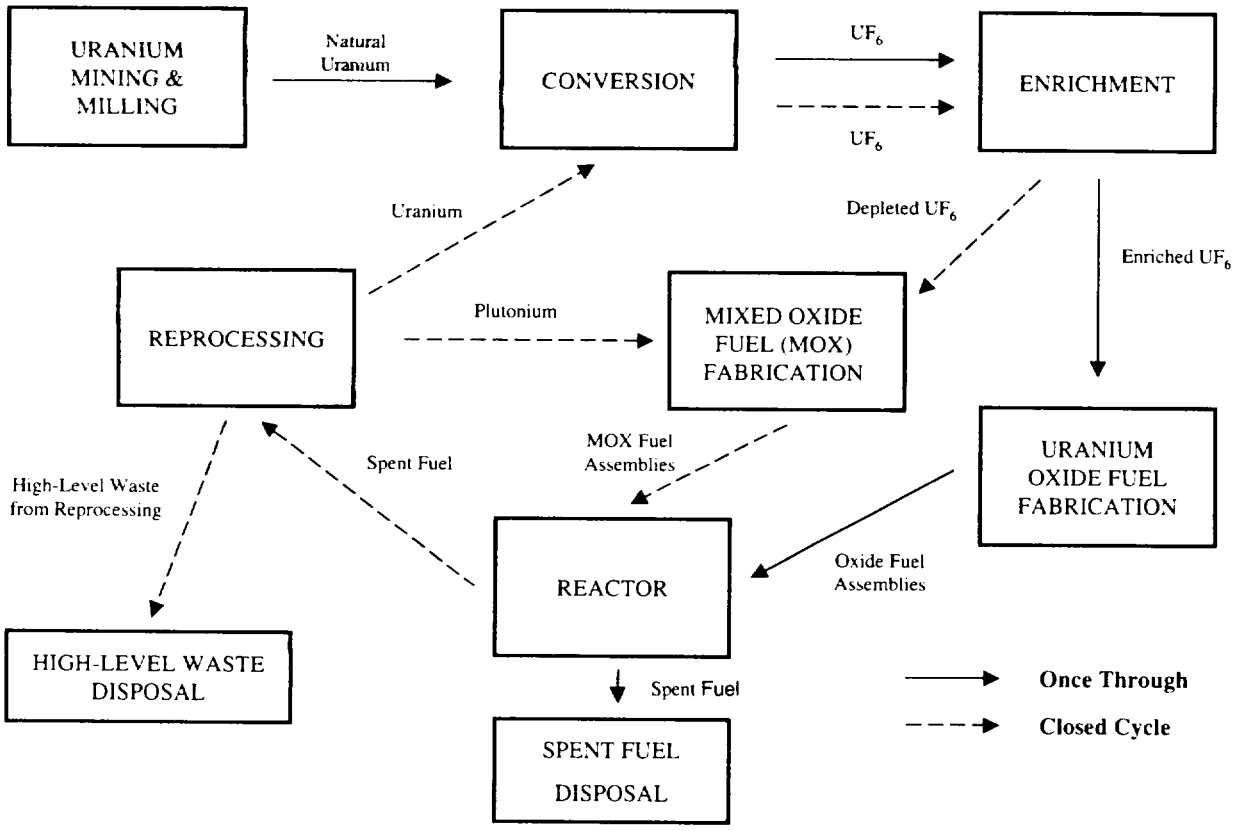
215. In order to meet sustainable development goals in the areas of equity and participation, nuclear energy will have to achieve a higher level of public acceptability than it enjoys in many countries today. New processes should be developed for public participation in nuclear issues generally, based on the best scientific information available but keeping in mind that communication must be a two-way street and that the public's perceptions and concerns must be heard and addressed. Governments have a key role in designing such processes, and allocating the required resources to their implementation. Education based on accurate information and good science will continue to be essential, but equity and participation will have their own importance. Ethical issues such as those raised by geological disposal of radioactive waste must be debated and put in perspective with other burdens passed to future generations such as the impacts of greenhouse gas emissions and other pollutants, and the exhaustion of natural resources. Other social and political issues have to be addressed in the process in an integrated way that allows for the identification of the full range of costs, benefits and possible trade-offs.

216. Technology transfer, technical assistance and co-operation with non-member countries will be especially important in the light of the growing demand for energy in those countries. Most of the new nuclear energy capacity is likely to be built in non-member countries in the medium term. Governments from OECD countries will have an important role in providing those countries with information and resources to address key issues in the field of legal frameworks, health and environmental protection, safety and waste management.

Annex 1

Schematic diagram of the nuclear fuel cycle for a light water reactor

The following diagram summarises the main steps of the fuel cycle for a light water reactor. It illustrates the number of activities that constitute the nuclear energy sector. The details of fuel cycle steps and levels vary from reactor type to reactor type but the main elements remain similar for current nuclear power plants. The fuel cycle of a nuclear power plant can be divided into three main stages: the so-called front-end, from mining of uranium ore to the delivery of fabricated fuel assemblies to the reactor; the fuel use in the reactor; and the so-called back-end, from the unloading of fuel assemblies from the reactor to final disposal of spent fuel or radioactive waste from reprocessing.



REFERENCES

[1] OECD (Organisation for Economic Co-operation and Development), (1999), OECD Policy Brief No. 8, OECD, Paris, France.

[2] OECD (Organisation for Economic Co-operation and Development), (1999), *The OECD Three-Year Project on Sustainable Development: A Progress Report*, OECD, Paris, France.

[3] IEA (International Energy Agency), (1998), *Key World Energy Statistics from the IEA - Data for 1996*, IEA, Paris, France.

[4] RHODES, R., and BELLER, D., (2000), *The Need for Nuclear Power*, in Foreign Affairs, January/February 2000, Vol. 79, No. 1, Washington, United States.

[5] Worldwatch Institute, (1999), *State of the World 1999*, W. W. Norton & Company Inc., United States.

[6] IEA (International Energy Agency), (1998), *World Energy Outlook*, OECD, Paris, France.

[7] IIASA (International Institute for Applied Systems Analysis) and WEC (World Energy Council), (1995), *Global Energy Perspectives to 2050 and beyond*, WEC, London, United Kingdom.

[8] BRUNDTLAND, G., Chairman, World Commission on environment and Development, (1987), *Our common Future (The Brundtland report)*, Oxford University Press, Oxford, United Kingdom.

[9] BANURI, T., *et al.*, (1996), *Equity and Social Consideration*, in Climate Change 1995 – Economic and Social Dimensions of Climate Change. Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York, United States, pp.79-124.

[10] OECD (Organisation for Economic Co-operation and Development), (1997), *The World in 2010: Towards a New Global Age*, OECD, Paris, France.

[11] The Royal Society, (1999), *Nuclear Energy: The future Climate*, The Royal Society and Royal Academy of Engineering, London, United Kingdom.

[12] SCHIPPER, L., *et al.*, (1999), *The IEA Energy Indicators Effort: Extension to Carbon Emissions as a Tool of the Conference of the Parties*, OECD, Paris, France.

[13] HAMILTON, K., *Genuine Saving as a Sustainability Indicator*, (1999), Second OECD Expert Workshop, Frameworks to Measure Sustainable Development, OECD, Paris, France.

[14] ARROW, K.J., *et al.*, (1996), *Intertemporal Equity, Discounting and Economic Efficiency*, in Climate Change 1995 – Economic and Social Dimensions of Climate Change. Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, New York, United States, pp. 125-144.

[15] GONZÁLEZ DE UBIETA, A., (1999), *Economic Sustainability of Nuclear Power*, in Nuclear in a Changing World, Proceedings (Vol. II), European Commission, Brussels, Belgium, pp. 33-50.

[16] FERTEL, M., (1998), *The outlook for US Nuclear Plants in a Competitive Electricity Market*, in Proceedings from the Uranium Institute Symposium 1998, London, United Kingdom.

[17] GALE, W., *et al.*, (1998), A new nuclear consensus, in Proceedings of a Seminar held in connection with ENC'98, Nice, France.

[18] OECD/NEA-IEA (Nuclear Energy Agency – International Energy Agency), (1998), *Projected Costs of Generating Electricity: Update 1998*, OECD, Paris, France.

[19] NEA (OECD Nuclear Energy Agency), (2000), *Reduction of Capital Costs of Nuclear Power Plants*, OECD, Paris, France.

[20] NEA (OECD Nuclear Energy Agency), (1996), *Future Financial Liabilities of Nuclear Activities*, OECD, Paris, France

[21] NEA (OECD Nuclear Energy Agency), (1991), *Decommissioning of Nuclear Facilities: Analysis of the Variability of Decommissioning Cost Estimates*, OECD, Paris, France.

[22] European Commission, Directorate-General XII, Science, Research and Development, (1995), *ExternE, Externalities of Energy, Vol.5, Nuclear*, European Commission, Brussels, Belgium.

[23] NEA (OECD Nuclear Energy Agency), (2000), *Methodologies for Assessing the Economic Consequences of Nuclear Reactor Accidents*, OECD, Paris, France.

[24] NEA (OECD Nuclear Energy Agency) and IAEA (International Atomic Energy Agency), (2000), *Uranium 1999 - Uranium Resources, Production and Demand*, OECD, Paris, France.

[25] BP AMOCO, (2000), *Statistical Review of World Energy June 2000*, Pillans & Wilson Greenaway, London, United Kingdom.

[26] NEA (OECD Nuclear Energy Agency), (1994), *Radiation Protection Today and Tomorrow, A Collective Opinion of the Committee on Radiation Protection and Public Health of the OECD Nuclear Energy Agency*, OECD, Paris, France.

[27] ICRP (International Commission on Radiological Protection), (1990), *Recommendations of the International Commission on Radiological Protection, Publication 60*, Pergamon Press, Oxford and New York, United States.

[28] UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation), (1994), *Ionising Radiation: Sources and Biological Effects*, UNSCEAR, New York, United States.

[29] NEA (OECD Nuclear Energy Agency), (1999), *Occupational Exposures at Nuclear Power Plants: Eighth Annual Report of the ISOE Programme*, OECD, Paris, France.

[30] NEA (OECD Nuclear Energy Agency), (1998), *Developments in Radiation Health Science and their Impact on Radiation Protection*, OECD, Paris, France.

[31] NEA (OECD Nuclear Energy Agency), (1998), *The Societal Aspects of Decision-making in Complex Radiological Situations*, Proceedings of a Workshop held in Villigen, Switzerland, 13-15 January 1998, OECD, Paris, France.

[32] HOGBERG, L., (1998), *Reactor Safety*, in Nuclear in a Changing World, Proceedings (Vol. II), European Commission, Brussels, Belgium, pp. 75-93.

[33] NEA (OECD Nuclear Energy Agency), (1999), *The Role of the Nuclear Regulator in Promoting and Evaluating Safety Culture*, OECD, Paris, France.

[34] SLOVIC, P., et al., (1979), *Rating the Risks,* Environment, Vol. 21, No.3.

[35] American Chemical Society and Resources for the Future, (1998), *Understanding Risk Analysis: A Short Guide for Health, Safety and Environmental Policy Making*, Washington, United States.

[36] NEA (OECD Nuclear Energy Agency), (1999), *Low-level Radioactive Waste Repositories: An Analysis of Costs*, OECD, Paris, France.

[37] NEA (OECD Nuclear Energy Agency) and IAEA (International Atomic Energy Agency), (1999), *Environmental Aspects of Uranium Mining and Milling Activities*, OECD, Paris, France.

[38] SMELLIE, J., (1995), *The Fossil Nuclear Reactors of Oklo*, Radwaste Magazine, Special Series on Natural Analogs.

[39] NEA (OECD Nuclear Energy Agency), (1996), *Radioactive waste management in perspective,* OECD, Paris, France.

[40] IEA (International Energy Agency), (1997), *IEA Energy technology R&D Statistics 1974-1995,* OECD, Paris, France.

[41] SLOVIC, P., (1999), *Rating the Risks*, Resources for the future, Washington, United States.

[42] STARR, C., (1991), *Social Benefit Versus Technological Risk*, Science, Vol. 165, pp. 1232-38, 1969; Twenty-year Retrospective on 1969, Science Paper of C. STARR, Risk Analysis, Plenum Press, New York, United States.

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NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY

NEA PROGRAMME OF WORK FOR 2001-2002 AND BUDGET FOR 2001

(Note by the Secretariat)

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NEA PROGRAMME OF WORK FOR 2001-02 AND BUDGET FOR 2001

INTRODUCTION

1. Members of the Steering Committee for Nuclear Energy will recall the decision of the OECD Council in 1994 to move to biennial programmes of work while retaining annual budgets. This document contains the draft NEA Programme of Work for the next biennium (i.e. the years 2001-02) and the Budget for 2001, covering both the NEA Main Secretariat (Chapter 33) and its Data Bank (Chapter 34), for presentation to the OECD Council.

Format

2. The format of the Programme of Work and Budget (PWB) document is very similar to what was adopted last year by the Organisation. This format basically resulted from the on-going OECD PWB reform project, but was tailored to fit the specific aspects of the NEA, including the fact that it is a Part II agency. There are further changes being made to the format of Part I PWB presentations for 2001 that are not yet applicable to Part II.

3. This document contains four main parts:

a) an Overview, which is similar to the amended version approved by the Steering Committee at its meeting last May, except that it has been shortened for presentation to the Council by deleting the references to the major trends under the individual standing technical committees;

b) a summary of changes in the budget proposal for 2001 compared with that approved by the Council for 2000 within the context of zero volume growth;

c) several tables and charts detailing proposed staff resources, appropriations, the structure of the NEA Secretariat, and the organisation of the Agency's standing technical committees for 2001;

d) a consolidated version of the programme of work, with aggregated activities, which, like the Overview, was approved by the Committee last May. Each of the fourteen activities is broken down into subactivities, objectives, planned outputs, links to horizontal programmes, outreach, coordination within and outside the OECD, and resources.

4. It should be noted that this document does not include the more detailed form of the programme of work approved by the Steering Committee. That version is now considered to be an internal NEA working document with greater detail for the Steering Committee and has not been sent to the Council since 1996.

5. Furthermore, this PWB does not include results achieved with respect to individual activities, which were included in last year's PWB because it covered the second year of the 1999-2000 biennium. As the current document deals with a new biennium, the NEA was instructed by the OECD Administration not to include results that relate to the previous period. In any case, such results were provided to the Steering Committee in the annual status reports of the standing technical committee chairmen circulated last May.

6. A key feature of this document is that the entire budget of the NEA, including indirect as well as direct costs, is broken down into the fourteen aggregated activities. The breakdown of resources covers staff in terms of man months, including consultants and auxiliaries, as well as funding, including external resources such as project staff, seconded experts, and voluntary and in-kind contributions.

Budget

7. Turning specifically to the proposed NEA budget for 2001, the Steering Committee was informed at its last meeting that the NEA Secretariat had been instructed by the OECD Administration to prepare a budget based on zero volume growth. Compared to the 2000 budget, there are several revisions proposed by the NEA Secretariat within the zero volume growth envelope, which, as noted above, are detailed in the second main part of this document.

8. The OECD Budget and Finance Service has not yet provided proposed nominal, technical and statutory adjustments to the draft zero volume growth budget that the NEA Secretariat was requested to submit to it in July. In any case, traditionally the Steering Committee has left the matter of such adjustments to the Council for decision. One possible adjustment of particular note concerns the item *Office rental and charges*. The Agency's contract with the owners of the building it occupies is expiring, and negotiations are currently underway on a new contract.

9. At its session in May 2000, the Steering Committee endorsed a proposal by the NEA Secretariat to create an A3 project post in the Division of Radiation Protection and Radioactive Waste Management for one year, to be funded from surplus income from sales of publications in 1999. Subsequently, the proposal was approved by the OECD Budget Committee and the Council. The project post is reflected in this document.

Conclusion

10. The Steering Committee is invited **to approve** the draft NEA Programme of Work for 2001-02 and Budget for 2001, for submission to the Secretary-General and, in turn, transmittal to the Council in the context of the programme of work and budget of the Organisation as a whole.

NUCLEAR ENERGY AGENCY: Overview

At this, the start of the 21st Century, more than 350 nuclear reactors continue to provide almost a fourth of the electricity generated in OECD and, for many OECD countries, nuclear power remains an important option to meet future electricity requirements. The programme of the Nuclear Energy Agency reflects not only the continued importance of nuclear power, but also its evolving nature. In fact, the NEA has undergone a far reaching process of reform, beginning with a report on the Agency by a High Level Advisory Group, followed by the adoption of a medium term Strategic Plan, and culminating in a restructuring of the Agency's Standing Technical Committees. As a result, the Agency will enter the new century better equipped to pursue its general objectives of:

- providing a forum for sharing information and experience and promoting international co-operation;
- providing a center of excellence which helps Member countries to pool and maintain their technical expertise; and
- providing a vehicle for facilitating policy analyses and developing consensus based on its technical work.

Under the terms of its Strategic Plan, adopted in 1999, the Agency is committed to pursuing a balanced programme of work in safety and regulation, radioactive waste management, nuclear law and liability, nuclear development and economics, radiation protection, nuclear science, public information, and the provision of Data Bank Services. Over the next two years, the Agency's new programme will maintain this balance but with increased emphasis on five key areas:

- the effective involvement of stakeholders and attention to societal concerns in decision-making in the nuclear field;
- the role of nuclear power in the context of sustainable development;
- the management and disposal of long-lived waste;
- decommissioning; and
- the maintenance of infrastructure associated with nuclear power.

The NEA will pursue progressively integrated approaches in areas which cut across its programme. It will also continue to pursue closer co-ordination with other sectors of the OECD, providing input on relevant horizontal issues, particularly sustainable development, and also with other international organisations so as to enhance international co-operation and avoid duplication.

The NEA will carefully screen countries interested in joining the Agency with a view to keeping its membership relatively small and homogeneous and ensuring that new members can contribute effectively to its Programme. With respect to outreach, the Agency will pursue a highly selective programme of assistance, primarily to CEEC and NIS, consistent with available resources, while pursuing a more formal and extensive co-operative relationship with Russia based on a Declaration on Co-operation, and also further contacts with China.

NEA Contributions to OECD Horizontal Programmes

The NEA will continue to contribute to the OECD Sustainable Development project by providing six man-months of A grade staff effort, to work on nuclear power aspects. To this effort will be added approximately six months of high-level consultant work.

Changes in Resource Allocation for 2001

The changes to be found in the budget proposal for 2001, compared with that approved by Council for 2000, are described below. It is of note that all proposed increases in appropriations are fully offset by proposed reductions elsewhere in the appropriations, so that, in terms of the budget, this proposal embodies zero volume growth. All changes are reflected in the appropriate tables and charts presented in this document.

1. *Waste Disposal* has been identified as a high priority area of the Agency's programme on which there is increased emphasis in the proposed Programme of Work (POW) for 2001-02. In June 2000, Council approved a request for the creation of a project post in this area which has been included in the appropriate tables and charts of the budget proposal. Council also agreed that, exceptionally, the NEA could fund this post from the carry forward of surplus publications revenue.

2. In order to address an anomaly in the staff grades of the NEA Legal Section, it is proposed to upgrade a B5 post to the level of A2/3. The holder of this position is primarily responsible for the Agency's programme of studies and dissemination of information on nuclear law, work which includes editing of various legal publications, such as the semi-annual *Nuclear Law Bulletin*, as well as representing NEA in various international negotiations and other fora. The incumbent is also actively involved in the other areas of work of the Section, particularly as concerns *nuclear liability*. The nature and extent of the responsibilities attached to this position are clearly consistent with those of an administrator and it is important for the post to be upgraded in order to attract and retain staff of the requisite calibre. The estimated budgetary cost of this upgrade is 61,000 FF, an amount fully offset by reductions in other appropriations outlined in paragraph 5 below.

3. With the return to budgetary stability after the budget reduction exercise, it has become increasingly apparent that existing levels of NEA appropriations for *missions* and *consultants* are insufficient to cover Agency requirements. To a large extent the shortfall in consultants is due to the high levels of technical specialisation needed for NEA work which, because it is neither desirable nor possible for the Agency to retain such expertise in-house, generates heavy reliance on expenditure for *consultants*. *Missions* are carefully screened by the NEA Management, but given the large number of the Agency's meetings held outside Paris and other factors, this item needs to be adjusted. It is proposed to address the imbalance on these lines by increasing the *missions* budgets by 52,000 FF and 18,000 FF for Chapters 33 and 34, respectively, and to add one *consultant* month (41,000 FF) to each Chapter. The combined increase on these two lines is 93,000 FF for Chapter 33 and 59,000 FF for Chapter 34. Both amounts are fully offset by reductions in other appropriations outlined in paragraph 5 below.

4. For 2001, there is a downward adjustment of 50,000 FF, or about one per cent, in the expertise provided by the NEA Data Bank to the NEA Main Secretariat. This change is reflected in both the appropriation tables and the activity tables of this document.

5. In order to maintain zero volume growth, the above mentioned increases are fully offset for Chapter 33 by a combination of reductions in *Reprographics* (a sub-heading of *Printing*); *Documentation and Library*; *Office Furniture*; and *Communications*. For Chapter 34, the equivalent reductions are combined in *Reprographics* and *Information Technology Equipment*. Details are in the appropriation table for each Chapter. These reductions will require careful monitoring of expenditure for each item.

NEA MAIN SECRETARIAT

STAFF RESOURCES

Number of staff (man/years)	2000	2001
Professional staff [1][2][3]	33.6	33.6
Support staff [1][2]	19.0	19.0
Project staff [4]	1.0	1.1
Consultants	1.9	2.0
Auxiliaries	2.5	2.5
Non-NEA Staff	1.8	1.8
TOTAL	**59.8**	**60.0**

APPROPRIATIONS

Budget by type of appropriation	2000	2001
Permanent Staff [2][3]	30,726,000	30,787,000
Other personnel costs:		
* Miscellaneous allowances	3,405,900	3,405,900
* Official travel	1,148,300	1,200,300
* Auxiliaries	640,700	640,700
Consultants and contracts	884,000	925,000
Conferences and meetings	93,600	93,600
Entertainment expenses	90,300	90,300
Global operating expenditure		
*Communication	1,019,000	1,009,000
*Office furniture	129,600	119,600
*Office rental and charges	3,020,000	3,020,000
*Share of OECD overheads	10,564,700	10,564,700
*Documentation and library	145,600	110,600
*Photocopies	165,300	165,300
*Printing	689,800	640,800
*Interpretation	704,400	704,400
*Translations (external)	440,000	440,000
Miscellaneous expenditures	3,400	3,400
Capital expenditure	46,700	46,700
Information technology equipment	489,000	489,000
SUB - TOTAL	**54,406,300**	**54,456,300**
Cost of expertise provided by Data Bank	4,798,900	4,748,900
GENERAL TOTAL	**59,205,200**	**59,205,200**

[1] *Professional* is defined to include grades B4 and above; *support* includes B3 and below

[2] Excluding frozen posts (which are also excluded from the budget appropriations)

[3] One A6 post is financed 60% by Chapter 33, 40% by Chapter 34

[4] To be financed by voluntary contributions + funds carried forward

NEA DATA BANK

STAFF RESOURCES

Number of staff (man/years)	2000	2001
Professional staff [1][2][3]	14.4	14.4
Support staff [1][2]	5.0	5.0
Project staff		
Consultants	1.3	1.3
Auxiliaries	1.3	1.3
Non-NEA Staff	1.0	1.0
TOTAL	**23.0**	**23.0**

APPROPRIATIONS

Budget by type of appropriation	2000	2001
Permanent Staff [2][3]	10,816,800	10,816,800
Other personnel costs:		
* Miscellaneous allowances	1,413,600	1,413,600
* Official travel	370,100	388,100
* Auxiliaries	327,700	327,700
Consultants and contracts	576,300	617,300
Conferences and meetings	38,300	38,300
Entertainment expenses	33,200	33,200
Global operating expenditure		
*Communication	488,800	488,800
*Office furniture	111,400	111,400
*Office rental and charges	1,510,000	1,510,000
*Share of OECD overheads	1,253,800	1,253,800
*Documentation and library	113,200	113,200
*Photocopies	85,900	85,900
*Printing	449,100	399,100
*Interpretation	347,000	347,000
*Translations (external)	67,700	67,700
Miscellaneous expenditures	2,000	2,000
Capital expenditure	49,700	49,700
Information technology equipment	3,054,200	2,995,200
SUB - TOTAL	**21,108,800**	**21,058,800**
Cost of expertise provided to NEA Main Secretariat	-4,798,900	-4,748,900
GENERAL TOTAL	**16,309,900**	**16,309,900**

[1] *Professional* is defined to include grades B4 and above; *support* includes B3 and below

[2] Excluding frozen posts (which are also excluded from the budget appropriations)

[3] One A6 post is financed 40% by Chapter 34, 60% by Chapter 33

NEA TOTAL APPROPRIATIONS

STAFF RESOURCES

Number of staff (man/years)	2000	2001
Professional staff [1][2]	48.0	48.0
Support staff [1][2]	24.0	24.0
Project staff	1.0	1.1
Consultants	3.2	3.3
Auxiliaries	3.8	3.8
Non-NEA Staff	2.8	2.8
TOTAL	**82.8**	**83.0**

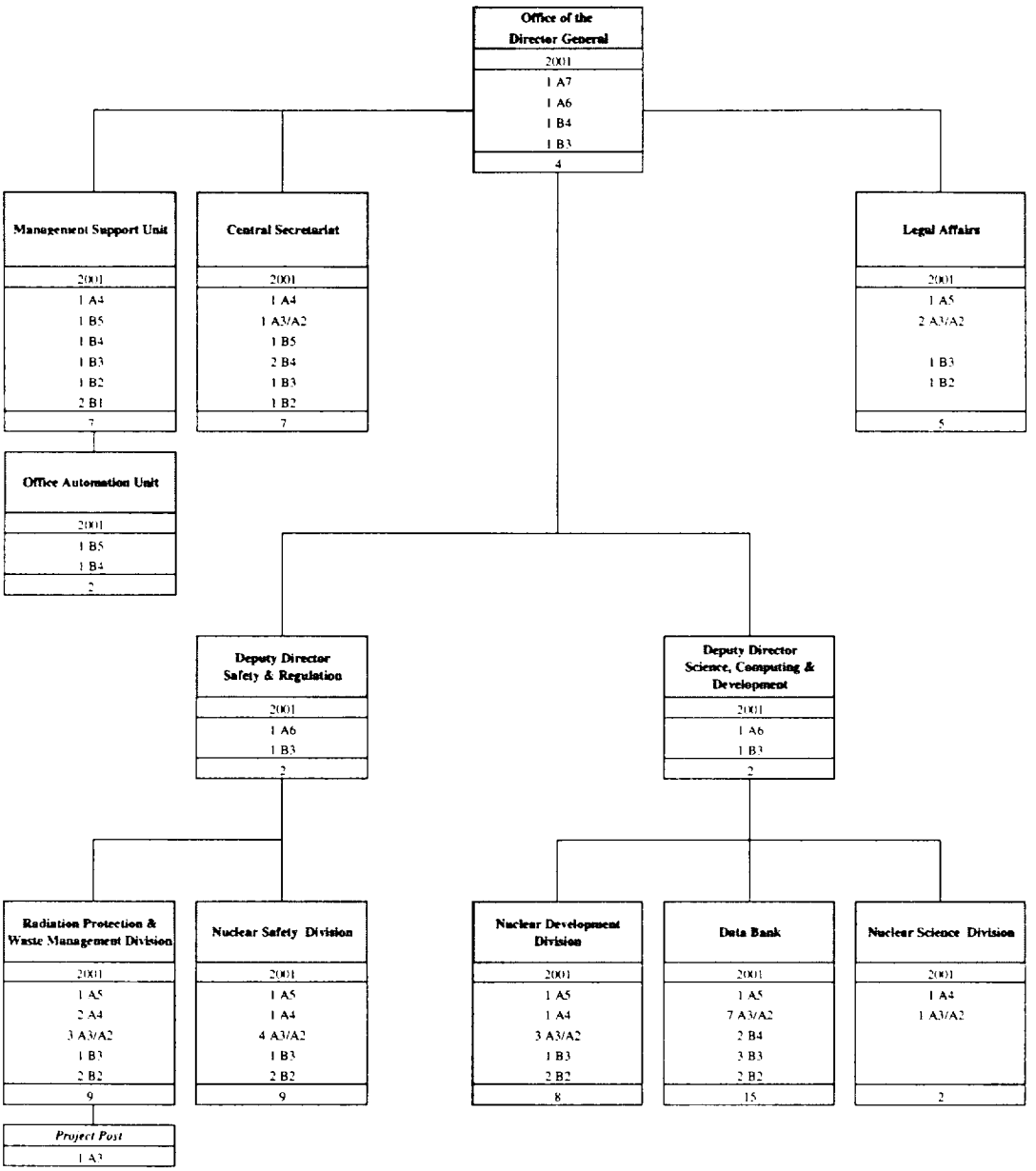
APPROPRIATIONS

Budget by type of appropriation	2000	2001
Permanent Staff [2][3]	41,542,800	41,603,800
Other personnel costs:		
* Miscellaneous allowances	4,819,500	4,819,500
* Official travel	1,518,400	1,588,400
* Auxiliaries	968,400	968,400
Consultants and contracts	1,460,300	1,542,300
Conferences and meetings	131,900	131,900
Entertainment expenses	123,500	123,500
Global operating expenditure		
*Communication	1,507,800	1,497,800
*Office furniture	241,000	231,000
*Office rental and charges	4,530,000	4,530,000
*Share of OECD overheads	11,818,500	11,818,500
*Documentation and library	258,800	223,800
*Photocopies	251,200	251,200
*Printing	1,138,900	1,039,900
*Interpretation	1,051,400	1,051,400
*Translations (external)	507,700	507,700
Miscellaneous expenditures	5,400	5,400
Capital expenditure	96,400	96,400
Information technology equipment	3,543,200	3,484,200
SUB - TOTAL	**75,515,100**	**75,515,100**
GENERAL TOTAL	**75,515,100**	**75,515,100**

[1] Defined to include grades B4 and above

[2] Excluding frozen posts (which are also excluded from the budget appropriations)

NUCLEAR ENERGY AGENCY
STAFF RESOURCES 2001

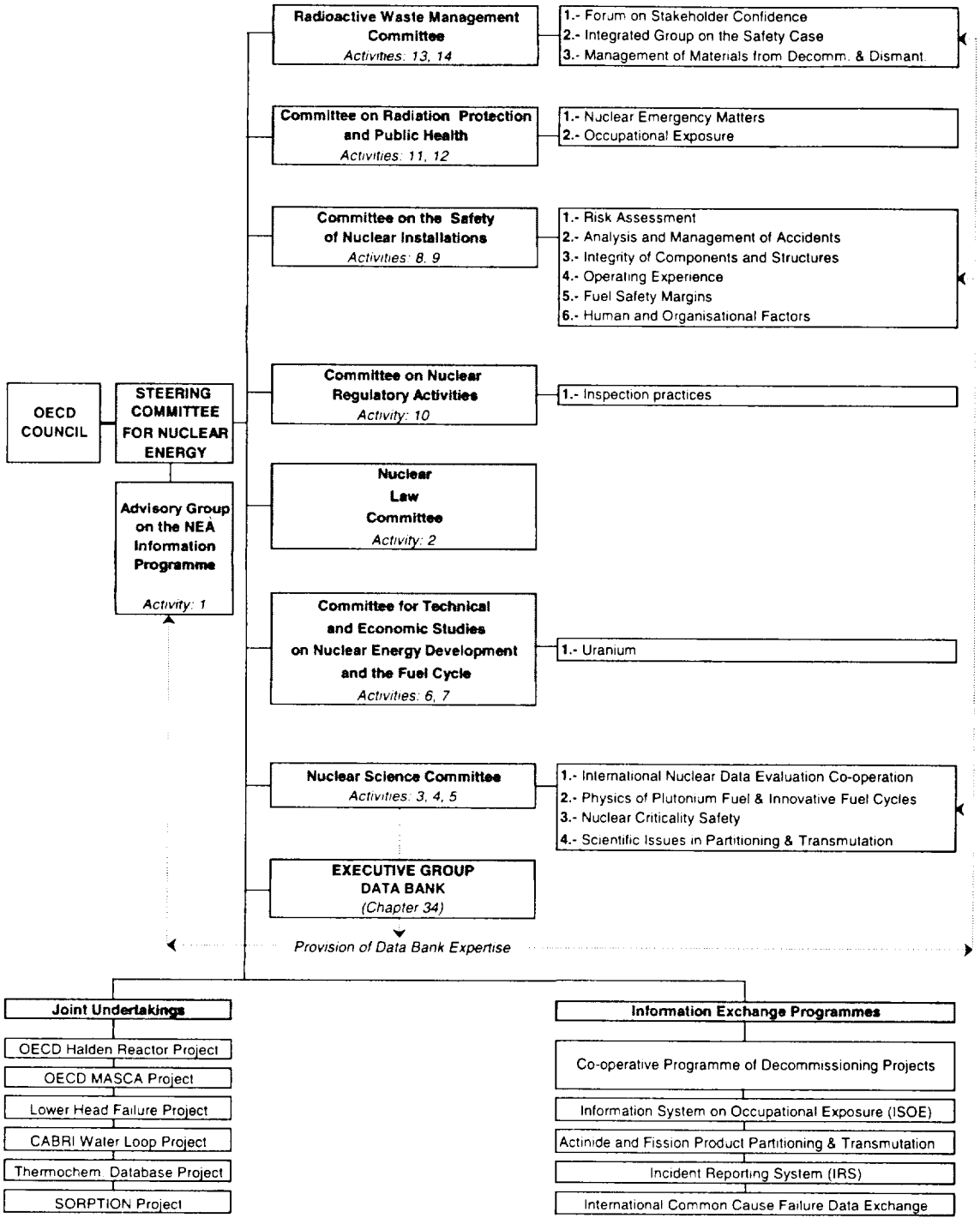


	2001	2002
Regular Posts	72	72
Project Posts	1	
Total:[1]	**73**	**72**

(1) Total excludes 7 frozen posts which are also excluded from the budget appropriations

COMMITTEE ORGANISATION CHART OF THE NEA *

(Including Level 1 Subsidiary Bodies)



* After restructuring in 2000

Activity 1: Support to the Management, Information and Publications Programme

Aggregation of sub-activities
Support to Management
NEA Information and Communication
Nuclear Energy and Society

Objective: to provide direct support to the Agency's Management and the Steering Committee for Nuclear Energy; to co-ordinate external relations activities and relations with non-members; to develop and carry out an information and communications programme aimed at providing Member governments and other stakeholders with scientifically sound information on nuclear energy through specific activities in Member countries and the production of publications and information material; to ensure recognition of the NEA's role and results, including its contribution to broad OECD policy debates; and to contribute to a co-ordinated approach to the Agency's work on nuclear energy and society.

Planned Outputs:

- Steering Committee for Nuclear Energy: Four Meetings Including Special Sessions Involving Policy Debates on Key Issues (Spring and Fall 2001/2002)
- Input to the OECD Annual Report
- NEA/International Atomic Energy Agency Co-ordination Meetings (Spring 2001/2002)
- *Annual Activity Report*: Publication (mid 2001/2002)
- *NEA News*: Semi-annual Publication (Spring, Fall 2001/2002)
- NEA Web Site: Maintenance and Further Improvement
- NEA Information Material for Specific Target Audiences, Including Development of Synthesis Reports on Key Topics
- Documents on Societal Aspects of Nuclear Energy Decision Making
- Information Booths at Major International Conferences
- Press Releases (about 15 annually) and Press Conferences

Links to Horizontal Programmes: Relations with Civil Society (contribution to co-ordination and reporting)

Outreach: Russia

Co-ordination with: CCNM; IAEA; EC

Resources:

ACTIVITY: 1	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	60	2,601	68%
	Support Staff	24	621	17%
Main	***Sub Total (Establishment Staff)***	***84***	***3,222***	***85%***
Resources	Consultants & Auxiliaries	2	77	2%
	Other Directly Allocatable Resources		506	13%
	Total Allocatable Costs for Activity		**3,805**	***100%***
Additional	*NEA Data Bank Expertise		245	
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		2,112	
Resources	*Pro-Rated Share of Overheads Paid to OECD		1,439	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		265	
Resources	*Project Staff			
	*Seconded Experts			
	*In-kind contributions			

Activity 2: Modernisation of Nuclear Liability Regime and Legal Services

Aggregation of sub-activities
Revision of the Paris Convention and the Brussels Supplementary Convention
Harmonisation of National Legislation and Strengthening of the National and International Liability Regimes
Support to Management and NEA Joint Projects
Studies and Information on Nuclear Law

Objective: to pursue modernisation of the nuclear liability regime; to support efforts to promote worldwide harmonisation of nuclear liability legislation; to provide support to the Agency's operational activities and its Joint Projects; to analyse and disseminate information on nuclear legislation; and co-operate with, and provide legal assistance to, certain non-member countries, especially CEEC and NIS.

Planned Outputs:

- Meeting of Nuclear Law Committee on Modernisation of Nuclear Liability Regime (Fall 2001)
- Meetings of Contracting Parties to Paris Convention and Brussels Supplementary Convention on Revision of those Conventions (Jan./Feb. 2001)
- Draft Protocols to Revise Paris Convention and Brussels Supplementary Convention: Submission to NEA Steering Committee for Approval and OECD Council for Adoption (Spring/Summer 2001)
- Legal Advice to Member Countries on Interpretation of Paris Convention, Brussels Supplementary Convention, and Joint Protocol Relating the Application of the Vienna and Paris Conventions
- *Nuclear Law Bulletin*: Semi-annual Publication (June, December 2001/2002)
- *Regulatory and Institutional Framework for Nuclear Activities*: Annual Update (Summer 2001/2002)
- *Overview of Nuclear Legislation in Central and Eastern Europe and the NIS:* Regular Update (Summer 2002)
- Meeting of Contact Group to Exchange Views on Liability for Nuclear Damage in Connection with Nuclear Safety Assistance Activities in Certain CEEC and NIS (June 2001)
- Meeting of the Ukrainian Joint Task Force on Nuclear Legislation (Upon request by Ukraine)
- Information/Training Seminars on Nuclear Law Topics for CEEC/NIS Specialists and other Topical Meetings, as Requested
- International Education Programme in Nuclear Law: Development of Programme Plan

Links to Horizontal Programmes: None

Outreach: CEEC and NIS as noted

Co-ordination with: CCNM; IAEA; EC; EBRD; European Insurance Committee; EURELECTRIC

Resources:

ACTIVITY: 2	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	36	2,234	61%
	Support Staff	24	621	17%
Main	***Sub Total (Establishment Staff)***	***60***	***2,855***	***78%***
Resources	Consultants & Auxiliaries	12	359	10%
	Other Directly Allocatable Resources		448	12%
	Total Allocatable Costs for Activity		**3,662**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		1,962	
Resources	*Pro-Rated Share of Overheads Paid to OECD		1,275	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions			
Resources	*Project Staff			
	*Seconded Experts	12		
	*In-kind contributions			

Activity 3: Co-operation in Nuclear Science and Research

Aggregation of sub-activities
Physics and Chemistry of the Fuel Cycle
R&D Needs in Nuclear Science
Criticality Studies
Material and Fuel Behaviour

Objective: to further develop the scientific knowledge base needed to support present and future nuclear technology, especially in the fields of material science, reactor physics, and fuel cycle physics and chemistry.

Planned Outputs:

- *Theoretical BWR MOX Benchmark:* Publication of Results
- *MOX Benchmark Based on Experimental Data (VENUS):* Publication of Results
- Workshop on Advanced Reactors with Innovative Fuel Cycles
- *Benchmark on MOX Loaded VVER-1000 Reactor:* Publication of Results
- *Benchmark on Behaviour of Full and Hollow Fuel Pellets:* Publication of Results
- *Benchmark Based on KRITZ Experiments:* Publication of Results
- *Transient Benchmark for Accelerator Driven Systems*: Publication of Results
- Seminar on Fission Gas Behaviour: Publication of Proceedings
- Seminar on Pellet Clad Mechanical Interaction
- International Fuel Performance Experiments (IFPE) Database: Publication of New Edition
- *MOX Burnup Credit Benchmark*: Publication of Results
- *International Criticality Safety Benchmark Experiments Project:* Publication of New Edition of Handbook
- Sub-critical Benchmark Experiments: Compilation in ICSBEP Database
- *Source Convergence Benchmark*: Publication of Results
- *Experiments to be Preserved – Priorities, Methods and Effort Needed*: Report
- Database of Reactor Physics Experiments

Links to Horizontal Programmes: None

Outreach: None

Co-ordination with: IAEA, EC

Resources:

ACTIVITY: 3	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	14	847	86%
	Support Staff			
Main	***Sub Total (Establishment Staff)***	***14***	***847***	***86%***
Resources	Consultants & Auxiliaries			
	Other Directly Allocatable Resources		134	14%
	Total Allocatable Costs for Activity		**981**	***100%***
Additional	*NEA Data Bank Expertise		1,768	
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		550	
Resources	*Pro-Rated Share of Overheads Paid to OECD		380	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions			
Resources	*Project Staff			
	*Seconded Experts			
	*In-kind contributions			

Activity 4: Data Bank (Chapter 34)

Sub-activities involved
Nuclear Data Co-ordination and Services
Software Validation and Services
Databases of Integral Experiments
Calculation Methods for Fission Reactors and Shielding

Objective: to be an international centre of reference for basic nuclear tools, by collecting, maintaining and testing nuclear data and computer programs and by providing internationally validated information as a direct service to national laboratories, universities and industry in Member countries.

Planned Outputs:

- Acquisition and Testing of About 120 New Computer Programs
- Compilation and Exchange of About 300 Data Sets from Experimental Activities
- Provision of Nuclear Data and Computer Program Services to more than 500 Accredited Establishments, Including Guidance and Advice on the Use of Programs and Data: Service (Ongoing)
- Newsletters About Newly Acquired Programs and Data Sets: Publication
- *Joint Evaluated Fission and Fusion (JEFF) Data Library*: Publication of New Version
- New Editions of Computer Program Abstracts on CD-ROM
- Reactor Physics Experiments Database: Publication of First Issue
- *Results from the PWR-MSLB Benchmark*: Publication of 4th Volume
- *BWR-Turbine Trip Transient Benchmark*: Publication of 2 Volumes
- Benchmark on a Highly Heterogeneous Reactor Cell: Publication of Results
- SATIF-5 and SATIF-6 Meetings: Publication of Proceedings
- *Neutron and Gamma Skyshine Benchmark*: Preliminary Report
- SINBAD Database for Shielding Experiments: New Release on CD-ROM
- 3 Training Courses on the Use of Important Computer Programs

Links to Horizontal Programmes: None

Outreach: Indirect through IAEA

Co-ordination with: Other nuclear data centers

Resources:

ACTIVITY: 4	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	106	6,397	49%
	Support Staff	54	1,420	11%
Main	***Sub Total (Establishment Staff)***	***160***	***7,817***	***60%***
Resources	Consultants & Auxiliaries	29	880	7%
	Other Directly Allocatable Resources		4,378	33%
	Total Allocatable Costs for Activity		**13,075**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Share of Other Internal NEA Costs (rent, etc.)		1,981	
Resources	*Share of Overheads Paid to OECD		1,254	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		120	
Resources	*Project Staff			
	*Seconded Experts	12		
	*In-kind contributions			

Activity 5: Data Bank Expertise Provided to the NEA Main Secretariat

Sub-activities involved
NEA Information and Communication
Physics and Chemistry of the Fuel Cycle
Criticality Studies
Material and Fuel Behaviour
Feedback from Operational Experience and the Incident Reporting System
Analysis and Management of Accidents
Technical and Scientific Studies and Databases

Objective: to assist the Main Secretariat of the NEA, using expertise from the Data Bank, in the fields of physics, chemical thermodynamics, computing and database management.

Planned Outputs:

- NEA Web Site: Provision of Technical Advice
- Safeguarding of Results from Different Benchmark Exercises
- International Fuel Performance Experiments (IFPE) Database: Update
- International Criticality Safety Benchmark Experiments Project (ICSBEP) Database: Update
- Exercises in Coolant System Analysis: Development of Database
- Thermochemical Database Project: Critical Reviews of Data for Selenium, Nickel, Zirconium and Selected Organic Ligands; Update of the Existing Reviews; Publication of Final Reports

Links to Horizontal Programmes: None

Outreach: None

Co-ordination with: None

Resources:

ACTIVITY: 5	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	31	2,813	80%
	Support Staff	6	187	5%
Main	***Sub Total (Establishment Staff)***	***37***	***3,000***	***85%***
Resources	Consultants & Auxiliaries	2	65	2%
	Other Directly Allocatable Resources		466	13%
	Total Allocatable Costs for Activity		***3,531***	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Share of Other Internal NEA Costs (rent, etc.)		1,219	
Resources	*Share of Overheads Paid to OECD			
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		40	
Resources	*Project Staff			
	*Seconded Experts			
	*In-kind contributions			

Activity 6: Economics and Data of Nuclear Development

Aggregation of sub-activities
Uranium Group Activities (includes "The Red Book" – Uranium: Resources, Production and Demand)
"The Brown Book" (Nuclear Energy Data)
Decommissioning Costs and Strategies
Nuclear Power: A Reference Book

Objective: to issue up-to-date authoritative publications on economic and statistical data related to peaceful applications of nuclear energy.

Planned Outputs:

- *The Red Book (Uranium: Resources, Production and Demand) 2001*: Publication mid-2002
- *Nuclear Power: A Reference Book* (end of 2002)
- *The Brown Book (Nuclear Energy Data):* June 2001, June 2002
- *Decommissioning Costs and Strategies in NEA Member Countries*: Publication (end of 2002)

Links to Horizontal Programmes: None

Outreach: Indirect through IAEA

Co-ordination with: IAEA, IEA, Uranium Institute

Resources:

ACTIVITY: 6	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	20	1,272	59%
	Support Staff	22	548	26%
Main	***Sub Total (Establishment Staff)***	***42***	***1,820***	***85%***
Resources	Consultants & Auxiliaries	1	39	2%
	Other Directly Allocatable Resources		285	13%
	Total Allocatable Costs for Activity		**2,144**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		1,190	
Resources	*Pro-Rated Share of Overheads Paid to OECD		811	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions			
Resources	*Project Staff			
	*Seconded Experts			
	*In-kind contributions			

Activity 7: Strategies and Policy Analysis for Nuclear Development

Aggregation of sub-activities
Nuclear Energy and Sustainable Development
Socio-political Aspects of Nuclear Energy
Infrastructure for Nuclear Energy Development
Fuel Cycle Studies
New Generation of Nuclear Power Plants in OECD Countries
Support to Other Parts of the OECD

Objective: to assist Member countries in evaluating the future role of nuclear energy, the policy issues arising within the nuclear sector, and the impact of other policies on nuclear development. This activity takes into account global climate concerns, sustainable development issues, the trend towards deregulation and privatisation of the electricity supply industry, the present stagnation of nuclear development in many countries, and the evolution of nuclear technology.

Planned Outputs:

- *Nuclear Energy in Sustainable Development Perspective:* Report (early 2001)
- *Trends in the Nuclear Fuel Cycle: Economic, Environmental and Social Considerations*: Report (mid-2001)
- *Accelerator Driven Systems and Fast Reactors in Advanced Fuel Cycles*: Comparative Study (mid-2001)
- Joint IEA/NEA Seminar: Publication of Proceedings (end of 2001)
- *Workshop on Socio-Political Aspects of Nuclear Energy:* Publication of Proceedings (end of 2001)
- *Next Generation of Nuclear Power Plants*: Publication (end of 2002)
- Input on Nuclear Power to IEA In-depth Country Reviews (3-4 per year)
- Contributions to 3 Chapters (Energy, Resources and Technology) of the OECD Analytical Report on Sustainable Development (early 2001)
- 6th P&T Information Exchange Meeting: Publication of Proceedings (mid-2001)
- *Depleted Uranium*: Publication (end of 2001)
- *Strategies to Address Reduced Level of Nuclear Education, R&D, and Facilities*: Publication (end of 2002)

Links to Horizontal Programmes: OECD Horizontal Programme on Sustainable Development

Outreach: Participation in IEA Energy Reviews in Certain Non-Member Countries

Co-ordination with: IEA, OECD, IAEA

Resources:

ACTIVITY: 7	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	45	2,847	76%
	Support Staff	14	362	10%
Main	***Sub Total (Establishment Staff)***	***59***	***3,209***	***86%***
Resources	Consultants & Auxiliaries	1	39	1%
	Other Directly Allocatable Resources		505	13%
	Total Allocatable Costs for Activity		**3,753**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		2,094	
Resources	*Pro-Rated Share of Overheads Paid to OECD		1,437	
	*Assigned to Horizontal Projects	12	352	
Additional	*Voluntary Contributions		442	
Resources	*Project Staff			
	*Seconded Experts			
	*In-kind contributions			

Activity 8: Collection and Analysis of Operating Experience

Aggregation of sub-activities
Feedback from Operational Experience and the Incident Reporting System
Human and Organisational Factors in Nuclear Power Plants

Objective: to manage, jointly with the International Atomic Energy Agency, the operation of the Incident Reporting System (IRS); to operate the Fuel Incident Notification and Analysis System (FINAS); to develop methodologies to minimise human and organisational errors; and to analyse operating data in order to extract lessons for safety improvements.

Planned Outputs:

- *Incident Reporting System (IRS):* Reports and Maintenance of Database (approx. 100 new reports per annum)
- Organisation of Workshops on Specific Issues and Emerging Trends (2001/2002)
- *Operating Experience:* Periodic Reports (Dec. 2002)
- *Common Cause Failures*: Database (Updates), 4 reports to be issued (2001/2002)
- Impact of Organisational Factors on Nuclear Safety: Studies (Nov. 2002)
- Databases on Human Reliability, Digital Control Systems and Common Cause Failures: Expansion and Development, Guidelines revised Dec. 2001
- *International Comparisons of Performance Indicators:* Workshop Oct. 2001, reports annually
- Studies on, and Compilation, of Accident Precursor Data: Annual Reports
- *The Fuel Incident Notification and Analysis System (FINAS):* Database of Events (updates)

Links to Horizontal Programmes: None

Outreach: Indirect through IAEA and EC

Co-ordination with: IAEA, IEA and EC

Resources:

ACTIVITY: 8	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	22	1,350	69%
	Support Staff	11	276	14%
Main	***Sub Total (Establishment Staff)***	***33***	***1,626***	***83%***
Resources	Consultants & Auxiliaries	2	77	4%
	Other Directly Allocatable Resources		255	13%
	Total Allocatable Costs for Activity		**1,958**	***100%***
Additional	*NEA Data Bank Expertise		246	
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		1,078	
Resources	*Pro-Rated Share of Overheads Paid to OECD		727	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		150	
Resources	*Project Staff			
	*Seconded Experts			
	*In-kind contributions			

Activity 9: Prevention, Mitigation and Management of Accidents

Aggregation of sub-activities
Integrity of Components and Structures
Safety Research Co-operation
Risk Assessment
Analysis and Management of Accidents
Fuel Safety Margins

Objective: to assist the Member countries in identifying and resolving issues related to integrity of reactor systems and components, thermal-hydraulics, containment behaviour, risk assessment and safety research.

Planned Outputs:

- State-of-the-art Reports and Technical Opinion Paper on Specific Safety Issues (3 per annum)
- Accident Management, Data Collection for Risk Assessments, and Ageing and Integrity Issues: Workshops (Spring 2001, Fall 2002)
- Ageing Phenomena: Publication of Catalogue (Dec. 2002)
- Safety Research: Update of Report (Dec. 2001)
- Support to the HALDEN, CABRI, SANDIA-Lower Head Failure and MASCA Joint Research Projects
- Establishment of New Projects in the Areas of Thermal-hydraulics and Severe Accidents
- Thermal-hydraulics, Severe Fuel Damage and Seismic Response of Pipes: International Standard Problems (ISP)
- Collection and Preservation of Thermal-hydraulic Data, Including International Standard Problems
- Identification of Research Needs in the Area of Fuel Safety (Fall 2001)
- Safety Criteria for High Burn-up Fuel: Review and Development (Fall 2001)
- Application of Risk Techniques to Passive Safety Systems: Review (Fall 2002)

Links to Horizontal Programmes: None

Outreach: IAEA and EC

Co-ordination with: IAEA and EC

Resources:

ACTIVITY: 9	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	40	2,512	72%
	Support Staff	18	455	13%
Main	***Sub Total (Establishment Staff)***	***58***	***2,967***	***85%***
Resources	Consultants & Auxiliaries	2	77	2%
	Other Directly Allocatable Resources		466	13%
	Total Allocatable Costs for Activity		**3,510**	***100%***
Additional	*NEA Data Bank Expertise		123	
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		1,948	
Resources	*Pro-Rated Share of Overheads Paid to OECD		1,327	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		150	
Resources	*Project Staff	3		
	*Seconded Experts			
	*In-kind contributions			

Activity 10: Regulation of Nuclear Installations

Aggregation of sub-activities
Regulatory Issues Inspection Practices

Objective: to exchange information on the safety and regulation of nuclear installations, and on regulatory inspection practices, for the purpose of better understanding national requirements and harmonising regulations.

Planned Outputs:

- Two Special Issue Meetings: Safety Research/Low Power and Shutdown Conditions
- Impact on Safety of Electricity Market De-regulation and on Maintaining Safety Competence into the 21st Century: Reports (Dec. 2000)
- Forum for Professionals of Regulatory Bodies Involved in Public Information: Discussion and Organisation (Dec. 2000)
- Comparisons of National Practices in Areas such as Performance Indicators, Inspection of Management, and Inspection of Consultants: Studies (2001, 2002)
- *Future Regulatory Challenges*: Update of Report (Dec. 2002)
- *Regulatory Effectiveness*: Report (Dec. 2001)
- *Commendable Inspection Practices*: Reports (Dec. 2001, Dec. 2002)
- *Investing in Trust-Nuclear Regulators and the Public*: Proceedings of Workshop (Fall 2001)

Links to Horizontal Programmes: None

Outreach: IAEA and EC

Co-ordination with: IAEA and EC

Resources:

ACTIVITY: 10	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	16	1,016	71%
	Support Staff	7	179	13%
Main	***Sub Total (Establishment Staff)***	***23***	***1,195***	***84%***
Resources	Consultants & Auxiliaries	1	39	3%
	Other Directly Allocatable Resources		188	13%
	Total Allocatable Costs for Activity		**1,422**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		787	
Resources	*Pro-Rated Share of Overheads Paid to OECD		535	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions			
Resources	*Project Staff			
	*Seconded Experts			
	*In-kind contributions			

Activity 11: Future Directions for Radiation Protection Policy

Aggregation of sub-activities
Future Directions for Radiation Protection Policy

Objective: to lead international discussions concerning the evolution of radiation protection towards a more concise and coherent system that appropriately reflects societal interest and stakeholder involvement in the decision-making process; to support Member country policies by providing timely indication of new issues and analyses of their possible implications for radiation protection regulation and implementation; to better understand the various radiation protection aspects of decommissioning activities; and to share national experience and approaches to radiation protection application and regulation during decommissioning activities. These activities will be supported by reviews of developments in health science and technology and their implications, and by building consensus approaches among Member countries.

Planned Outputs:

- *Evolution of the System of Radiation Protection*: Report (2001)
- *Better Integration of Radiation Protection in Modern Society*: Workshop (2001)
- Societal Concerns and Objectives in the Area of Radiological Risk Assessment and Management: Report (2001)
- Consensus of Views on the Societal Aspects of a New System of Radiation Protection: Report from the NEA Committee on Radiation Protection and Public Health to the International Commission on Radiological Protection (ICRP) (2002)
- Radiation Protection Aspects of Decommissioning, Covering Strategies, Site Release, and Regulatory Framework – Contribution to NEA cross-cutting activity: Report (2002)
- A Summary of National Experience with Respect to Worker Education and Experience Qualifications: Report (2001)

Links to Horizontal Programmes: None

Outreach: Negligible

Co-ordination with: OECD Environment Directorate, ICRP, IAEA, EC

Resources:

ACTIVITY: 11	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	14	953	68%
	Support Staff	9	224	16%
Main	***Sub Total (Establishment Staff)***	***23***	***1,177***	***84%***
Resources	Consultants & Auxiliaries	1	39	3%
	Other Directly Allocatable Resources		185	13%
	Total Allocatable Costs for Activity		**1,401**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		775	
Resources	*Pro-Rated Share of Overheads Paid to OECD		526	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		300	
Resources	*Project Staff			
	*Seconded Experts	1		
	*In-kind contributions			

Activity 12: Protection of the Public in Nuclear Emergencies and Workers in Nuclear Installations

Aggregation of sub-activities
Nuclear Emergency Matters
Occupational Exposure of Nuclear Facility Workers

Objective: To assist Member countries in improving their management of nuclear emergencies and in analysing the policy implications of related new technologies by organising various International Nuclear Emergency Exercises. Future exercises (INEX 2000 and INEX 3) will focus on areas such as decision making in post-accidental situations, third-party liability and agricultural aspects. To continue to collect and analyse occupational exposure data, and to exchange practical experience in operational radiation protection at nuclear power plants through co-ordination of the Information System on Occupational Exposure (ISOE).

Planned Outputs:

- The Results of the INEX 2000 Exercise: Summary and Analysis Report (2001)
- Policy and Practical Implications of Decision Making in Post-accidental Situations: High-level Workshop (2001)
- Development and Implementation of INEX 3 Exercises: Planning Document (2001)
- ISOE Annual Report, Including Statistical and Radiation Protection Analysis of the Occupational Exposure Database and Experience: Publications (2001 and 2002)
- ISOE International ALARA Symposium Addressing Specific Technical Issues Concerning Radiation Protection during Operation and Maintenance of Nuclear Power Plants: (2001 and 2002)
- Analysis of Data Available in the ISOE Databases, or Data Solicited from Participants: Information Sheets
- ISOE Databases: Updates in hard copy and user-friendly computerised format (2001 and 2002)
- SILENE International Accident Dosimetry Intercomparison Exercise, also sponsored by NEA Nuclear Development Committee: Exercise, summary workshop and report (2001)

Links to Horizontal Programmes: None

Outreach:

– Experts from several non-member countries, in particular CEEC and NIS, participate in INEX exercises
– Many non-NEA members participate in the ISOE Programme directly or through the IAEA

Co-ordination with: IAEA, EC

Resources:

ACTIVITY: 12	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	11	682	73%
	Support Staff	5	121	13%
Main	***Sub Total (Establishment Staff)***	***16***	***803***	***86%***
Resources	Consultants & Auxiliaries			
	Other Directly Allocatable Resources		126	14%
	Total Allocatable Costs for Activity		**929**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		521	
Resources	*Pro-Rated Share of Overheads Paid to OECD		359	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		50	
Resources	*Project Staff			
	*Seconded Experts	2		
	*In-kind contributions			

Activity 13: Strategic Issues and Confidence in Waste Management

Aggregation of sub-activities
Waste Management Strategies and Policies
Confidence Building in Waste Disposal

Objective: to address the technical, scientific, regulatory and ethical aspects of strategies and policies related to the management of long-lived radioactive waste, including spent fuel; to promote common understanding and implementation of approaches among Member countries; to clarify technical and non-technical aspects of confidence building in waste disposal; and to identify and address emerging issues in the general field of radioactive waste management.

Planned Outputs:

- Peer Reviews of National Activities on Request: Italy/2001, Belgium/2001
- *Analysis of Confidence Building Aspects in Integrated Safety Assessments*: Report (2001)
- International Conference on Geologic Disposal: (2001/2002)
- *The Role of Geosphere Stability and Natural Analogues in a Safety Case:* Report (2002)
- *Strategic Waste Management Options*: Position Paper (2002)
- *Case Studies on Confidence Building with Stakeholders*: Report (2002)
- *Analysis of Regulatory Control in Waste Management*: Report (2002)
- *Nuclear Waste Bulletin* No. 15: Publication (2002)

Links to Horizontal Programmes: None

Outreach: Negligible

Co-ordination with: OECD Environment Directorate, IAEA, EC

Resources:

ACTIVITY: 13	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	19	1,327	67%
	Support Staff	12	317	16%
Main	***Sub Total (Establishment Staff)***	***31***	***1,644***	***83%***
Resources	Consultants & Auxiliaries	2	77	4%
	Other Directly Allocatable Resources		258	13%
	Total Allocatable Costs for Activity		**1,979**	***100%***
Additional	*NEA Data Bank Expertise			
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		1,089	
Resources	*Pro-Rated Share of Overheads Paid to OECD		735	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		200	
Resources	*Project Staff			
	*Seconded Experts	1		
	*In-kind contributions			

Activity 14: Technical and Scientific Activities to Establish and Evaluate Long-term Safety; Decommissioning Related Issues

Aggregation of sub-activities
Special Aspects of Long-term Safety and their Integration into a Safety Case
Decommissioning of Nuclear Facilities and Management of Very Low Level Waste
Technical and Scientific Studies and Databases

Objective: to promote defensible selection and safety assessment of underground disposal concepts for long-lived waste; to increase scientific and technical knowledge concerning the management of radioactive waste; to promote exchange of information and experience in the decommissioning of nuclear facilities; and to promote the establishment of environmentally-sound strategies for managing very low level waste.

Planned Outputs:

- International Database on Events, Features and Processes (FEPs) of Relevance to Long-term Safety Assessments: Publication (2001)
- GEOTRAP Forum on Migration of Radionuclides Through the Geosphere: Publication of Proceedings and Technical Synthesis Reports (2001, 2002)
- The Activities of the Clay Club: Topical Reports (2001, 2002)
- The Role of Specific Engineered Barriers: Report (2002)
- Forum on Sorption Modelling: Workshop and Report (2002)
- Management of Very Low Level Waste and Nuclear Facility Decommissioning: Technical Reports (2001), Workshop (2002)
- Waste Management Aspects of Decommissioning, Covering Strategies, Site Release, and Regulatory Framework – Contribution to NEA cross-cutting activity: Report (2002)
- NEA Thermochemical Data Base: Reports (2001, 2002) – See also Activity 5

Links to Horizontal Programmes: None

Outreach: Experts from Estonia and the Slovak Republic participate in Co-operative Programme on Decommissioning

Co-ordination with: IAEA, EC

Resources:

ACTIVITY: 14	RESOURCES	MONTHS	COST (IN 000's FF)	% OF ACTIVITY
	Professional Staff	34	2,017	74%
	Support Staff	10	248	9%
Main	***Sub Total (Establishment Staff)***	***44***	***2,265***	***83%***
Resources	Consultants & Auxiliaries	3	116	4%
	Other Directly Allocatable Resources		356	13%
	Total Allocatable Costs for Activity		**2,737**	***100%***
Additional	*NEA Data Bank Expertise		2,365	
Indirect	*Pro-Rated Share of Other Internal NEA Costs (rent, etc.)		1,505	
Resources	*Pro-Rated Share of Overheads Paid to OECD		1,014	
	*Assigned to Horizontal Projects			
Additional	*Voluntary Contributions		40	
Resources	*Project Staff	10		
	*Seconded Experts	5		
	*In-kind contributions			

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NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY

NEA/NE(2000)11
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REVIEW OF THE NEA COMMITTEE STRUCTURE

(Note by the Secretariat)

The Steering Committee is invited to:
i) take note of the final report on the review of the NEA committee structure;
ii) recall its decision of May 1999, to maintain the current structure of the standing technical committees;
iii) take note of the revision process carried out by the standing technical committees, including their mandates, their sub-structures and methods of work;
iv) approve the mandates of the standing technical committees set out in Annex I;
v) take note of Annex III concerning the future structure of the NEA Secretariat.

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Or. Eng.

REVIEW OF THE NEA COMMITTEE STRUCTURE

I. INTRODUCTION

1. The Steering Committee will recall that, as part of a four-stage process of reform which originated from recommendations of a High Level Advisory Group on the Future of the OECD Nuclear Energy Agency (HLAG), a decision was taken as the third step of the NEA reform to review the NEA committee structure and working methods, taking into account the new *Strategic Plan* of the Agency.

2. This review was timely because the OECD as a whole (except the NEA and the IEA, due to the different nature of their work) had recently carried out an examination of its committee structure, at the request of the Council, the purpose being to create a culture of evaluation within the committees and to achieve a reduction in the number of both committees and subsidiary bodies.

3. The present document is the final report on the scope, process and outcome of the NEA reform, a provisional version of which was considered by the Steering Committee at its last meeting in May 2000. At this time, the Steering Committee approved the document with some specific comments and decided that the final version would be approved at its meeting in October 2000.

4. Compared with the version already examined by the Committee (NEA/NE(2000)2), this final version presents the detailed outcome of the review, including adjustments in dealing with horizontal activities, and the role of the Steering Committee and its Bureau. In addition, the report presents the streamlined committee and sub-committee structure as well as the up-dated mandates of the committees. Furthermore, a brief description of the basic role and structure of the NEA Secretariat is provided, following the review of the organisation of the Secretariat as the fourth stage of the NEA reform process.

II. SCOPE AND PROCESS OF THE REVIEW

5. At its session in May 1999, the Steering Committee was invited to review a document [NEA/NE(99)3], which had been prepared by the Secretariat with the help of a think-tank composed of five external experts and senior staff from the Agency. This document developed two options for the future NEA committee structure, the first one consisting in maintaining the current structure of the main standing technical committees, and the second, based on an adjustment of that structure, involving a reduction in the number of standing technical committees from seven to five.

6. At that session, the Steering Committee decided [NEA/NE/M(99)1] to maintain for the time being the current structure of NEA standing technical committees, while inviting their chairmen to pursue a review of their subsidiary bodies and programmes of work, in line with the process of reform outlined in the document [NEA/NE(99)3]. This process involved streamlining standing technical committee sub-structures and transforming them into more task-oriented bodies. A reduction of 10 % in the number of subsidiary bodies and meetings was set as an objective. At the same time, the standing technical committees were invited to review their own mandates and those for their subsidiary bodies.

7. Another purpose of the exercise was to adjust subsidiary bodies' working methods in order to achieve a more efficient handling of the increasing number of issues cutting across areas of competence within the Agency and the OECD.

8. On 11 June 1999, the Director-General wrote to the chairmen of all NEA standing technical committees to inform them of the decisions taken by the Steering Committee concerning the review of the NEA committee structure, and to provide them with the necessary guidance on the objectives, scope and timing of this exercise.

III. OUTCOMES OF THE REVIEW

9. As a first step in the review, each NEA committee has launched a broad reflection on its strategy for the coming years, bearing in mind the objectives set out in the NEA *Strategic Plan* and the future orientation of its activities. In a second step, each committee has focused on the review itself, namely:

- the appropriateness of its mandate, in light of these objectives;
- the adequacy of its sub-structure to carry out its work efficiently, both in terms of quality and cost;
- improving its working methods; and
- improving the handling of cross-cutting activities within and outside the NEA.

10. The following paragraphs provide a summary of results of the review. The new chart of the NEA committee structure and sub-structure is presented in Annex I, as well as more detailed information concerning the process and the outcomes of the review for each committee.

1. Mandates of Standing Technical Committees

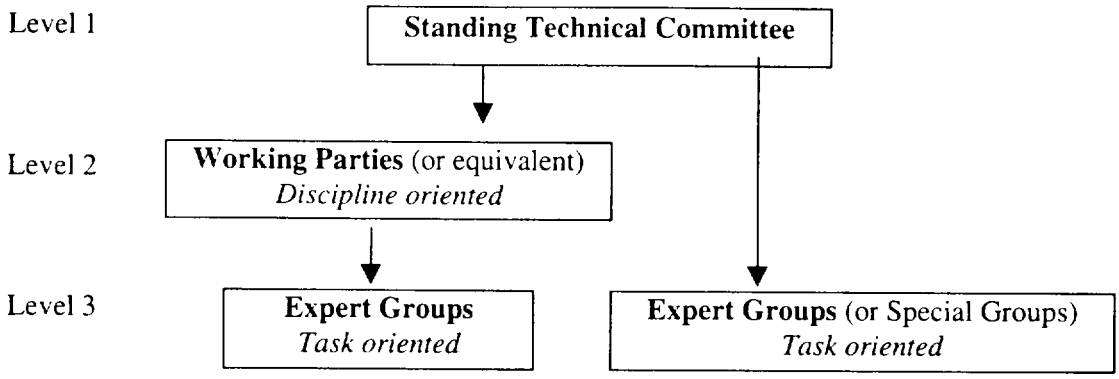
11. Between October 1999 and June 2000, all standing technical committees reviewed their mandates: the Group of Governmental Experts on Third Party Liability proposed a new mandate and to change the name of the Group to "Nuclear Law Committee"; the CRPPH proposed modifications to the Committee's mandate to better reflect the NEA *Strategic Plan*; the NSC proposed that the Committee's present mandate be confirmed and it approved a proposal for a minor adjustment of the explanatory note attached to the mandate, with a view to better reflecting the new *Strategic Plan* objectives; and the RWMC and the NDC proposed slight changes and revisions to their mandates. The CSNI and CNRA did not see any immediate need to propose modifications to their present mandates.

All adjusted or updated mandates of the standing technical committees are reproduced in Annex I. They are submitted to the Steering Committee for approval. In principle, the mandate for each standing technical committee is five years but this can be adjusted to correspond closely to the Programme of Work or a new Strategic Plan.

2. Sub-Structure

12. The standing technical committees have reviewed their structures whilst bearing in mind several reasons for increasing their efficiency: better control of the Programme of Work, more effective treatment of cross-cutting issues and reduction of working parties/working groups and meetings. Some groups have been suppressed or merged and others have been created. Some have been retained as "Discipline-oriented Groups" or transformed into "Task-oriented Groups", depending on the type and duration of the work and the necessity to maintain a network of experts in specific technical areas.

13. After revision, the proposed general structure of the individual committees will be as follows:



14. At level 2, working parties report directly to the committee: they maintain an efficient network between experts and carry out longer term activities (discipline oriented).

15. At level 3, two types of expert groups exist:

- expert groups or special groups reporting directly to the committee to carry out specific tasks for the committee (task oriented);
- expert groups created by the working parties to carry out, under their control, specific tasks (task oriented).

Duration of the mandates would be set at five years for committees (level 1) and, respectively, three years for level 2 and two years for level 3. These mandates, which would be more product oriented, might be reviewed in the meantime if necessary.

16. Substantial progress has also been achieved on harmonisation of the nomenclature of the committee sub-structures, although the process is not yet complete. Further efforts in this area have to be pursued.

17. All the committees have finalised the review of their structures. The following table provides a precise picture of the results of the review in terms of reduction of numbers of subsidiary bodies.

	OLD STRUCTURE Number of Groups		**NEW STRUCTURE** Number of Groups	
COMMITTEES	Discipline oriented	Task oriented	Discipline oriented	Task oriented
CSNI	7	20	5	14
CNRA	1	1	1	1
NDC	0	7	0	7
NSC	6	14	6	8
RWMC	3	6	3	7
CRPPH	3	9	2	8
TPL			(*)	
TOTAL	77		62	

(*) *setting up one new working party or expert group is under consideration.*

18. In order to assure a smooth transition from the existing structure to the new one and to avoid any difficulties in the implementation of the Programme of Work for 2000, the new structure will be established progressively during 2000 with the objective of being operational for the 2001-2002 Programme of Work. The revision process at levels 2 and 3 is ongoing and is expected to be completed by the end of this year.

3. Working Methods of Standing Technical Committees

19. The review of the working methods of standing technical committees has resulted in the adoption of several measures to reduce the workload on Member countries and to increase not only their own efficiency and flexibility, but also that of the subsidiary bodies. These measures are described in Annex I. One committee plans to increase its annual meetings to two a year, but its sub-structure has been streamlined and the total number of meetings will be reduced. The committees will continue to develop the concepts of sharing of work and communicating via electronic networks. In this respect, the NEA Secretariat will assist in developing tools to facilitate the work of the experts. Teleconferencing has already been implemented in specific cases. The committees will regularly report to each other on issues of common interest. All issues of co-ordination between committees will be reported to the annual meeting of the chairmen of the standing technical committees.

4. Cross-cutting activities

20. The *Strategic Plan* notes that some areas of Agency work are cross sectorial by nature. At its meeting in spring 1999, the Steering Committee acknowledged the increasing number of issues cutting across areas of competence within the Agency and the OECD, and asked the committees to develop ways to improve the handling of such issues.

21. A number of cross-cutting issues have already been identified, as indicated in Annex II. This annex reflects the current situation as reviewed by the chairmen of standing technical committees at their meeting last May. Collaborative work and joint activities are underway in many areas but further actions are necessary to increase efficiency in programme rationalisation and implementation.

22. The roles of the respective committees have been clarified for each of these cross-cutting activities, with actions to be taken in each area. In particular, the committees have considered the introduction of appropriate mechanisms for co-ordination, such as setting up joint task groups and cross representation, when necessary. In certain cases, a committee has been asked to take the lead, but this has not been considered as a general rule for all cross-cutting activities.

23. Beyond the measures taken by the standing technical committees themselves, the handling of cross-cutting activities will be addressed at three levels:

- the Steering Committee has a specific role to play, as mentioned in section IV below. Because of the relevance of this topic to the POW, the cross-cutting activities were also identified in the document on the Main lines of the POW for 2001-2002 [NEA/NE(2000)1];
- the Secretariat has the task of identifying areas of horizontal co-operation and of anticipating possible overlapping. In particular, its role is to assure the optimal use of existing competencies throughout the Agency and to avoid the creation of new ones in a standing technical committee if they already exist in another committee;
- one of the main tasks of the annual meeting of standing technical committee chairmen is to agree on the division of labor between committees with respect to cross-cutting activities, and on the modalities of implementation of the Programme of Work in these areas.

IV. ROLE OF THE STEERING COMMITTEE AND ITS BUREAU

24. Among its overall responsibilities, the Steering Committee is expected to:

- approve priorities and resources of standing technical committees; and
- monitor the results of their programmes.

25. In the light of the outcome of this review and to fulfil these objectives, it is appropriate to consider how the Steering Committee's interface with standing technical committees might be usefully adjusted in order to ensure that the Committee is kept informed of the progress of their work, including that of their sub-structures.

26. This feedback from - and dialogue with - standing technical committees will continue to take place on, at least, three levels:

- during the periodic reporting to the Steering Committee by individual chairmen of technical committees on the achievements and prospects of their committees every other year or so;
- when the biennial NEA Programme of Work is presented to the Steering Committee for approval; and
- when broad reviews are undertaken of the NEA's goals and objectives in conjunction with revising the Agency's *Strategic Plan* every five years or so, or due to some other factor.

27. The role of the Bureau in connection with the overall committee structure is:

- to provide guidance to the Secretariat and standing technical committees on issues that may arise between regular Steering Committee meetings;
- to help in reaching solutions to issues raised by the standing technical committees;
- to facilitate the exchange of information between the Steering Committee and the standing technical committees;
- to represent the Steering Committee at the annual meeting of the Secretariat and standing technical committee chairmen when issues concerning committee structure may arise.

V. STRUCTURE OF THE SECRETARIAT

28. On several occasions, the Director-General informed the Steering Committee that, as the fourth stage of the reform process, he would reconsider the structure of the Secretariat in light of the outcome of the overall NEA reform process, with a view to adapting it if and when necessary. Taking into account that the Steering Committee decided to maintain the existing structure of the standing technical committees while reducing and streamlining the sub-structure, as well as improving the methods of work of the committees, the Director-General has concluded that major changes to the structure of the Secretariat are not required. Nevertheless, this exercise has provided an opportunity to adjust and consolidate some functions in the Senior Management, in the Science and Data Bank area and in Central Services. An organisation chart of the NEA Secretariat is provided in Annex III, which also provides a brief description of the basic role of the different areas of the NEA Secretariat, including the Senior Management, technical divisions, Central Secretariat and Administration.

VI. CONCLUSIONS

29. The aforementioned adjustments to NEA committee structure and working methods are consistent with changes made in the OECD as a whole and with the objectives of the NEA's *Strategic Plan*. It is clear, however, that the implementation process will continue for a few months in line with the schedule of meetings of the committees. Nevertheless, the process should be complete by the end of the year, prior to initiation of the 2001-2002 Programme of Work.

30. The significant reduction in the number of subsidiary bodies, along with the improvement of their methods of work, will make it possible to reduce the overall number of meetings accordingly.

VII. ACTION BY THE STEERING COMMITTEE

31. The Steering Committee is invited to:

i) **take note** of the final report on the review of the NEA committee structure;

ii) **recall** its decision of May 1999, to maintain the current structure of the standing technical committees;

iii) **take note** of the revision process carried out by the standing technical committees, including their mandates, their sub-structures and methods of work;

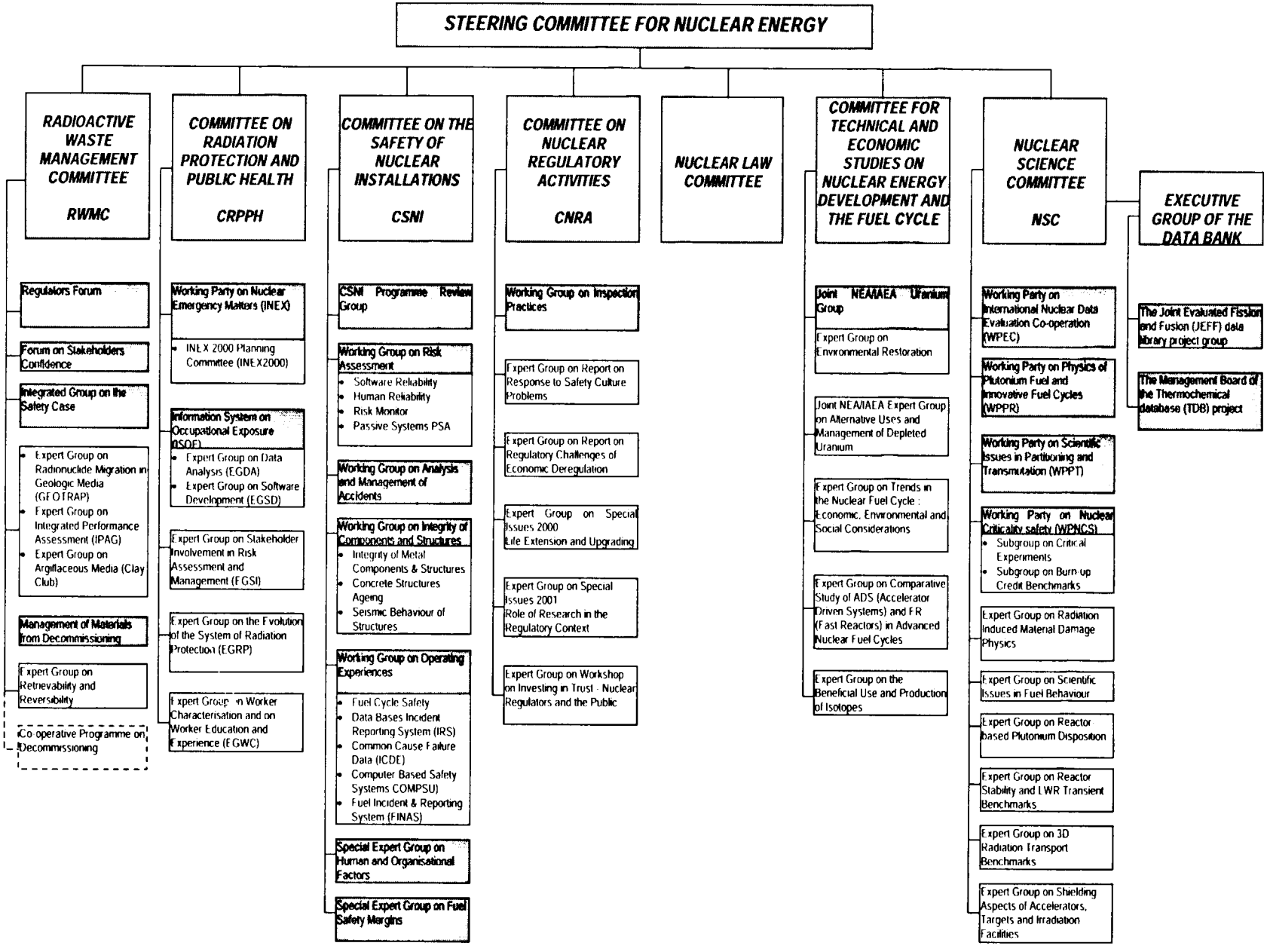
iv) **approve** the mandates of the standing technical committees set out in Annex I;

v) **take note** of Annex III concerning the future structure of the NEA Secretariat.

ANNEX I

Detailed outcome of the review process of NEA committee structure

COMMITTEE STRUCTURE OF THE OECD NUCLEAR ENERGY AGENCY (NEA)



GROUP OF GOVERNMENTAL EXPERTS ON THIRD PARTY LIABILITY IN THE FIELD OF NUCLEAR ENERGY

1. Review process

At its October 1999 meeting, the Group of Experts considered the continued suitability of its mandate and methods of work in light of the Agency's new *Strategic Plan,* the newly expanded Programme of Work for Legal Affairs, and changes in the composition of the Group's membership[1] In addition, the Group was conscious of the fact that, during the NEA Steering Committee's own meeting earlier that month, several members had spoken in favour of enlarging the mandate of the Group and all had agreed that it should remain a separate NEA standing technical committee.

2. Mandate of the Group

As a result, the members of the Group of Experts proposed a new mandate for the Group with a view (i) to encouraging the development of national legislation governing the peaceful uses of nuclear energy based upon internationally accepted principles, and in particular to promote world-wide harmonisation of nuclear liability legislation and policies, (ii) to fostering a more global regime of civil liability and compensation for nuclear damage including examining issues related to the interpretation and application of the international nuclear liability instruments; and (iii) to addressing issues falling within the field of nuclear law generally as and when appropriate, and to undertake all other work involving legal matters entrusted to it by the NEA Steering Committee. The Group would also be renamed as the "Nuclear Law Committee".

Revised mandate

Date of creation: *24 January 1957*

Duration: *Unspecified*

Last revision: *1974*

The Nuclear Law Committee will work to encourage provisions for equitable compensation of damage in the event of a nuclear incident. In particular, the Committee is mandated to deal with issues relating to civil liability for damage caused by a nuclear incident and to financial security mechanisms designed to ensure that funds will be available to compensate such damage. It addresses these issues in the context of Member countries' nuclear legislation and of international nuclear liability instruments, including 1) the 1960 Paris Convention on Third Party Liability in the Field of Nuclear Energy and the 1963 Brussels Convention Supplementary to the Paris Convention, 2) the 1963 Vienna Convention on Civil Liability for Nuclear Damage and the 1997 Protocol to Amend the Vienna Convention, 3) the 1988 Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention, and 4) the 1997 Convention on Supplementary Compensation for Nuclear Damage. The Nuclear Law Committee will also strive to eliminate or minimise any legal impediments to the safe use of nuclear energy.

More specifically, the Committee has a mandate to:

i) examine issues relating to the interpretation and application of international nuclear liability instruments, especially with respect to their harmonious application under Member countries' national laws, and encourage broader adherence to those instruments with a view to fostering further progress towards a global regime of liability and compensation for nuclear damage;

ii) encourage the development of national legislation governing the peaceful uses of nuclear energy based upon internationally accepted principles, particularly in the area of liability and compensation;

iii) promote the harmonisation of national policies and legislation in the nuclear liability and compensation field amongst its Member Countries;

iv) develop recommendations concerning the Paris Convention and the Brussels Supplementary Convention for submission, if appropriate, to the Steering Committee for Nuclear Energy.

The Nuclear Law Committee serves as a forum for the exchange of information and the sharing of experience between Member countries on these issues.

The Nuclear Law Committee is also mandated to undertake all other work involving legal issues that may be entrusted to it by the NEA Steering Committee.

The Nuclear Law Committee will co-operate with other NEA Standing Committees. It may set up subsidiary bodies to better facilitate the achievement of its goals, invite experts in other fields to attend its meetings, and sponsor meetings of specialists. It may also establish contacts with its counterparts in the European Community, the International Atomic Energy Agency, and other international organisations on matters of common interest.

3. Modification of working group structure and methods of work

It is conceivable that in the future the Nuclear Law Committee may wish to establish one or more working parties or expert groups to carry out certain tasks that would be better addressed by a smaller subsidiary body than by the Committee as a whole. Such an initiative is likely to occur in connection with activities to be undertaken by the Committee pursuant to its expanded mandate, particularly in the field of general nuclear law matters. In that event, the Nuclear Law Committee will, of course, comply with NEA Steering Committee requirements concerning the terms of reference, specified objectives, expected products and schedule, and fixed duration of all such subsidiary bodies.

4. Handling of cross-cutting activities

The Group will continue contributing to the activities of other committees, as required.

Reference

[1] Approximately one-half of the Members of the Group of Experts are neither Parties to the Paris Convention nor to the Brussels Supplementary Convention

NUCLEAR SCIENCE COMMITTEE (NSC) AND ITS EXECUTIVE GROUP

1. Review process adopted and general approach

At its annual meeting at the beginning of June 1999, the Nuclear Science Committee (NSC) started debating the NEA reform process and its implications for the committee and its Executive Group, responsible for the Data Bank activities. Already at that time, the NSC took account of the recommendations of the newly adopted NEA *Strategic Plan* by introducing two modifications in the Programme of Work for 2000. The future NSC strategy, programme of work and working methods were also discussed, including proposals for a prioritisation and regrouping of activities. The review process continued and the NSC finalised a document[1] on the future NSC strategy and organisation during its meeting in June 2000.

2. Mandate of the NSC, including that of the Executive Group

The NSC reviewed the mandate, including that of the Executive Group for the Data Bank, considering its consistency with the NEA *Strategic Plan* and the organisational aspects related to the NEA reform process. It was concluded that the main body of the present mandate conformed well to the new situation. However it was agreed to propose a slight adjustment to the scope and objectives in the explanatory note attached to the mandate, to better reflect the *Strategic Plan* and the considered programme of work for 2001-2002. The final adjustments were decided at the NSC meeting in June 2000.

The original mandate for the NSC and its Executive Group was approved by the NEA Steering Committee on 1 October 1991. The NSC Bureau reviewed this mandate at its Bureau meeting in December 1999 and the proposed modifications, mainly to the explanatory note, were approved by the NSC by written procedure in January 2000.

Date of creation: *1 October 1991*

Duration: *5 years*

Last revision: *not relevant*

MEMBERSHIP

The Committee shall consist of one or more representatives from each Member country.

SCOPE AND OBJECTIVES

Under the authority of the Steering Committee, the Committee shall promote co-operation among Member countries in fields of nuclear science relevant to the purposes of the Agency according to its Statute and its Strategic Plan, and shall propose to the Steering Committee the main orientation and priorities of the nuclear science programme of the Agency. In particular, the Committee shall constitute a forum for the exchange of information and experience, co-ordinate scientific activities in Member countries, and promote appropriate studies and projects as well as the provision of scientific services such as the compilation, evaluation and processing of nuclear data, the construction and maintenance of nuclear data bases, and the collection and dissemination of quality-assured computer programs for

nuclear applications. In defining its activities, it shall seek to anticipate future developments in both existing and new technologies as well as to respond to current technological problems.

WORKING METHODS

The Committee shall promote the exchange of information on, and collaboration and co-ordination in the development of, facilities, techniques and equipment for studies within its scope. It shall encourage joint use of existing research installations in Member countries, and the establishment of joint projects in accordance with the Statute of the Agency.

The Committee shall recommend to the Director-General the organisation of or co-operation in conferences, seminars, specialist meetings and technical workshops relevant to its activities.

The Committee may set up working parties to carry out studies and to keep under review issues defined in its programme of work. They shall be established for an initial period not exceeding three years, with the possibility of being extended for subsequent periods not exceeding three years, after due review. Their chairmen shall report to each of the Committee's meetings.

REPORTING

The Committee shall report at least annually to the Steering Committee.

LIAISON

The Committee shall interact with other standing committees of the Agency in matters of common interest and with other bodies within the Organisation, as appropriate.

The Committee shall carry out its tasks taking fully into account the work of other international organisations, both governmental and non-governmental. It shall also maintain, as appropriate and in conformity with the Statute of the NEA, contacts with international organisations working in related fields, with which relations have been established by the Steering Committee in agreement with the Council, including, where provided for, through the participation of representatives of those organisations in meetings of the Committee.

COMMITTEE OFFICERS

The Committee shall designate its Chairman and Vice-Chairmen for a one-year term.

EXECUTIVE GROUP

The Committee shall establish an Executive Group with the task of keeping under review the scientific services provided by the NEA Data Bank for the benefit of its Participating countries or of the Agency as a whole, comprising the collection, processing, validation and dissemination of computer programs and scientific and technical data. The Executive Group shall assist the Secretariat in establishing proposals for the work programme and budget for these services, to be considered by the Committee with a view to making recommendations to the Steering Committee.

*The Executive Group shall consist of members of the Committee chosen each year and including, but not limited to, at least one representative of each Participating country of the Data Bank.**

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* At the date of adoption of these Terms of Reference: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Japan, Korea, Mexico, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom.

REVIEW

The Committee shall from time to time provide to the Steering Committee advice, which may assist its review of these Terms of Reference.

3. Modification of working group structure and working methods

The NSC has reviewed its structure and decided on the following three main modifications to its organisation,

- the merging of two working parties (WPEC and WPMA), in the field of nuclear data, into one single working party (WPEC),
- the reduction from 14 task forces or working party subgroups to 9 task-oriented expert groups or working party subgroups,
- the creation of a working party dealing with scientific issues related to nuclear waste partitioning and transmutation.

The possible renewal of any expert group mandate will be handled by the NSC in the same way as for the working party mandates, whereas the subgroup mandates will be reviewed by the respective working party.

Most members of the NSC working parties, expert groups and subgroups are electronically well equipped to efficiently share work and communicate via networks. The working parties are also, as far as possible, grouping meetings together, or arranging meetings in conjunction with larger conferences to minimise travel for the delegates.

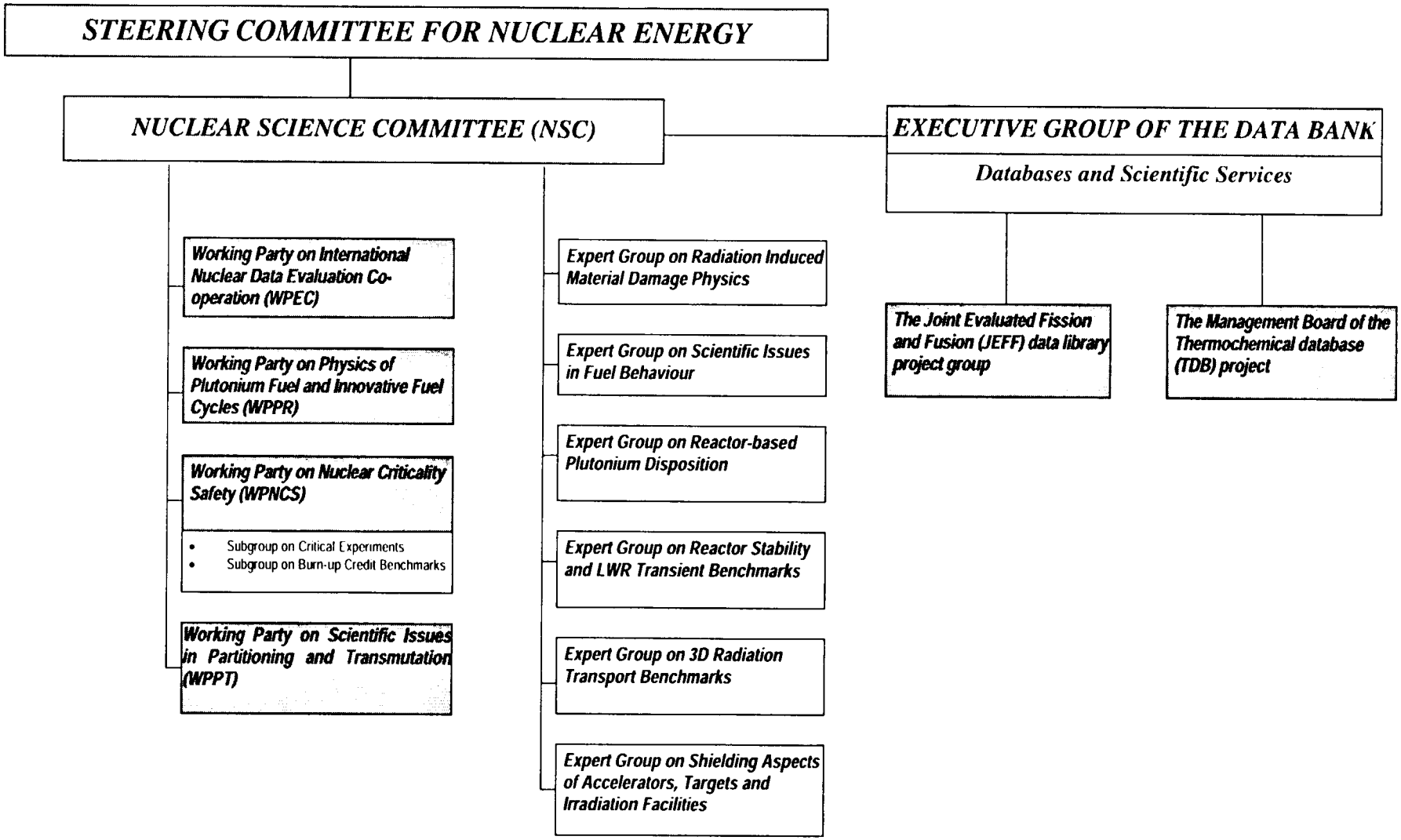
4. Handling of cross-cutting activities

The NSC and the Data Bank will further develop co-operation with other NEA committees, as well as the informal and formal co-operative agreements with national and international organisations. In the case of internal NEA co-operation, the NSC will make full use of the yearly meetings of the chairmen of the NEA standing technical committees, to identify areas of common interest and to solve any conflict of interest that might develop from the different programmes of work. The internal co-ordination will also be assured by close contact within the NEA Secretariat. A number of cross-cutting activities and joint projects, involving the NSC and the Data Bank, are already established, as mentioned in Annex II.

Reference

[1] Nuclear Science Committee Strategy and Organisation - NEA/NSC/DOC(2000)1

STRUCTURE OF THE NSC AND THE DATA BANK



COMMITTEE FOR TECHNICAL AND ECONOMIC STUDIES ON NUCLEAR ENERGY DEVELOPMENT AND THE FUEL CYCLE (NDC)

1. Review process adopted and general approach

The existence of a new NEA *Strategic Plan* has provided a basis for accurately reflecting current thinking of Member countries concerning the NEA goals and objectives. The NDC took this opportunity to review its strategic directions of work. Initial discussions were held by the NDC Bureau with the support of the NDD Secretariat. The recommendations of the Bureau were contained in papers[1,2] submitted to the NDC meeting on 20-21 January and 14–15 June 2000 and fully supported by Member countries.

2. Mandate of the Committee

In June 2000, the NDC decided to verify the adequacy of its mandate to meet the new strategic objectives and finally decided to propose a revision of the existing mandate which dates from 1977.

Date of creation: *26 October 1977*

Duration: *Unspecified.*

Last revision: *not relevant*

Under the authority of the Steering Committee for Nuclear Energy, to conduct technical, resource, economic, strategic and policy-support studies on nuclear energy development, its fuel cycle and related issues in support of Member countries' peaceful national energy or nuclear energy policies. Specifically, the following topics should be included in the programme of activities:

- *The economics of the nuclear option, and the associated market issues.*
- *Technologies concerning the full range of nuclear fuel cycle activities, including decommissioning.*
- *Infrastructure to support the nuclear option.*
- *The production, supply and demand of nuclear materials and radioisotopes and other aspects of their management.*
- *The potential and expected contribution of nuclear energy in a sustainable development perspective.*

Furthermore the Committee should address the preceding topics by:

- *Contributing to the dissemination of information in the areas listed above.*
- *Establishing a liaison with other NEA Committees and other parts of the OECD, as appropriate, to analyse and comment on aspects within its competence contained in any report relating to the mission of the NEA or specifically submitted to the Steering Committee.*
- *Reviewing related work in national and other international governmental organisations, especially the International Atomic Energy Agency and advise the Steering Committee on the co-ordination of the NDC's work with that of others.*

- *Maintaining an understanding of the role and work of all organisations relevant to the area of interest of the Committee, such as industry, trade organisations, regulators, interest groups or professional associations.*
- *Reporting every year to the Steering Committee, reviewing NEA activities in this field and making proposals for the future programme of work.*

3. Modification of working group structure and methods of work

The NDC has no permanent subsidiary bodies. All groups to conduct a study or carry out a task are established for a single purpose which, once achieved, results in disbandment of the Group. This having been said, the Joint NEA/IAEA Uranium Group has existed for many years, due to its mandate having been repeatedly renewed as a part of the programme of work established at the outset of each budget cycle.

NDD activities will continue to reflect past practices but with more specific attention being given to the efficiency with which expert groups are managed. Specific areas for improvement have been identified.[2] Guidelines for the management of NDC expert groups have been adopted with a view to reducing the burden on Member countries.

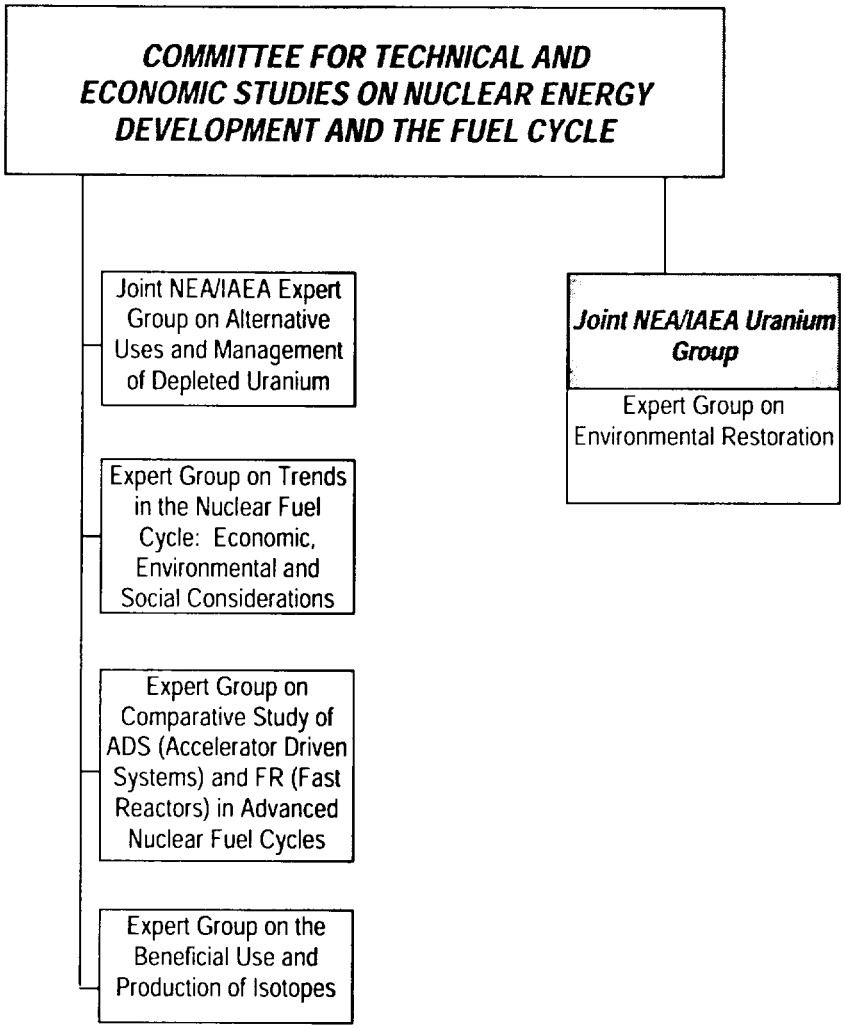
4. Handling of cross-cutting activities

Two thirds of the deliverables within the 1999/2000 NDD programme of work involve collaborative working, either within the NEA or with other organisations. One of the five specifically defined objectives of NDC[1] is to pursue such interactions and this feature of work will continue to be assigned a very high priority.

References

[1] NDC Strategy - NEA/SEN/NDC(99)32
[2] NDC Efficiency - NEA/NDC/DOC(99)15

STRUCTURE OF THE NDC



COMMITTEE ON THE SAFETY OF NUCLEAR INSTALLATIONS (CSNI)

1. Review process adopted and general approach

In order to develop its own Strategic Plan, the Committee on the Safety of Nuclear Installations (CSNI) established a special Group under the chairmanship of a CSNI Vice-Chairman. There were three fundamental reasons to develop such a Plan: first, to ensure that the strategic direction of the CSNI is aligned with that of the NEA *Strategic Plan;* second, to implement the recommendations of a senior group of external experts which reviewed the effectiveness of the CSNI in 1998; and, third, to maximise efficiency in view of decreasing R&D budgets in Member countries.

The Group met twice in 1999 and produced a report[1], which was discussed and adopted by the CSNI at its December 1999 meeting. The report contains a review of the technical issues facing the international safety community over the next few years, a new structure for the CSNI and its working groups, and a series of recommendations and criteria to ensure that the work of the CSNI is carried out in a business-like manner.

2. Mandate of the Committee

The mandate has not been changed.

Date of creation: *1 February 1973*

Duration: *Unspecified*

Last revision: *not relevant*

The Committee on the Safety of Nuclear Installations shall be responsible for the activities of the Agency concerning the technical aspects of the design, construction and operation of nuclear installations insofar as they affect the safety of such installations.

The Committee shall constitute a forum for the exchange of technical information and for collaboration between organisations, which can contribute, from their respective backgrounds in research, development, engineering or regulation, to these activities and to the definition of its programme of work. It shall have regard to the exchange of information between Member countries with safety R&D programmes of various sizes in order to keep all Member countries involved in and abreast of developments in safety technology.

The Committee shall review the state of knowledge on selected topics of nuclear safety technology and safety assessment, including operating experience. It shall initiate and conduct programmes identified by these reviews and assessments in order to overcome discrepancies, develop improvements and research consensus on technical issues of common interest. It shall promote the co-ordination of work in different Member countries including the establishment of joint undertakings, and shall assist in the feedback of the results to participating organisations.

The Committee shall focus primarily on power reactors and other nuclear installations currently being built and operated; it shall also consider the safety implications of scientific and technical developments. Furthermore, it shall examine any other matters referred to it by the Steering Committee.

The Committee shall organise its own activities. In implementing its programme the Committee shall establish co-operative mechanisms with the Committee on Nuclear Regulatory Activities to work with that Committee on matters of common interest, avoiding unnecessary duplications. It may sponsor specialist meetings and technical working groups to further its objectives.

The Committee shall also co-operate with the Committee on Radiation Protection and Public Health and the Radioactive Waste Management Committee on matters of common interest.

3. Modification of working group structure and methods of work

The major changes are as follows:

i) A Programme Review Group will be created to assist the Bureau in improving top-down direction of the programme of work, and help improve the quality of the CSNI reports. This Group will also compile and maintain a list of "safety issues" and identify cross-cutting issues.

ii) The principal working groups will be re-named working groups and be reduced from five to four; the number of subgroups is also substantially reduced. These discipline-oriented working groups are considered necessary to maintain a network of experts.

iii) Two special expert groups with a very specific time limited mandate are created to deal with the cross-cutting issues of fuel safety margins and human and organisational factors. On both of these issues there is increased concern and activity in our Member countries.

In addition, guidelines have been developed for the identification and approval of work. These include criteria for measuring success in achieving objectives and in prioritising work. Finally, the CSNI intends to review the overall effectiveness of its Strategic Plan three years after its implementation.

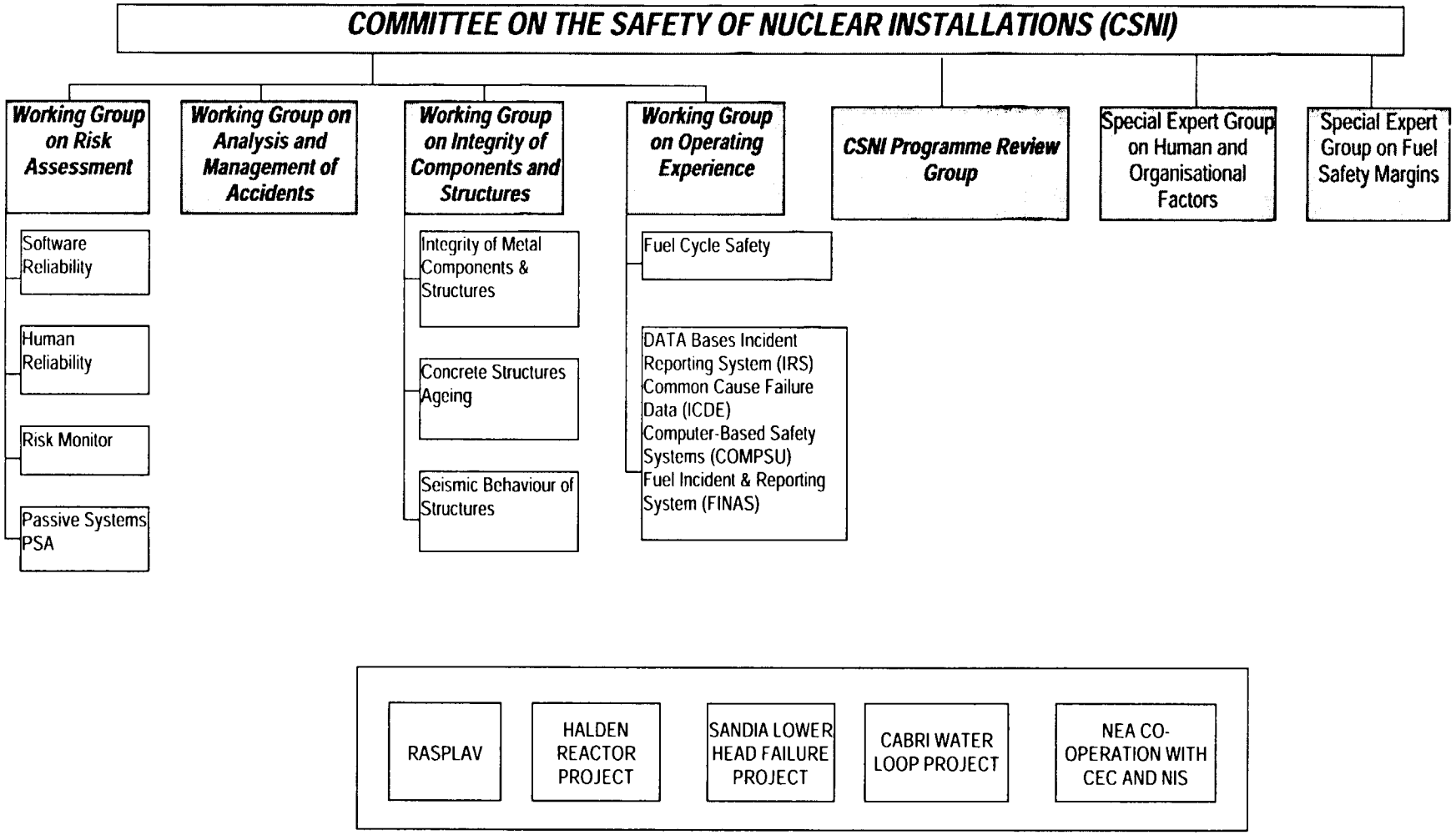
4. Handling of cross-cutting activities

This will be dealt with by the Programme Review Group and the Bureau as discussed previously.

Reference

[1] The Strategic Plan for the Committee on the Safety of Nuclear Installations - NEA/CSNI/R(2000)3

STRUCTURE OF THE CSNI



COMMITTEE ON NUCLEAR REGULATORY ACTIVITIES (CNRA)

1. Review process adopted and general approach

In 1997 the Committee on Nuclear Regulatory Activities (CNRA) conducted, through an external group of experts, an in-depth review of its role, activities and working methods. Furthermore, in the same year, the CNRA published a report on "Future Regulatory Challenges". This report outlines the socio-political and technical issues that regulatory bodies were likely to face over the next five to ten years.

These two initiatives resulted in a revised CNRA mandate, which was discussed and approved by the Steering Committee in May 1998. They also led to the establishment of a long-term programme of work, which is currently being carried out, and in a number of changes to the working methods of the Committee. In addition the CNRA has a simple structure consisting of only one working group which deals with inspection practices. In general, ad hoc expert groups having a well-focused mandate and time limit carry out tasks. Because of this, the CNRA decided that the basic elements of a strategic plan were already in place and that the Bureau, rather than a special task group, should develop it. The CNRA Strategic Plan has been approved and issued (NEA/CNRA/R(2000)3.

2. Mandate of the Committee

The mandate of the CNRA was revised recently. No significant changes are envisaged as a result of this review.

Date of creation: *3 October 1989*

Duration: *Unspecified*

Last revision: *1 December 1997*

The Committee on Nuclear Regulatory Activities shall be responsible for the programme of the Agency concerning the regulation, licensing and inspection of nuclear installations with regard to safety.

The Committee shall constitute a forum for the exchange of information and experience among regulatory organisations. To the extent appropriate, the Committee shall review developments which could affect regulatory requirements with the objective of providing members with an understanding of the motivation for new regulatory requirements under consideration and an opportunity to offer suggestions that might improve them or avoid unwarranted disparities among Member countries. In particular it shall review current practices and operating experiences with a view to disseminating lessons learned.

The Committee shall promote co-operation among Member countries to enhance efficiency and effectiveness in the regulatory process and to maintain an adequate level of capability and competence.

The Committee shall focus primarily on existing power reactors and other nuclear installations; it may also consider the regulatory implications of new designs of power reactors and other types of nuclear installations. Furthermore it shall examine any other matters referred to it by the Steering Committee.

The Committee shall collaborate with, and assist, as appropriate, other international organisations for co-operation among regulators and consider, upon request, issues raised by these organisations.

The Committee shall organise its own activities. In implementing its programme the Committee shall establish co-operative mechanisms with the Committee on the Safety of Nuclear Installations, the Committee on Radiation Protection and Health and the Radioactive Waste Management Committee to work on matters of common interest and to promote sharing of information and resources avoiding unnecessary duplication. It may sponsor specialist meetings and working groups to further its objectives.

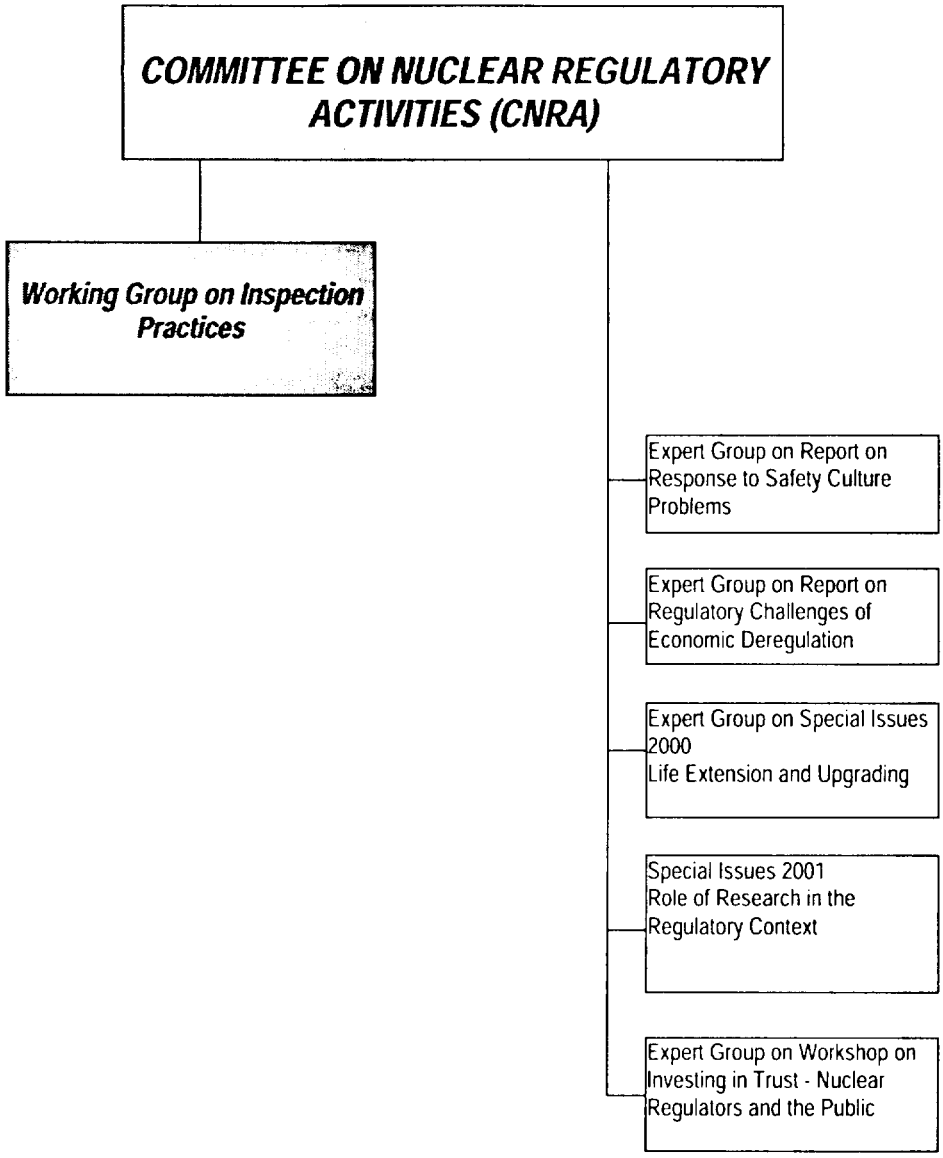
3. Modification of Working Group structure and methods of work

The Working Group on Inspection Practices will be maintained. Other tasks will continue to be carried out by task oriented groups.

4. Handling of cross-cutting activities

Having in each CNRA meeting a specific agenda item dealing with requests to the CSNI will further enhance the existing good co-operation with that Committee. Co-operative mechanisms will be established with the CRPPH and with the RWMC, if and when necessary.

STRUCTURE OF THE CNRA



COMMITTEE ON RADIATION PROTECTION AND PUBLIC HEALTH (CRPPH)

1. Review process and general approach

In 1998 the CRPPH began considering ways to adapt its structure and processes to better reflect the needs of Member countries and the guidance in the developing NEA Strategic Plan. The Bureau proposed a new approach to developing the CRPPH programme of work at the Committee's April 1999 meeting, focused and formalised the Committee's working methods, while reinforcing the Committee's task/project approach. Based on a partial test of the approach in developing the 1999 – 2000 CRPPH programme of work, the Bureau refined its approach, which was then applied to the development of the Committee's 2000 – 2001 structure and programme of work, and approved by the Committee [1].

2. Mandate of the Committee

The CRPPH has reviewed its mandate and approved a proposal for slight modifications to better reflect the Strategic Plan.

Date of creation: *3 July 1957*

Duration: *Unspecified*

Last revision: *1993*

The general objective of the NEA in the field of radiation protection is to contribute to the adoption and the maintenance of high standards of protection for workers and members of the public in all practices involving the use of ionising radiations, and particularly in the field of nuclear energy.

In this context, the mandate of the Committee on Radiation Protection and Public Health (CRPPH) shall be:

1. *to provide a forum for the exchange of information and the transfer of experience between national radiation protection and public health authorities on radiation protection policies and approaches and their implementation in the various practices and situations involving radiation exposures;*

2. *to seek international understanding and guidance, in support of national authorities, on questions of common concern regarding the interpretation and implementation of the ICRP recommendations and other international standards in the various fields of application of radiation protection, and to contribute to the development of harmonised positions in this field;*

3. *to keep under review and contribute to the advancement of the state-of-the-art in the field of radiation protection at the scientific and technical level and promote the preparation of authoritative advice and reference documents for use by national authorities and policy makers in those areas where international consensus on radiation protection concepts and practices is required; and*

4. *to advance concepts and policies which make the system of radiation protection more simple, transparent and adaptable to the broader social dimensions of decision making in complex radiological situations.*

5. *to promote and initiate international co-operative activities on specific radiation protection and radiation-related public health topics of interest to the NEA's Member countries in the framework of the NEA's Strategic Plan.*

In the fulfilment of its mandate, the CRPPH will work in close co-operation with other NEA Committees as appropriate, as well as with the competent bodies within relevant OECD Directorates and other international organisations active in the field.

3. Modification of working group structure and methods of work

The structure of the Committee's subsidiary bodies, developed based on this new approach, is centred around on a few "core" projects, which require some continuity over time in order to be effective, with all other work being performed on a time-limited task basis. All projects report annually to the CRPPH on progress made on goals from the previous year, proposals for goals for the coming year, and, as appropriate, milestones and metrics of performance.

As a result of the review, the substructure of the Committee has been modified. Most notably:

- The Working Group on Science and Technology Affecting Radiation Protection Regulation and Practice (WGST) was disbanded in 1999.
- The Working Group on Risk Management (WGRM), and the Working Group on the Societal Aspects of Radiation Protection (WGSA) were disbanded upon completion of their mandates in 1999. The recommendations from both Groups for follow-up work were consolidated and given to the Expert Group on Stakeholder Involvement (EGSI), which was created by the CRPPH in April 1999. The EGSI will be disbanded upon completion of its work in early 2001.
- The Working Group on Controllable Dose (WGCD) was created in April 1999 and successfully completed its mandate in April 2000 and was disbanded. The CRPPH felt that some follow-up was necessary in this area, and created the Expert Group on the Evolution of the System of Radiation Protection (EGRP) in April 2000. This Group is expected to complete its work and disband by March 2002.

The two core programmes, INEX and ISOE have reviewed their Terms of Reference and Terms and Conditions, respectively, during 1999, and these were approved by the CRPPH in April 2000.

4. Handling of cross-cutting activities

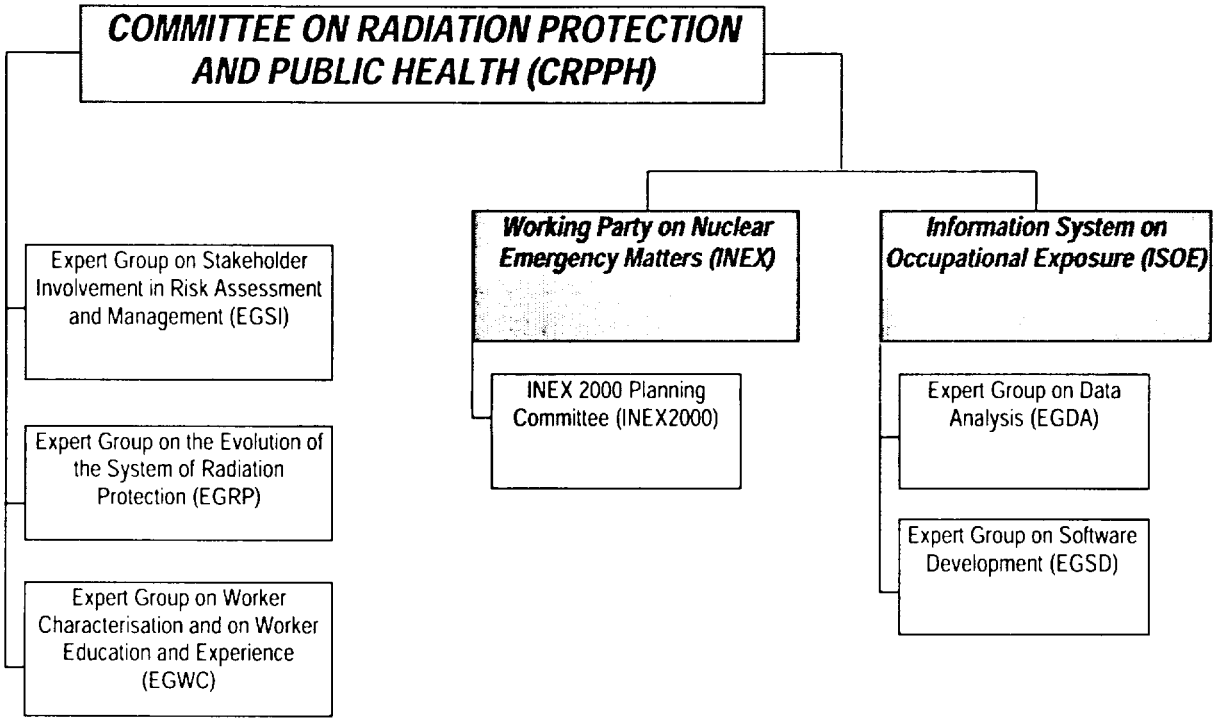
- CRPPH has been addressing, in co-operation with RWMC, the area of exclusion, exemption and clearance, which is a central issue for decommissioning. In addition, the CRPPH is co-sponsoring the revision of the IAEA Basic Safety Standard 89, jointly with experts from the RWMC as well as from the NEA's Co-operative Programme on Decommissioning.
- The issue of stakeholder involvement is being addressed by the CRPPH in the context of post-accident clean-up situations, dose reconstruction and site release. It was agreed to prepare a CRPPH Workshop, co-sponsored by the RWMC.

- The CRPPH agreed to join with the RWMC, NDC, CNRA and CSNI to jointly address decommissioning issues, as described in the issues paper agreed upon by the Chairmen of the Standing Technical Committees in May 2000.
- Co-operative mechanisms will be established with the CNRA, if and when necessary.

Reference

[1] Restructuring of the CRPPH – NEA/CRPPH(99)6/REV1

STRUCTURE OF THE CRPPH



RADIOACTIVE WASTE MANAGEMENT COMMITTEE (RWMC)

1. Review process and general approach

The review of the RWMC strategic role, its main working areas and substructure of advisory bodies was undertaken as an initiative of the RWMC Bureau in mid 1998. In response to the *Strategic Plan* of the NEA, and taking into account specific input from Member countries, state-of-the art studies and an evaluation of recent waste management policy experience in some Member countries, RWMC has enlarged its orientation as described in its strategic document[1].

To adopt the structure of its sub-bodies towards this new orientation, RWMC endorsed a document[2] entitled "RWMC structure and its implementation" in May 1999.

The new structure is designed to emphasise the work in the areas of integration of technical activities, stakeholders' involvement, and decommissioning.

2. Mandate of the Committee

The RWMC has reviewed its mandate and approved a proposal for slight modifications reflecting the *Strategic Plan*, to be submitted to the Steering Committee in due course.

Date of creation: *23 June 1975*

Duration: *Unspecified*

Last revision: *1992*

The NEA has an acknowledged role in developing a global strategy for considering aspects of sustainability concerning the use of nuclear power and nuclear materials. The general objective of the NEA in the field of radioactive waste management is to contribute to the adoption of safe and effective policies and practices in Member countries for all types of radioactive waste. In this context, the mandate of the Radioactive Waste Management Committee (RWMC) shall be:

1. *To constitute a forum of senior representatives from waste management agencies, regulatory authorities, policy-making bodies, research and development institutions with responsibilities in waste management, and other government-nominated specialists, for the exchange of information and experience on waste management policies and practices in NEA Member countries, and for advancing the state of the art on the technical or society aspects of waste management strategies.*

2. *To develop a common understanding of the basic issues involved, and to promote the adoption of common philosophies of approach based on the discussion of the various possible waste management strategies.*

3. *To keep under review the state-of-the-art in the field of radioactive waste management at the technical, scientific, regulatory and societal level, and in public acceptance matters.*

4. *To contribute to the dissemination of information in this field through the organisation of specialist meetings and publication of reports and consensus statements summarising the results of joint activities for the benefit of the international scientific community, competent authorities at national level and other audiences generally interested in the subject matter.*

5. *To offer, upon request, a framework for the conduct of international peer reviews of national activities in the field of radioactive waste management, such as R&D programmes, safety assessments, specific regulations, etc.*

6. *To propose to the Steering Committee for Nuclear Energy:*

   - *a programme of work of general interest in this field, including medium and long-term priorities as appropriate, for implementation within the available NEA Secretariat resources, such as various types of studies in the relevant technical areas.*

   - *specific initiatives for implementation by a number of interested countries contributing resources for that purpose, such as the setting up of joint R & D projects, or the development of data bases.*

In the fulfilment of its responsibilities, the RWMC will interact with relevant NEA Committees, OECD directorates, scientific bodies, and international organisations.

3. Modification of working group structure and methods of work

Progress in geological disposal made during the last decade calls for a more integrated view of the safety case for geologic disposal. Therefore the long-standing discipline-oriented groups, PAAG (Performance Assessment Advisory Group) and SEDE (Co-ordination Group on Site Evaluation and Design of Experiments for Radioactive Waste Disposal), are being disbanded. A new group on the working party level, the Integrated Group for the Safety Case (IGSC), is being established as the main technical advisory body of the RWMC.

To adequately address the paramount importance of stakeholder issues for substantive progress in geologic disposal programmes, a Forum of Stakeholders Confidence (FSC) is being established, reporting directly to the RWMC.

The RWMC has an important role in supporting and administering the NEA "Co-operative Programme For Exchange Of Scientific And Technical Information Concerning Nuclear Installations Decommissioning Projects". The partners in the NEA Co-operative programme have extended their agreement until the year 2005, and at the same time strengthened its focus on policy related issues. To fully integrate the experience of this Co-operative Programme into the NEA activity in decommissioning, RWMC will address decommissioning issues together with the co-operative programme in a joint discipline-oriented sub-group, which should work on the basis of a mandate covering the agreement extension period of the NEA co-operative programme.

Radioactive waste management policy issues will be dealt with by the RWMC itself with the support, as appropriate, of dedicated expert groups, e.g. on Retrievability/Reversibility. These working groups most probably will produce their results in less than two years and after finalising their work, will be disbanded.

A "Forum of Regulators" has been established, the role of which will be to exchange information between regulators on issues in connection with radioactive waste management. The participants in this Forum are the representatives of regulatory authorities who are members of the RWMC. The Forum will establish appropriate links with other committees, particularly the CNRA. The Forum will not report to the RWMC.

4. Handling of cross-cutting activities

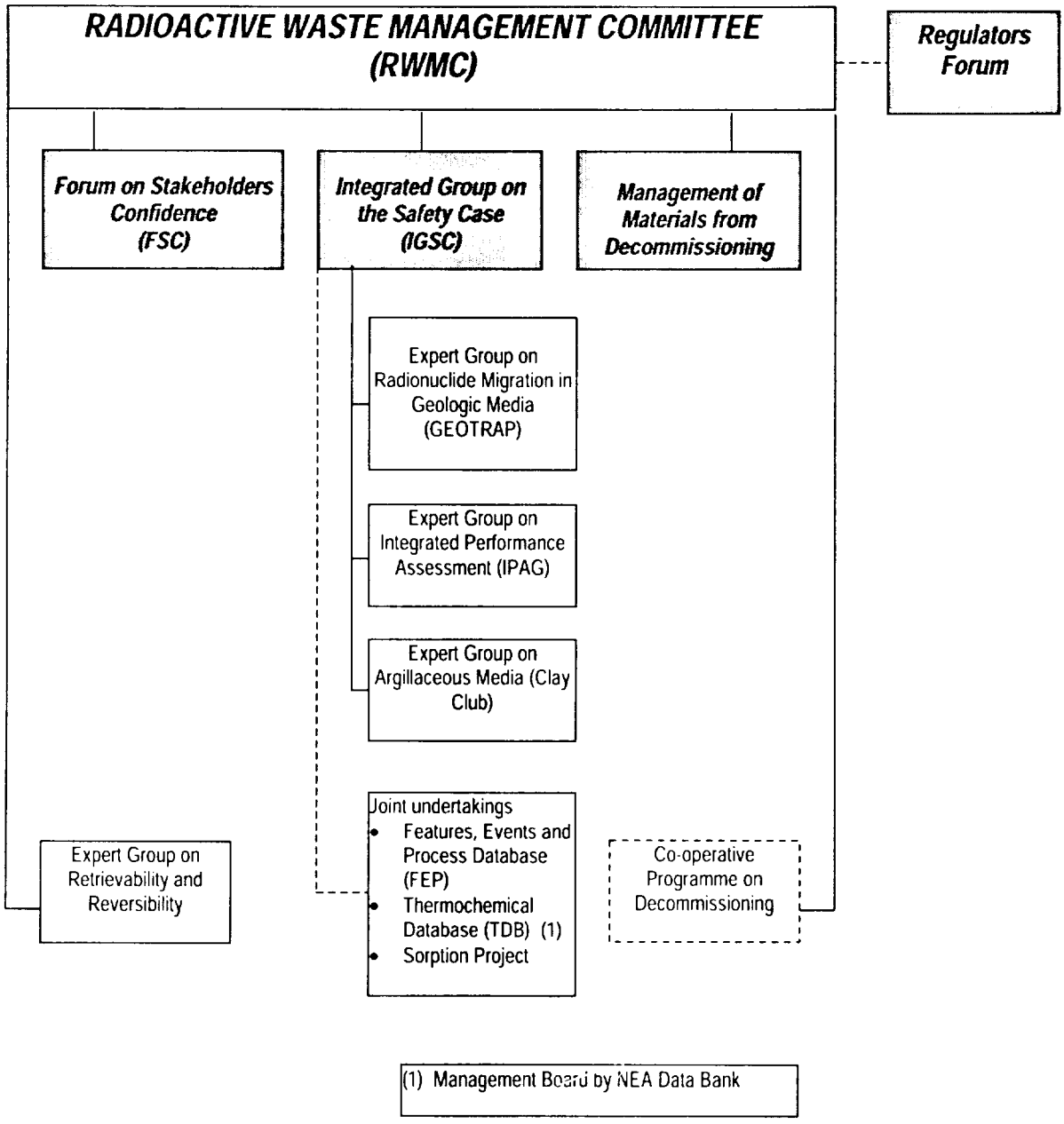
Important issues of horizontal co-operation are part of the strategic areas of the RWMC, including the development of international guidance in the area of ICRP and IAEA recommendations. The RWMC participates actively in the horizontal project on sustainable development and NEA activities concerning stakeholder issues. Through its decommissioning group, the RWMC is prepared to take a leading role on NEA horizontal activities in this area.

References

[1] Strategic Areas in Waste Management - the Viewpoint and Work Orientations of the NEA RWMC - NEA/RWM(99)5

[2] RWMC Structure and its Implementation - NEA/RWM/DOC(99)3

STRUCTURE OF THE RWMC



ANNEX II

Identification of Horizontal Activities
Role of Standing Technical Committees

INTRODUCTION

A number of cross-cutting issues have been identified as indicated in the table below.

	Legal	NSC	NDC	CSNI	CNRA	CRPPH	RWMC
Sustainable development	*	*	**	*	*	*	*
Fuel studies		*	*	*			
Decommissioning	(*)		*	*	*	*	*
Neutronic and Thermal-hydraulic code coupling		*		*			
Safety research of fuel cycle activities		*		**			
Partitioning & Transmutation		*	*				(*)
Regulatory aspects of radiation protection and waste management	(*)				**	*	*
Stakeholder involvement			*		*	*	*
Infrastructure and education		*	*	*	*	*	
R & D strategy		*	*	*		*	*
Deregulation of the electricity market			*		*		

Note: ** represents a committee which leads the activity and (*) represents existing activities or potential future contributions.

This table reflects the current situation as reviewed by the chairmen of standing technical committees during their meeting in May 2000. Measures to handle these cross-cutting activities, as described below, have been agreed by the chairmen.

SUSTAINABLE DEVELOPMENT

The NDC has taken the lead in co-ordinating efforts to address relevant issues and other committees have been contributing to the preparation of the NEA document prepared in conjunction with the meeting of the OECD Council at Ministerial level in 2001.

FUEL STUDIES

The NSC will maintain its programme on behaviour of irradiated fuel, with particular emphasis on basic phenomena of physical, chemical and mechanical property changes of fuel under normal operating conditions. It also supervises the NEA Data Bank efforts in preserving experimental data on irradiated fuel collected by the NSC or the CSNI. The CSNI is continuing its programme on fuel behaviour by integrating related aspects with a view to assessing the technical basis for current safety criteria and their applicability to high burn-up fuel and new fuel designs and materials. These activities are complementary and the two committees will co-ordinate them.

DECOMMISSIONING

The Secretariat prepared a list of decommissioning issues that could effectively be addressed through the collective expertise of the NEA Committees. At their last meeting, the standing technical committee Chairmen identified five priorities and decided joint approaches to address each.

The RWMC will continue supporting the Co-operative Programme for Exchange of Scientific and Technological Information Concerning Nuclear Installations Decommissioning Projects, particularly addressing the management of materials from decommissioning. It will expand its activity related to clarifying regulatory requirements. The NDC will maintain its programme on economical aspects in decommissioning and is planning to address strategic issues in the future, including long-term maintenance of decommissioning funds. The CSNI will continue addressing human factor and organisational aspects in maintaining plant safety from the moment the decision to decommission is taken to the actual implementation of the process. The CNRA will review the progress in regulatory aspects of decommissioning and dismantling of nuclear facilities in close co-operation with the CRPPH and RWMC. The CRPPH will continue to lead discussions of the radiation protection aspects of decommissioning, including: exclusion, exemption, clearance and radiation protection input to overall decommissioning strategies. The Group of Governmental Experts will contribute to clarifying future legal and liability requirements in decommissioning.

Progress will be monitored by the Secretariat, and reported annually to the meeting of standing technical committee Chairmen and to the Steering Committee.

NEUTRONIC AND THERMAL-HYDRAULIC CODE COUPLING

The NSC has been undertaking efforts to couple neutronic and thermal-hydraulic computer codes in close collaboration with the CSNI, taking account of recent progress in computing power. A series of benchmarks has been commissioned. The results of these exercises are positive but technical limitations are also identified. The NSC will continue to work on improving neutronic models as a neutron physics problem, and the CSNI will expand its activities by applying coupled codes.

Both committees will maintain the current co-ordination mechanisms such as cross-representation in each working group. The present working arrangement will be maintained until the current series of benchmarks is completed. In the future, the possibility of setting up a joint task group will be considered to deal with specific tasks.

SAFETY RESEARCH OF FUEL CYCLE FACILITIES

The NSC will maintain its criticality programme as a problem of nuclear physics, including the collection of experimental data. The CSNI will continue its programme on the safety of fuel cycle facilities and take the lead in reviewing related safety research needs in co-operation with the NSC.

PARTITIONING AND TRANSMUTATION

The NSC will maintain its activity on physics issues in P & T related technologies and the NDC will maintain those on analytical studies and strategic issues in this area. It has been agreed that NDC and NSC will jointly organise the biennial information exchange meeting and co-ordinate cross-representation in relevant expert groups. The RWMC will be informed of the progress.

REGULATORY ASPECTS OF RADIATION PROTECTION, WASTE MANAGEMENT AND DECOMMISSIONING

The CRPPH and RWMC will maintain their programmes on regulation related matters and inform the CNRA of future activities at the preparation stage. The Nuclear Law Committee might be asked to contribute to clarifying requirements in its area of competence, as appropriate. The Forum of Regulators will be established to enable the exchange of information between regulators on issues connected with radioactive waste. The participants in this Forum will be the representatives of regulatory authorities who are members of the RWMC. The Forum will establish appropriate links with other committees, particularly with the CNRA. The Forum will not report to the RWMC.

STAKEHOLDER INVOLVEMENT AND INTERACTION WITH THE PUBLIC

The NDC, the CRPPH, the CNRA and the RWMC pursue or are planning to launch activities concerning interaction with the public. This topic was discussed at the May 2000 meeting of standing technical committee chairmen.

INFRASTRUCTURE AND EDUCATION

The NSC has been co-ordinating the Data Bank effort to preserve nuclear data and important codes and is planning to consolidate its role as a recognised international centre for monitoring such information. In addition, the Data Bank will continue to organise courses on the utilisation of specific computer codes. The NDC has been working on infrastructure with particular emphasis on education and will continue this effort. The CSNI has been reviewing needs of safety research and the state of safety research facilities and capability, and strengthening co-operation among Member countries. This committee has identified facilities to be preserved and has been proposing international projects at such facilities. The CNRA has been addressing the issue of maintaining competence. The CRPPH maintains a database on faculties and training courses for radiation protection. Co-ordination mechanisms between committees are in place. Following the planned policy debate on infrastructure by the Steering Committee, an integrated approach will be developed.

STRATEGY FOR RESEARCH AND DEVELOPMENT

The NSC is planning to address research needs in specific areas of nuclear science to lay the groundwork for development of future technologies. The NDC has been working on R & D strategy for the nuclear fuel cycle, with emphasis on P & T, and is planning to expand this effort in R & D needs for next generation power plants. The CSNI has been regularly reviewing the needs for and priorities of safety research and published a series of SESAR (Senior Group of Experts on Safety Research) reports with recommendations. This effort will continue. The CRPPH has been reviewing the state of research in radiobiology and radiation protection, and needs for future research, since its Workshop on Radiation Protection toward the Turn of Century. The RWMC has been reviewing the progress in research related to geological disposal and identified areas where efforts should be focused in its Report on Strategic Areas in Radioactive Waste Management.

Co-ordination mechanisms between committees are in place to ensure information exchange on this issue. A paper prepared by the Secretariat could serve as a basis for narrowing issues and identifying priorities.

DEREGULATION OF THE ELECTRICITY MARKET

The NDC has been working on the impact on nuclear power of deregulation of the electricity market, in co-operation with the IEA. The CNRA has been working on the regulatory challenges in the deregulated environment. Future meetings of chairmen of standing technical committees will discuss possible interaction.

ANNEX III

Structure of the NEA Secretariat

I. INTRODUCTION

The organisation chart of the NEA Secretariat is presented at the end of the present Annex.

It will be recalled that the NEA was set up under a decision of the OEEC (predecessor of the OECD) Council, as a semi-autonomous Agency within the Organisation. The tasks assigned to the Agency are carried out under the authority of the Council, by the Steering Committee for Nuclear Energy. Being included in the so-called Part II of the OECD programme and budget, the annual estimates of expenditure are prepared by the Steering Committee and are then submitted to the Council for approval.

The decentralised status of the NEA which takes into account the high specialisation of its activities, is reflected in the structure of its Secretariat which includes Senior Management, Central Services and technical divisions.

II. GENERAL DIRECTORATE

The NEA Secretariat is headed by the Director-General of the NEA. The Director-General is assisted by the Deputy Director-General and two Deputy Directors. The DG and the three Deputy Directors form the Senior Management of the NEA.

The Deputy Director-General reports to the Director-General and heads the Agency on his behalf in his absence. In addition he supervises the Central Secretariat, the Legal Affairs Section and the Administration.

The Deputy Director for Science and Development supervises the activities of the Nuclear Science Section and the Nuclear Development Division. He is also the Head of the Data Bank. In addition, he takes the lead with respect to day-to-day contacts at senior level with the IEA, and the OECD for global issues such as sustainable development. He reports to the Director-General. The Deputy Director for Nuclear Safety and Regulation supervises the Nuclear Safety Division and the Radiation Protection and Radioactive Waste Management Division. He reports to the Director General.

The two Deputy Directors co-ordinate the activities within their respective areas of responsibility and ensure the good co-operation between the two sectors of the Agency.

In addition to their respective areas of responsibility, the Deputy Director-General and the Deputy Directors may be entrusted by the Director-General with particular tasks of more general interest to the NEA.

III. CENTRAL SERVICES

CENTRAL SECRETARIAT

The Central Secretariat carries out co-ordination and analytical work as well as operational activities in support of the Agency's programme. It is a focal point within the NEA Secretariat structure with direct links to the Agency's Senior Management and to the Divisions. The Central Secretariat has four areas of responsibility. The Head of the Central Secretariat reports to the Deputy Director-General. In his capacity as Secretary of the Steering Committee, he may be assigned tasks directly by the Director-General.

1. The Secretariat of the Steering Committee for Nuclear Energy

The Central Secretariat provides ongoing secretariat support for the regular sessions of the Steering Committee, including policy debates, as well as for the organisation of special events.

2. Assistance to the NEA Management in central tasks involving co-ordination across the Agency

The Central Secretariat develops analytical material for strategic planning purposes, as well as for information, reporting, or other action.

3. Support to NEA External Relations

The Central Secretariat provides co-ordination and assistance on issues concerning relations with non-member countries, NEA membership accession issues, development of co-operation links with "major players" non-members, relations with governmental and non-governmental national or international bodies, annual NEA/IAEA co-ordination meetings.

4. Management of the NEA Information and Publications Programme

The Central Secretariat has the responsibility to provide Member governments, stakeholders, and interested parties with information resulting from the NEA Programme of Work, and to enhance awareness and understanding of the scientific, technical and economic aspects of the nuclear option. Another complementary responsibility is to raise public awareness of the NEA itself.

For this purpose, the Central Secretariat manages the NEA Publications Unit in charge of publications production and marketing and it is responsible for NEA public relations and media relations activities.

It seeks to develop a wide range of products to meet information demand from government and other decision-making circles in Member countries, in particular for policy-oriented material. The information and communication tools operated by the Central Secretariat include printed material, the NEA Web site, media contacts, and other public relations means such as information and publications booths at major international conferences.

ADMINISTRATIVE UNIT

The Management Support Unit (MSU) provides support to all sectors of the Agency in matters concerning the management, administration and cost effective use of resources. In doing so, the Unit maintains contacts with other directorates of the OECD, particularly Central Services, and also with external suppliers. The Unit reports to the Deputy Director-General and is responsible for providing NEA Senior Management with reports and analysis on the availability and use of NEA resources.

More specifically, the work of the MSU may be divided into the following principal areas:

1. Financial Resources

The MSU oversees all aspects of the Agency's financial and budgetary resources. It provides assistance in the planning of appropriation requests and reports and is responsible for validating most items

of Agency expenditure, which includes ensuring compliance with the rules and regulations of the Organisation. The Unit is also responsible for reconciliation with Central accounts.

2. Staff Resources

The MSU provides Agency-wide support in administrative aspects governing the management of staff resources. Furthermore, the MSU keeps up-to-date administrative records for all staff and provides support to the staff with respect to their emoluments and other entitlements such as salaries, allowances and home leave. It also helps directors and heads of division prepare recruitment panels and process contracts for recruitment of regular and temporary staff. The Section also manages all aspects of staff training.

3. Facilities Management

The MSU has responsibility for all matters concerning the use of NEA premises, including contracts with the owners, building managers, appropriate local authorities, and local utility providers. The Unit also manages office supplies and equipment stocks.

The MSU is responsible for the operation of the Agency's Office Automation Network. In addition, this section has responsibility for the Agency's telephone systems.

The MSU is responsible for the operation of the Agency's library facilities and archiving of Agency documents.

The MSU provides support for the collection and dispatch of mail.

IV. TECHNICAL DIVISIONS

1. LEGAL AFFAIRS

The Legal Affairs has responsibility for the following areas: support services and legal advice for the Agency's technical activities; administration of the Paris and Brussels Conventions on nuclear third party liability and harmonisation of nuclear laws; dissemination of information on nuclear law; and assistance to Central and Eastern European countries in developing their nuclear legislation, especially that on nuclear third party liability. The Head of the Legal Affairs Section reports to the Deputy Director-General.

1. Legal support for the Agency's technical activities

The Section advises the Senior Management, the Division Heads and those responsible for the different Agency activities on the legal aspects of the Agency's administration. This work includes, in particular:

- providing advice on the application of the Agency's and the OECD's statutory texts and procedures, as well as on NEA's relations with other international organisations;

- providing advice on, and preparation of, draft recommendations and decisions for the Steering Committee for Nuclear Energy and the OECD Council;

- drafting agreements for the Agency's technical co-operation projects and providing legal advice.

The Head of the Legal Affairs Section serves also as the registrar of the European Nuclear Energy Tribunal.

2. Harmonisation of national laws and regulations on nuclear energy, particularly in the field of civil liability

The Section is responsible for the administration, implementation and interpretation of the Paris Convention on Third Party Liability in the Field of Nuclear Energy and the Brussels Supplementary Convention, as well as the Joint Protocol on the Application of the Vienna Convention and the Paris Convention. Attention is also given to the co-ordination of these instruments with the Vienna Convention and the Supplementary Compensation Convention.

This work is carried out mainly within the Group of Governmental Experts on Nuclear Third Party Liability in the Field of Nuclear Energy and sub-groups occasionally set up for a specific task.

At their request, the Section also advises Member countries on their draft nuclear legislation.

3. Dissemination of Information on Nuclear Law and Related Studies

Information on nuclear law is developed and disseminated through the Nuclear Law Bulletin and analytical studies on the different aspects of nuclear legislation.

4. Assistance to Central and Eastern European Countries

Activities in this field, carried out in close co-operation with the other competent international organisations, aim at helping the CEEC and NIS, and in certain cases other non-Members, to establish a suitable legal framework for civil uses of nuclear energy (particularly on third-party liability and insurance aspects) and to encourage their adherence to international agreements.

2. NUCLEAR SCIENCE SECTION AND DATA BANK

The Nuclear Science Section and Data Bank together provide the Steering Committee and its subsidiary bodies with expertise in maintaining and developing the scientific knowledge supporting present and future nuclear technology, specifically in the areas of reactor and fuel cycle physics, fuel cycle chemistry and criticality safety. The Data Bank also acts as an international reference centre for Member countries, providing direct services of quality-assured scientific nuclear data and computer programs, needed to advance this scientific knowledge. The Head of Division reports to the Deputy Director for Science and Development.

The Section supports the NEA Nuclear Science Committee (NSC) and its Executive Group, and provides expertise to other divisions within the Agency, specifically in the field of database development

and management. It has also well-established collaborations with other international or national bodies, especially in scientific nuclear data compilation and evaluation and in computer program validation and exchange. The Head of Section reports to the Deputy Director for Science and Development.

In particular, the areas of responsibility are:

1. To give technical and administrative support to:
   - the Nuclear Science Committee (NSC) and its Working Parties and Working Groups
   - the Executive Group of the NSC and its Working Parties and Working Groups
   - the Management Board of the Thermochemical Database (TDB) project and its review groups

   through the organisation and documentation of regular meetings.

2. To provide expert input to the work of these groups, particularly through the organisation of scientific workshops and conferences on behalf of these bodies.

3. To provide Member countries with direct and quality-assured services of scientific data and computer programs, according to official agreements with other national and international centres.

4. To organise international standard problem exercises (benchmarks), with a view to arriving at a consensus on the preferred modelling and computation methods to be used in different application areas.

5. To co-operate closely with other divisions within NEA and when requested and mutually agreed, to provide expertise to joint undertakings, especially in the field of database development and management.

6. To report regularly to other bodies in the NEA on the activities of the NSC, its Executive Group and the co-operative programmes. To co-ordinate work and collaborate with other sectors of the OECD, and with other international bodies, in particular the EC and the IAEA.

7. To disseminate and communicate the work of the NSC and its subsidiary bodies through publication of workshop proceedings, technical reports and reports directed to a wider audience, and through presentation of the work at international conferences and through articles.

3. NUCLEAR DEVELOPMENT DIVISION

The Nuclear Development Division acts to directly support the activities of energy and nuclear energy policy makers in OECD/NEA Member countries. The Head of Division reports to the Deputy Director for Science and Development. There are four principal facets to its role:

1. To act as an authoritative source of information, providing advice as appropriate, on the areas within its competence including economics, resources and technology, complemented by isotope production and uses; the impact of electricity market deregulation on nuclear energy; nuclear energy and sustainable development, including environmental studies.

2. To give technical and administrative support to the Committee for Technical and Economic Studies on Nuclear Energy Development and the Fuel Cycle, also known as the Nuclear Development Committee and to manage an on-going programme of studies in support of Member countries' interests.

3. To encourage the integration of nuclear issues and NEA activities more generally within the OECD broader framework. In particular, to pursue a synergistic and mutually supportive relationship with the International Energy Agency.

4. To disseminate the results of the work of the NDC and NDD for the benefit of Member countries and the nuclear community. This involves the preparation and presentation of papers and publications, exchanges of correspondence and the maintenance of relationships with organisations concerned with the national and international development and deployment of nuclear energy and related issues.

4. NUCLEAR SAFETY DIVISION

The role of the Division is to facilitate the execution of the work programme and to assist the two NEA safety Committees, namely the Committee on the Safety of Nuclear Installations (CSNI) and the Committee on Nuclear Regulatory Activities (CNRA). The Head of Division reports to the Deputy Director for Nuclear Safety and Regulation.

The staff of the Division are highly experienced in one or more of the various areas of nuclear safety. Their task is to assist the chairmen of the various Committees and Working Groups, organise meetings, co-ordinate the preparation and subsequent distribution of reports, help identify emerging issues, and assist the chairmen of the various groups in formulating proposals to address these issues.

The Division gives technical and administrative support to the two Committees and co-ordinates the execution of the entire programme. Each staff member of the Division is assigned the responsibility for one or more working groups. The basic criterion used for making such assignments is the particular technical competence of the staff member. Short-term tasks or groups are assigned to staff members according to technical competence and workload The Division is responsible for identifying the need for joint research projects, as well as promoting and eventually establishing them.

5. RADIATION PROTECTION AND RADIOACTIVE WASTE MANAGEMENT DIVISION

The Radiation Protection and Radioactive Waste Management Division assists the Steering Committee and its subsidiary bodies in all areas relevant to radioactive waste management and radiation protection, and related technical aspects of decommissioning of nuclear facilities. In doing so, the Division supports two of the NEA's Standing Technical Committees and their subsidiary bodies. The Head of Division reports to the Deputy Director for Nuclear Safety and Regulation.

The main tasks of the Division are:

1. To give technical and administrative support, through the organisation and documentation of regular meetings, including specific bodies like core groups, bureau meetings, etc., to

   - the CRPPH and its Working Parties and Working Groups
   - the RWMC and its Working Parties and Working Groups
   - the Liaison Committee of the Co-operative programme on Decommissioning

- the ISOE and its Working Groups .

2. To provide expert input to the work of these groups, particularly through the organisation of topical sessions and of scientific workshops on behalf of them.

3. To organise the development, maintenance and quality assurance of information databases and other tools used by Member country organisations.

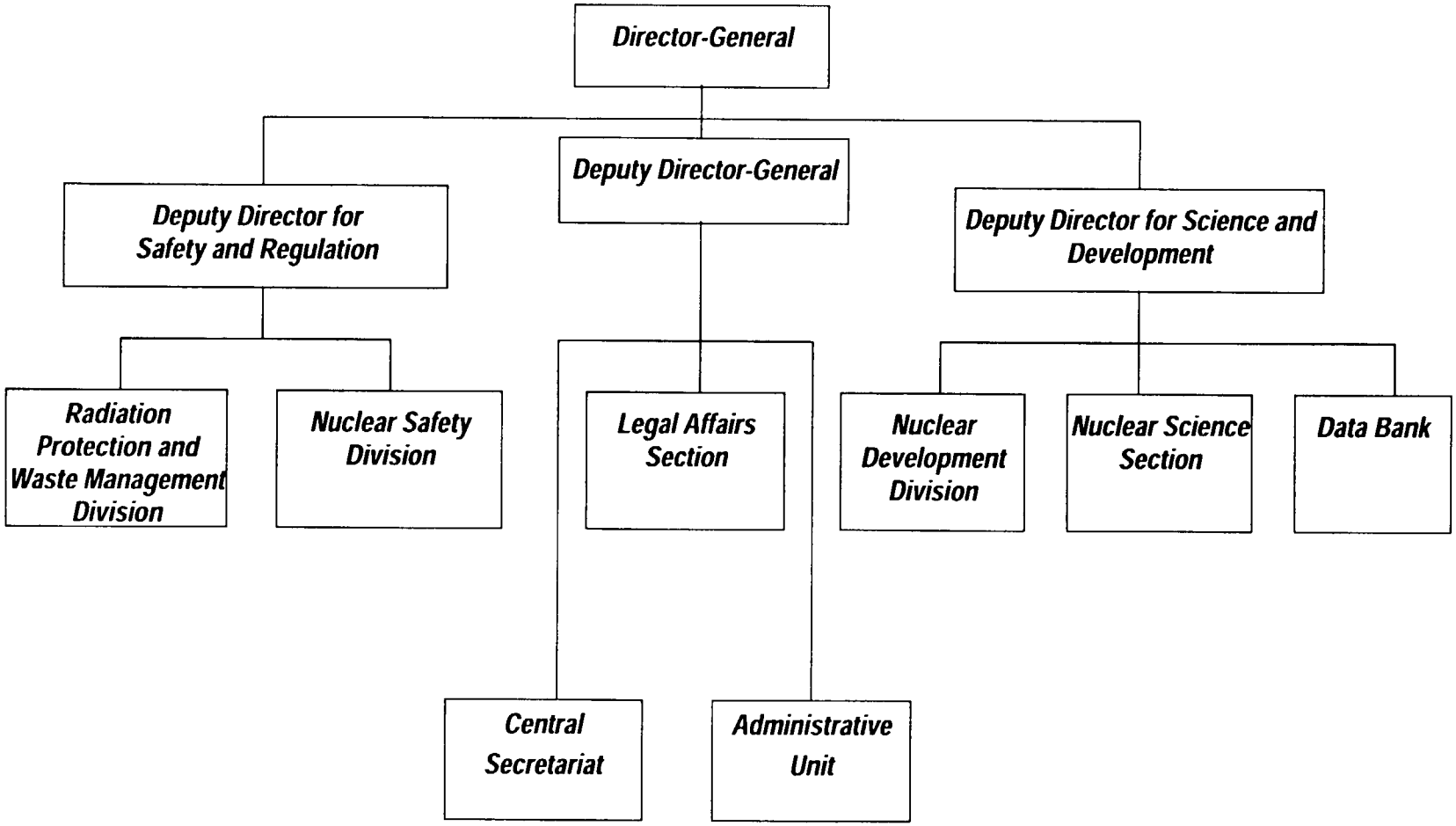
4. To regularly report on the activities of the RWMC, the CRPPH and the co-operative programmes associated with them to other bodies in the NEA. To co-ordinate work and organise collaboration within the NEA on horizontal activities, with the OECD ENV and PUMA directorates, with EC and the IAEA, and with other international bodies in the fields of radiation protection, waste safety, waste technology and decommissioning.

5. To disseminate and communicate the work of the Committees, their subsidiary bodies and the co-operative programmes through publication of technical reports and reports directed to a wider audience through presentations at international conferences, and through articles

6. To serve the Member countries at their request through the organisation of, and participation in, International Peer Reviews; through participation in international advisory or standards bodies, in conference programme committees and workshops.

Attached: Chart of the structure of the Secretariat

STRUCTURE OF THE NEA SECRETARIAT



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NUCLEAR ENERGY AGENCY
STEERING COMMITTEE FOR NUCLEAR ENERGY

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THE OECD/NEA MASCA PROJECT

(Note by the Secretariat)

Or. Eng.

94976

The OECD/NEA MASCA Project

Introduction

1. One important function being performed by the NEA and, in particular, the Committee on the Safety of Nuclear Installations (CSNI), is to review the nuclear safety research carried out in the OECD countries, identify research needs and, whenever necessary, initiate and oversee international research projects.

2. In recent years, the CSNI and its technical groups have held several discussions on the priorities for safety research and on the need for preserving the minimum technical infrastructure necessary to resolve relevant safety issues. Severe accidents were identified as an area where collaborative international research efforts are needed.

3. In-vessel and ex-vessel accident management strategies depend on the knowledge of the properties and behaviour of the molten corium, which affects the loading of the reactor pressure vessel and its failure mode.

4. Discussions have taken place between the NEA, the Kurchatov Institute and a number of Member countries aimed at defining the technical scope of an experimental programme – named MASCA (MAterial SCAling) – using the Kurchatov Institute facilities located near Moscow. On this basis, a Project Agreement containing the terms of participation was circulated to potential participants. Seventeen countries have confirmed their participation, as shown in Table 1.

Objective, Scope and Schedule

5. The objective of the MASCA Project is to improve the knowledge of the conditions under which core melt stratification can occur, and the consequences of stratification for in-vessel retention and for ex-vessel phenomena, which are relevant for accident management strategies. A variety of materials property data needed for the analysis of the experiments and for code development will also be produced in the programme.

6. The project will involve the use of proven technology and of facilities made available in a previous OECD Project (RASPLAV). The tests will be carried out at very high temperatures and with prototypical reactor materials, as well as simulants. Extensive post-test examinations are contemplated.

7. The project extends over a period of three years, starting 1 July 2000, and will be completed in June 2003. The total budget is 3.0 M$ (US).

8. Studies on melt stratification materials properties and on heat transfer will be carried out in 2001 and in the first half of 2002. A large-scale confirmation test with prototypical reactor core materials is contemplated for the last year of the programme. Analyses will accompany the experimental programme as required both for the test preparations and for the interpretation of the results.

Legal Framework and the Role of the NEA

9. The project is being established under an Agreement, which determines the rules and co-operation framework which apply to the participants in the project. As with other OECD/NEA sponsored joint projects, control will be vested in a Management Board, which will be assisted by a Programme Review Group dealing with the technical basis of the programme.

10. The role of the NEA will again be to co-ordinate the effort for establishing the programme's technical scope, the financial basis of the project and the legal framework of the Agreement. Once the project is under way, the NEA will support the project administration and the transfer of information to participants, in addition to handling secretariat functions in the project's steering bodies. The NEA Secretariat's costs will be defrayed by a yearly lump sum and specific reimbursement of mission expenses.

11. The Steering Committee for Nuclear Energy will be regularly informed of the progress achieved, pursuant to Article 5(c) (ii) of the Agency's Statute.

Action Requested

12. The Steering Committee is invited ***to take note*** of the setting-up of the OECD/NEA MASCA Joint Project pursuant to Article 5(b) of the Agency's Statute.

Table 1

LIST OF MASCA SIGNATORIES

The Russian Research Center "Kurchatov Institute"
(and other Russian Participants)

The AIB-Vinçotte Nuclear jointly with Tractebel S.A. Belgium

The Atomic Energy of Canada Limited

The Nuclear Research Institute of the Czech Republic

The Fortum Engineering Ltd. jointly with
Valtion Teknillinen Tutkimuskeskus and Säteilyturvakeskus, Finland

The Commissariat à l'Énergie Atomique/Institut
de Protection et de Sûreté Nucléaire, France

The Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH., Germany

The KFKI Atomic Energy Research Institute, Hungary

The Agenzia Nazionale per la Protezione dell'Ambiente
jointly with the Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, Italy

The Nuclear Power Engineering Corporation, Japan

The Korea Atomic Energy Research Institute

The Kernfysische Dienst (KFD), Netherlands

The Consejo de Seguridad Nuclear, Spain

The Statens Kärnkraftinspektion, Sweden

The Paul Scherrer Institute, Switzerland

The Health and Safety Executive, United Kingdom

The United States Nuclear Regulatory Commission

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THE OECD/NEA SORPTION PROJECT - PHASE II

(Note by the Secretariat)

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94950

THE OECD/NEA SORPTION PROJECT – PHASE II

Background

1. In October 1995, the NEA Performance Assessment Advisory Group (PAAG) of the Radioactive Waste Management Committee decided to carry out a study to investigate the potential of thermodynamic models for improving representation of sorption in Performance Assessment. The Sorption Modelling Project was created with the objectives of organising a workshop to gather new information and producing a comprehensive status report. The Steering Committee endorsed the setting up of this project in October 1996 (NEA/NE(96)15). The workshop was organised in Oxford (United Kingdom) in May 1997 and the status report was commissioned.

2. The Oxford workshop focused on advances that have been made in the field of sorption modelling, with presentation of successful examples of radionuclide sorption onto natural samples. On that basis, participants decided to launch a second phase of the Sorption Project.

Objective and methodology

3. The objective of the Sorption Project (Phase II) is to demonstrate the applicability of different chemical thermodynamic modelling approaches to support the selection of sorption parameters for safety assessments of radioactive waste disposal.

4. The project is taking the form of a "benchmarking" exercise for the different modelling approaches being pursued by the various participating organisations. The overall aim is to interpret selected well-characterised datasets for sorption onto complex materials. By applying the various modelling approaches in a systematic way to the same measured data, an evaluation of the merits and limitations of the approaches will be possible and recommendations on the use of these models can be made.

Organisation

5. Terms and conditions of the new co-operative joint project are defined in a formal "Arrangement" signed by participants.

6. Control of the project is vested in a Management Board, with each participant in the project designating a member. The Management Board will keep the Steering Committee for Nuclear Energy regularly informed of the progress of work, pursuant to Article 5(c) ii) of the Agency's Statute.

7. The technical direction is provided by a Technical Direction Team, which consists of five international experts with experience in sorption modelling and an understanding of the requirements of safety assessments of radioactive waste disposal systems.

8. The NEA Secretariat is undertaking administrative and secretarial support for the Project. However, the NEA is not responsible for technical issues. The competent services of the OECD are responsible for soliciting contributions, for dealing with required expenditures, and keeping the financial accounts of the Project.

9. The technical contribution of participants includes being involved in modelling exercises and actively contributing to technical discussions on modelling approaches and successes and failures.

10. A total timescale of 24 months is envisaged for the project, with an intermediate milestone after the first six months. This milestone is considered important to allow an assessment of the viability of the project based on existing datasets. If there are insufficient datasets that are suitable for this type of detailed modelling exercise, the project will be terminated.

11. Each participant commits to contribute to a central fund that provides the resources for the Technical Direction Team. A total budget of about 323K Euros (2 120K FRF) is required to support a technical team of five members, including both daily rates and travel expenses over the two year period of the Project. Each participant also commits to bear the costs of its own modelling team(s).

Participation

12. The first meeting of the Management Board of the Sorption Project (Phase II) will be held on 28 September 2000, at Issy-les-Moulineaux. The following twelve organisations from ten Member countries are expected to participate in this project:

ANSTO, Australia
NIRAS/ONDRAF, Belgium
RAWRA, Czech Republic
POSIVA, Finland
ANDRA, France
JNC, Japan
CRIEPI, Japan
ENRESA, Spain
HSK, NAGRA & PSI, Switzerland (participating jointly)
BNFL, United Kingdom
NIREX, United Kingdom
NRC, United States

Action requested

13. The Steering Committee is invited ***to take note*** of the setting up of Phase II of the OECD/NEA Sorption Project, pursuant to Article 5(b) of the Agency's Statute.