Licensing and Regulatory Control of Nuclear Installations

LEGAL SERIES No.10

INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA, 1975

LICENSING AND REGULATORY CONTROL OF NUCLEAR INSTALLATIONS

The following States are Members of the International Atomic Energy Agency:

AFGHANISTAN
ALBANIA
ALGERIA
ARGENTINA
AUSTRALIA
AUSTRIA
BANGLADESH
BELGIUM
BOLIVIA
BRAZIL
BULGARIA
BURMA
BYELORUSSIAN SOVIET SOCIALIST REPUBLIC
CAMBODIA
CANADA
CHILE
COLOMBIA
COSTA RICA
CUBA
CYPRUS
CZECHOSLOVAKIA
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA
DENMARK
DOMINICAN REPUBLIC
ECUADOR
EGYPT
EL SALVADOR
ETHIOPIA
FINLAND
FRANCE
GABON
GERMAN DEMOCRATIC REPUBLIC
GERMANY, FEDERAL REPUBLIC OF
GHANA
GREECE
GUATEMALA
HAITI
HOLY SEE
HUNGARY
ICELAND
INDIA
INDONESIA
IRAN
IRAQ
IRELAND
ISRAEL
ITALY
IVORY COAST
JAMAICA
JAPAN
JORDAN
KENYA
KOREA, REPUBLIC OF
KUWAIT
LEBANON
LIBERIA
LIBYAN ARAB REPUBLIC
LIECHTENSTEIN
LUXEMBOURG
MADAGASCAR
MALAYSIA
MALI
MAURITIUS
MEXICO
MONACO
MONGOLIA
MOROCCO
NETHERLANDS
NEW ZEALAND
NIGER
NIGERIA
NORWAY
PAKISTAN
PANAMA
PARAGUAY
PERU
PHILIPPINES
POLAND
PORTUGAL
REPUBLIC OF SOUTH VIET-NAM
ROMANIA
SAUDI ARABIA
SENEGAL
SIERRA LEONE
SINGAPORE
SOUTH AFRICA
SPAIN
SRI LANKA
SUDAN
SWEDEN
SWITZERLAND
SYRIAN ARAB REPUBLIC
THAILAND
TUNISIA
TURKEY
UGANDA
UKRAINIAN SOVIET SOCIALIST REPUBLIC
UNION OF SOVIET SOCIALIST REPUBLICS
UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND
UNITED REPUBLIC OF CAMEROON
UNITED STATES OF AMERICA
URUGUAY
VENEZUELA
YUGOSLAVIA
ZAIRE
ZAMBIA

The Agency's Statute was approved on 23 October 1956 by the Conference on the Statute of the IAEA held at United Nations Headquarters, New York; it entered into force on 29 July 1957. The Headquarters of the Agency are situated in Vienna. Its principal objective is "to accelerate and enlarge the contribution of atomic energy to peace, health and prosperity throughout the world".

Printed by the IAEA in Austria
November 1975

LEGAL SERIES No. 10

LICENSING AND REGULATORY CONTROL OF NUCLEAR INSTALLATIONS

A SELECTION OF PAPERS PRESENTED AT THE
REGIONAL SEMINAR IN NUCLEAR LAW FOR LATIN AMERICAN COUNTRIES,
RIO DE JANEIRO, 25 - 29 JUNE 1973,
AND THE STUDY GROUP MEETING ON
REGULATIONS AND PROCEDURES FOR LICENSING NUCLEAR INSTALLATIONS,
ATHENS, 16 - 20 DECEMBER 1974

INTERNATIONAL ATOMIC ENERGY AGENCY
VIENNA, 1975

LICENSING AND REGULATORY CONTROL OF NUCLEAR INSTALLATIONS
IAEA, VIENNA, 1975
STI/PUB/421
ISBN 92-0-176175-9

FOREWORD

With a view to stimulating exchanges of information and experience on legal problems concerned with national nuclear energy programmes and on related legislation and regulations together with their implementation, the International Atomic Energy Agency convened a Regional Seminar in Nuclear Law for Latin American Countries in Rio de Janeiro, Brazil, from 25 to 29 June 1973, and a Study Group on Regulations and Procedures for Licensing Nuclear Installations in Athens, Greece, from 16 to 20 December 1974. These meetings were held in co-operation with the Brazilian Nuclear Energy Commission and the Greek Atomic Energy Commission respectively.

A selection of ten papers presented at the first meeting and all the nine papers presented at the second meeting are reproduced in this publication to serve as reference materials on some typical approaches to licensing and regulatory control of nuclear facilities and on legal aspects of nuclear safeguards from an international standpoint. The opinions expressed are personal and do not necessarily reflect the views of the governments or organizations concerned. The papers reflect the situation existing at the time of their presentation, though in the case of one paper presented at Athens the updating of some material to December 1974 was considered useful.

CONTENTS

I

REGIONAL SEMINAR IN NUCLEAR LAW FOR LATIN AMERICAN COUNTRIES

Rio de Janeiro, 25 to 29 June 1973

LEGISLATIVE FRAMEWORK AND REGULATORY REQUIREMENTS FOR THE INTRODUCTION OF NUCLEAR POWER

HA-VINH PHUONG
Legal Division,
International Atomic Energy Agency,
Vienna

Abstract

LEGISLATIVE FRAMEWORK AND REGULATORY REQUIREMENTS FOR THE INTRODUCTION OF NUCLEAR POWER.

The adoption of appropriate legislation is to be considered as a prerequisite to the introduction of nuclear power in view of the issues that need to be regulated. Preparatory steps should be started at the earliest stage in conjunction with the planning of nuclear power projects. The primary objectives of a licensing scheme are to ensure safety, public health and environmental protection as well as financial protection for third parties in case of nuclear incident. For licensing purposes, a legislative framework and regulatory determinations are required. Within such a framework and pursuant to such regulatory determinations, the elaboration of safety standards, rules, guides and enforcement procedures is to be considered of paramount importance. To this end a number of international recommendations and advisory material prepared by the IAEA provide useful guidance. A licensing process would normally be split into several stages relating to site approval, construction permit, pre-operational tests, and operating licence, each stage being subject to safety assessments and reviews as determined by regulations. Financial protection against nuclear damage has also to be insured. A special regime of nuclear liability has been established by international conventions, based on the principle of strict liability of the operator of a nuclear installation. As a result of such channelling of liability to him, his liability is limited in amount and time. This liability system has the dual purpose of ensuring appropriate protection for potential victims and of relieving the nuclear industry from unlimited liability risks, which would impede practical applications of atomic energy. For the elaboration of nuclear legislation and specialized regulations the Agency's advisory services have proved to be of help to countries embarking on a nuclear power programme.

1. INTRODUCTION

Amongst the recommendations adopted by a Working Group on Nuclear Power Reactors of Interest to Developing Countries, which was convened by the IAEA in October 1971 in Vienna, it was stated that "the adoption of appropriate legislation is an essential prerequisite for contracting for and implementing a nuclear power project" [1]. Legislative provisions and regulatory measures are required because of the need:

(1) To protect the public health and safety and the environment by providing reasonable assurances that authorized nuclear facilities are located, designed, constructed and operated in such a way as to have a minimum impact on the environment, to prevent accidents from occurring, and to mitigate their consequences if they should occur; and

(2) To ensure adequate financial protection for third parties in the event of an occurrence causing nuclear damage in view of the special nature and potential magnitude of such damage.

On account of the time involved in the law-making process under any given legal system (usually years), especially when the formulation of a law is confronted with the need of harmonizing overlapping responsibilities within a national administration, with the desirability of optimizing the balance of promotional interests and safety control and, also, with relatively new legal concepts as in the case of nuclear energy, the framing of legislation should be started at the earliest possible stage in the planning of a nuclear power programme. This would ensure that enabling acts, liability provisions, safety regulations and licensing procedures are readily available prior to or, at least, at the start of the implementation of a nuclear power project. The adoption of a systematic and interdisciplinary approach to the work required would facilitate the integrated use of many sciences and disciplines involved and the full collaboration of various agencies and departments concerned that are necessary in the planning and decision-making process. This requires a great amount of co-operative effort on the part of the authorities, the public utilities, universities or research institutions and the private sector as well.

2. LICENSING REGULATIONS AND PROCEDURES

2.1. Legal basis and objectives

States generally recognize the need for regulating hazardous activities and this, of course, applies to nuclear installations. In some countries the basic principles of a licensing system for nuclear facilities may be found in the law establishing a national body on atomic energy and vesting it with broad responsibilities and regulatory powers. By virtue of such powers the competent body (a national atomic energy commission or a department of the government) would merely have to establish such regulatory schemes and administrative procedures as the need arises for the licensing of nuclear power plants. In other countries where a legal framework for nuclear activities has not been enacted or is not broad enough to provide a legislative basis for the establishment of a reactor licensing system it would be necessary to prepare enabling legislation, preferably comprehensive enough, to embrace both the regulatory and liability aspects of a nuclear power programme and vesting sufficient discretion in a competent authority for dealing with regulatory and procedural matters.

In both cases, it is to be noted that the objectives of licensing regulations should be:

(a) To set out standards providing a reasonable assurance that compliance therewith would ensure the safe operation of nuclear facilities without undue risk to the health and safety of the public; and

(b) To achieve a technically feasible and lowest possible level of exposure of persons to radiation and of pollution of the environment, with a minimal negative economic impact on the execution of nuclear power projects.

2.2. Regulatory determinations

The main provisions of a licensing system would usually define the scope of the regulatory requirements; establish or determine the competent authority in the licensing process, its powers and duties; provide for the setting up of control and advisory bodies; and specify the qualifications and conditions to be fulfilled by the applicant for a licence, the information and documentation to be submitted by him in respect of a proposed activity, a phasing of the safety evaluation of the project by technical bodies under the responsibility of the competent authority, and the conditions under which the latter may grant, amend, suspend or revoke a licence as well as the obligations resulting therefrom for a licensee. The elaboration of safety standards, codes of practice, guides and procedures is to be considered of primary importance for the enforcement of the licensing requirements, and it is deemed desirable that responsibility in this respect be entrusted to the licensing authority with broad powers enough to enable it, with the help of established bodies of specialists, to formulate, issue, amend or revise safety prescriptions and rules in the light of needs or experience. Thus, the purely technical provisions of regulations could be more readily responsive than the principle provisions of a law to technical developments and other changes as their revision could be more easily undertaken without involving a lengthy process of parliamentary approval. A practical way to handle the preparation of such specialized regulations and rules would be to make the fullest use of safety recommendations and technical guidance provided in a large number of IAEA publications[1].

In the preparation of licensing procedures, consideration should be given to a well-defined network of advisory bodies fully representative of the departments and agencies concerned and of all appropriate disciplines, including that of ecology, in order to ensure effectively and efficiently the integrity of the regulatory process. The findings and conclusions of such interdisciplinary bodies should be made known to the public so as to assure it of the consistent and comprehensive treatment of the safety aspects in each project evaluation. At defined stages in the safety review process, administrative investigations or public hearings may be contemplated, depending upon established practices for the authorization of hazardous activities in the country or because such proceedings are deemed to be a practical method of securing and bringing to the limelight complete data and evidence on the safety and technical soundness of a proposed project. Experience has shown, however, that instead of being a medium of communication to the public on nuclear safety issues, public hearings in some instances may be converted into a legal battleground on procedural matters, thus extending the licensing process over unduly long periods. Since the actual time required between the start of construction and the commissioning of a nuclear power plant determines the interest during construction, a shorter construction schedule would result in reduced interest payment which in turn would be reflected in the overall cost of the plant. Therefore, in order to avoid additional costs due to excessive delays in licensing proceedings, it may prove useful to set out time limits for successive stages in the regulatory process, subject to the discretion of the licensing authority to extend the established schedule under special circumstances, for instance in cases where prima facie evidence of good cause so warrants.

Sufficient delegation of authority by the competent body to its technical organs or advisory bodies for the safety assessment and regulatory review of a nuclear licence application, consistent with the technical expertise available to the authorities, would also be desirable in order to remove some impediments contributing to delays in the regulatory process.

---

[1] See Annexes I and II.

2.3. Scope of licensing requirements

It is generally recognized that nuclear energy presents minor environmental problems as compared with other technologies and industries (see, e.g., Refs [2, 3]). Nuclear energy also enjoys an almost perfect safety record, which is the result of effective safety-in-depth measures and quality assurance efforts that have been applied since the inception of the nuclear industry to protect the public health and safety. It is most important that these concerns about health, safety and environmental protection be fully maintained within the purview of a licensing scheme.

A proper approach to the licensing of nuclear facilities would consist in an early determination on the matter of site suitability, prior to the granting of a site licence or construction permit in which conditions should be imposed upon the applicant to eliminate the risk of an accident that might be significant for public safety. A procedure requiring approval of construction in several steps may be envisaged, in which case approval at each stage would relate to individual systems or a group of systems in the proposed installation. The applicant should be required to submit comprehensive information and documentation on fundamental safety aspects in defined stages as the work proceeds (pre-construction and pre-operation safety reports). In this connection, nuclear safety standards and guidelines available in the IAEA recommendations provide useful guidance as regards the safety requirements which should be met for the safe operation of nuclear power stations and the structure and contents of related safety assessments[2].

Through the sequence of approvals for the siting, construction and operation under a regulatory scheme for reactor licensing, each site and plant should be subject to a safety review on a case-by-case basis to determine the extent to which siting and safety criteria are satisfied or siting should be reconsidered, or modifications to the proposed design or operation of the plant are required in the interests of public health and safety and, also, with proper regard to avoidance of pollution and preservation of the environment. Both the regulatory and operating aspects are thus closely connected in the safety evaluation of a nuclear power project by the licensing authority, which should request from the applicant such information as may be necessary and impose upon him such conditions as the authority deems fit from the safety standpoint. Such conditions are usually laid down in an operating licence, which may be split into an interim authorization and a full operating licence to keep in step with the fulfilment by the applicant of all the safety measures prescribed and other requirements under a phased programme of tests for bringing the reactor to power (commissioning).

In short, the enforcement of licensing requirements must provide a reasonable assurance that, through verified compliance therewith, nuclear installations can be operated without undue risk to the public health and safety and with proper regard to the environment. To this end, the licensing authority should have a hand in events at every turn in the implementation of a nuclear power project. It may be expected that, with the development of standardized units, the regulatory review of basic design features of reactors of a standard type could be streamlined and emphasis would be laid in meeting the site requirements. For instance, after detailed investigations into several

---

[2] See in particular IAEA Safety Series Nos 31 and 34, and IAEA Technical Reports Series Nos 139 and 153.

aspects of a proposed site (boundaries, geology, meteorology, population density, etc.) on the basis of comprehensive information submitted by an applicant, determination of the siting suitability by the licensing authority could be followed by an early construction permit decision based on less-documented design information in respect of a reactor unit of established technology and standardized design to be built at the selected site. In this perspective, the licensing procedure may be aimed at simplifying the safety assessment of the design of standard reactors in order to concentrate upon siting criteria and site evaluation in the best interests of public safety and with due regard to a country's demand for electricity on a timely basis.

It may also be noted that in a number of countries nuclear installations operated by a department of the government or an agency set up by it are usually exempted from the licensing requirements, though they remain subject to all the other safety provisions of a licensing scheme. This is generally motivated by the consideration that facilities for training, research or isotope production for practical applications in agriculture, medicine or industry should not be unnecessarily subjected to the special legal regime established for nuclear power plants and associated facilities.

3. LEGISLATION ON NUCLEAR LIABILITY

Financial protection of the public against nuclear damage resulting from or connected with the construction and operation of nuclear installations has to be ensured prior to the start of such activities. Inasmuch as a regulatory control of their safety aspects is basically required, the regulation of nuclear liability and financial security therefor is to be viewed as an essential component of a reactor licensing system. It must, however, be stressed that the special regime of nuclear liability has been formulated to assist the development of a new branch of industry as well as to provide adequate protection for third parties involved in a nuclear accident. Accordingly, these objectives should be borne in mind in the administration of regulatory control over nuclear power stations.

3.1. Basic considerations

Civil (or third party) liability for nuclear damage is a matter of private law and deals with the questions of:

Who is to be held responsible for nuclear damage and must, therefore, pay compensation to a victim or victims thereof;

To what extent; and

Under what conditions.

Whereas the traditional principles of liability in the law of torts are based on the concept of fault, the relatively new system of nuclear liability — which was conceived in the last decade in the light of a new technology — is governed by the concept of risk. This was deemed necessary because the rules of civil law, devised for conventional risks, would not offer adequate protection against the special risks connected with nuclear activities.

The formulation of a special regime of liability in the field of nuclear energy was entirely initiated at the international level and was motivated by two major considerations:

(1) The need for ensuring appropriate protection against the risks of personal injury and of damage to property, in taking into account the potential magnitude of nuclear incidents, the length of time involved in some cases for detecting a radiation damage and, especially, the difficulty of furnishing proof of its origin; and

(2) The desirability of relieving the nuclear industry and its suppliers from unlimited liability risks that would hinder the development of the peaceful uses of atomic energy.

A balance of these considerations or, in other words, a compromise between the acceptable risks connected with nuclear activities and the benefits resulting therefrom for the community, is reflected in the system of liability for nuclear damage, which is embodied in a number of international conventions [4] and incorporated into many national laws [5].

3.2. Basic principles

The progressive and contemporary approach to liability for nuclear damage, both at the international and national level, is characterized by the following basic principles:

(1) Absolute (or strict or objective) liability

Because of the special risks related to nuclear activities, liability is linked to the risk involved, irrespective of fault. This means that the victim has not to prove that the damage was caused by fault or negligence of the operator of a nuclear installation; the sole burden of proof upon the victim is to provide evidence of a link of causation between his loss or damage and the event that caused such loss or damage.

(2) Channelling of liability

All liability is channelled to a single person, the operator of a nuclear installation. He is exclusively liable for all damage caused by a nuclear incident in his installation or involving nuclear materials in the course of transport from or to his installation. Therefore, no person other than the operator can be held liable. The channelling of liability to the operator, and to him exclusively, is aimed at simplifying the judicial proceedings for the victim since he does not have to sue different persons, as he might have to do under common law, to ensure the success of his claim. Another advantage of the channelling system is that in relieving the suppliers of services, materials or equipment connected with a nuclear installation from liability claims, the absolute and exclusive liability of the operator helps to simplify the contractual arrangements between him and his suppliers. The concentration of the insurance cover on the operator alone would lead to a reduction in the financial securities for third party liability and, consequently, in the overall cost of the nuclear plant.

(3) Limitation of liability in amount

The operator's exclusive liability places a heavy burden on him. Therefore, as a counter-balance to this concept of absolute liability such liability should be limited in amount. Moreover, liability without limitation in amount cannot be insured or otherwise guaranteed and, accordingly, would not be effective. The operator must obtain and maintain insurance or other financial guarantee up to the established liability limit. (The minimum amount of liability under both the Paris Convention of 1960 and the Vienna Convention of 1963 is equivalent to US $ 5 million as at 29 April 1963 for any one incident [6].)

In the last resort, should the insurance cover or other financial security of the operator prove insufficient to satisfy all claims, the State that licensed the operator (or Installation State) must provide the additional funds required up to the liability limit (state intervention).

(4) Limitation of liability in time

Radiation injuries may produce delayed effects but, on the other hand, the liability fund or reserves under any insurance cover or other financial security cannot be maintained for unduly long periods. As a compromise, therefore, the international conventions on nuclear liability generally provide for the limitation of the operator's liability to a period of 10 years from the date of a nuclear incident.

(5) Single court competent

The Vienna and Paris Conventions have both uniformly established the general rule that there should be only one court competent for dealing with all claims resulting from a nuclear incident, and only one law to govern the substance of such claims. Jurisdiction lies with the courts of the Contracting Party within whose territory the nuclear incident occurred — or, in the case of a state not being a Contracting Party, the courts of the state of the liable operator (the Installation State). The determination of the competent court is also a determination of the relevant national law to be applied to all claims. The channelling of all claims to one single court is an important condition for ensuring equitable distribution of compensation in the event nuclear damage exceeds the established limit of liability in amount and compensation must be reduced proportionally.

4. THE IAEA ADVISORY SERVICES IN NUCLEAR LEGISLATION

Since 1964 the IAEA has assisted an increasing number of Member States upon request in the framing of enabling legislation or specialized regulations for nuclear activities and, in particular, for the licensing of nuclear plants. The purpose of such advisory services is to work out with the competent authorities solutions to legal questions that could advance a national programme on atomic energy and, also, to assist them in the formulation of appropriate legislation consistent with international standards or recommendations as well as with current trends in regulating nuclear safety and liability. A typical illustration of such assistance and its outcome can be found in the case of the Philippines.

Within the framework of a Pre-Investment Study on Power including Nuclear Power in Luzon, carried out in the Philippines in 1964-66 by the IAEA as executing agency for the Special Fund of the United Nations Development Programme, the services of a legal expert were provided to the

Philippine Atomic Energy Commission for four months in 1965 for advice on, and the drafting of, legislation to regulate the introduction of nuclear power [7]. As a result of such co-operation between the Agency and the Philippine authorities, Republic Act No. 5207 was signed on 15 June 1968 by the President of the Republic and became effective on 15 May 1969 to govern both the regulatory and liability aspects of a comprehensive nuclear power programme. Broad regulatory powers are vested in the Philippine Atomic Energy Commission for issuing regulations and rules for the licensing of nuclear facilities and materials. Subsequently, at the Commission's request, the Agency further assigned in 1971, and then in 1973, a legal officer of its staff as short-term consultant to review draft licensing regulations and procedures prepared by the Commission, before adoption under its authority. Two legal officers of the Commission also received IAEA fellowships in 1968 and 1971 respectively, for training with the licensing authorities in the United States of America and the United Kingdom, and with the IAEA Secretariat, so as to make them conversant with the safety goals of regulatory control and with the practical administration of such control through licensing procedures. Thus, the requisite rules and regulations and qualified officers to assist the authorities in the regulatory aspects of a licensing process were available for the implementation of the first nuclear power project decided by the Government in 1974.

ANNEX I

IAEA SAFETY SERIES

No.	Title	Year of issue	Status
1	Safe Handling of Radioisotopes	1958	Safety Standard, Superseded
1	Safe Handling of Radioisotopes, Second Edition with Revised Appendix I	1962	Safety Standard, Superseded
1	Safe Handling of Radionuclides, 1973 Edition	1973	Safety Standard (Sponsored by IAEA/WHO)
2	Safe Handling of Radioisotopes, Health Physics Addendum	1960	Guide-book, Superseded (See No. 38)
3	Safe Handling of Radioisotopes, Medical Addendum	1960	Guide-book (Joint IAEA/ILO/WHO Pub.) Superseded (See No. 25)
4	Safe Operation of Critical Assemblies and Research Reactors	1961	Guide-book, Superseded (See No. 35)
5	Radioactive Waste Disposal into the Sea	1961	Guide-book
6	Regulations for the Safe Transport of Radioactive Materials	1961	Safety Standard
	Revised	1964	
	Revised	1967	
	Revised	1973	(Sponsored by IAEA/WHO)
	List of National Competent Authorities		
	Advisory Material for the Application of the IAEA Transport Regulations	1973	Guide-book (see No. 37)
7	Regulations for the Safe Transport of Radioactive Materials — Notes on Certain Aspects of the Regulations	1961	Guide-book, Superseded
8	The Use of Film-badges for Personnel Monitoring	1962	Guide-book
9	Basic Safety Standards for Radiation Protection	1962	Safety Standard
	Revised	1967	
10	Disposal of Radioactive Wastes into Fresh Water	1963	Guide-book, Superseded (see S.S.36)
11	Methods of Surveying and Monitoring Marine Radioactivity	1965	Guide-book
12	The Management of Radioactive Wastes Produced by Radioisotope Users	1965	Safety Standard
13	The Provision of Radiological Protection Services	1965	Safety Standard

No.	Title	Year of issue	Status
14	The Basic Requirements for Personnel Monitoring	1965	Safety Standard
15	Radioactive Waste Disposal into the Ground	1965	Guide-book
16	Manual on Environmental Monitoring in Normal Operations	1966	Guide-book
17	Techniques for Controlling Air Pollution from the Operation of Nuclear Facilities	1966	Guide-book
18	Environmental Monitoring in Emergency Situations	1966	Guide-book
19	The Management of Radioactive Wastes Produced by Radioisotope Users — Technical Addendum	1966	Guide-book
20	Guide to the Safe Handling of Radioisotopes in Hydrology	1966	Guide-book (Sponsored by IAEA/FAO/WHO)
21	Risk Evaluation for Protection of the Public in Radiation Accidents	1967	Guide-book (Joint IAEA/WHO Pub.)
22	Respirators and Protective Clothing	1967	Guide-book
23	Radiation Protection Standards for Radioluminous Timepieces	1966	Safety Standard (Joint IAEA/ENEA Pub.)
24	Basic Factors for the Treatment and Disposal of Radioactive Wastes	1967	Guide-book
25	Medical Supervision of Radiation Workers	1968	Guide-book (Joint IAEA/WHO/ILO Pub.)
26	Radiation Protection in the Mining and Milling of Radioactive Ores	1968	Code of Practice (Joint IAEA/ILO Pub.)
27	Safety Considerations in the Use of Ports and Approaches by Nuclear Merchant Ships	1968	Guide-book (Joint IAEA/IMCO Pub.)
28	Management of Radioactive Wastes at Nuclear Power Plants	1968	Guide-book
29	Application of Meteorology to Safety at Nuclear Plants	1968	Guide-book
30	Safety Aspects of the Design and Equipment of Hot Laboratories	1969	Guide-book
31	Safe Operation of Nuclear Power Plants	1969	Code of practice (Sponsored by IAEA/WHO)
32	Planning for the Handling of Radiation Accidents	1969	Guide-book (Sponsored by IAEA/ILO/FAO/WHO)
33	Guide to the Safe Design, Construction and Use of Radioisotopic Power Generators for Certain Land and Sea Applications	1970	Guide-book (Joint IAEA/ENEA Pub.)

No.	Title	Year of issue	Status
34	Guidelines for the Layout and Contents of Safety Reports for Stationary Nuclear Power Plant	1970	Guide-book (Sponsored by IAEA/WHO)
35	Safe Operation of Research Reactors and Critical Assemblies, with Technical Appendix	1971	Code of Practice (Sponsored by IAEA/WHO)
36	Disposal of Radioactive Wastes into Rivers, Lakes and Estuaries (Revised Edition of No. 10)	1971	Guide-book (Sponsored by IAEA/WHO)
37	Advisory Material for the Application of the IAEA Transport Regulations	1973	
38	Radiation Protection Procedures (Revised Edition of No. 2)	1973	
39	Safe Handling of Plutonium	1974	Guide-book
40	Safe Use of Radioactive Tracers in Industrial Processes	1974	Guide-book (Sponsored by IAEA/WHO)
41	Objectives and Design of Environmental Monitoring Programmes for Radioactive Contaminants	1975	Guide-book (Sponsored by IAEA/WHO)

Safety standards and codes of practice are approved and recommended by the IAEA Board of Governors to Member States to be taken into account in the formulation of national regulations and rules of practice.

ANNEX II

IAEA TECHNICAL REPORTS SERIES (PERTINENT PUBLICATIONS)

No.	Title	Year of issue
15	A Basic Toxicity Classification of Radionuclides	1963
27	Technology of Radioactive Waste Management Avoiding Environmental Disposal	1964
31	Training in Radiological Protection: Curricula and Programming	1964
78	Operation and Control of Ion-exchange Processes for Treatment of Radioactive Wastes	1967
82	Treatment of Low- and Intermediate-level Radioactive Waste Concentrates	1968
83	Economics in Managing Radioactive Wastes	1968
87	Design and Operation of Evaporators for Radioactive Wastes	1968
88	Aseismic Design and Testing of Nuclear Facilities	1968
89	Chemical Treatment of Radioactive Wastes	1968
95	Quick Methods for Radiochemical Analysis	1969
101	Standardization of Radioactive Waste Categories	1970
106	The Volume Reduction of Low-activity Solid Wastes	1970
109	Personnel Dosimetry Systems for External Radiation Exposures	1970
116	Bituminization of Radioactive Wastes	1970
120	Monitoring of Radioactive Contamination on Surfaces	1970
118	Reference Methods for Marine Radioactivity Studies	1970
122	Air Filters for Use at Nuclear Facilities	1970
133	Handbook on Calibration of Radiation Protection Monitoring Instruments	1971
135	Storage Tanks for Liquid Radioactive Wastes: Their Design and Use	1972
136	Use of Local Minerals in the Treatment of Radioactive Waste	1972
139	Earthquake Guidelines for Reactor Siting	1972
142	Inhalation Risks from Radioactive Contaminants	1973
148	Control of Iodine in the Nuclear Industry	1973
150	Measurement of Short-range Radiations	1973
152	Evaluation of Radiation Emergencies and Accidents: Selected Criteria and Data	1974
153	Organization of Regulatory Activities for Nuclear Reactors	1974
155	Thermal Discharges at Nuclear Power Stations	1974
164	Steps to Nuclear Power — A Guidebook	1975

REFERENCES

[1] INTERNATIONAL ATOMIC ENERGY AGENCY, Technical Report IAEA-140 (1971) 19.

[2] INTERNATIONAL ATOMIC ENERGY AGENCY, Environmental Aspects of Nuclear Power Stations (Proc. Symp. New York, 1970), IAEA, Vienna (1971).

[3] IAEA/WHO, Nuclear Power and the Environment, IAEA, Vienna (1973).

[4] Various authors, Safety aspects of nuclear plants — Legislative, insurance and regulatory aspects, Peaceful Uses of Atomic Energy (Proc. Conf. Geneva, 1971) 3, UN, New York, and IAEA, Vienna (1972) 389 et seq.

[5] EUROPEAN NUCLEAR ENERGY AGENCY, Nuclear Legislations — Nuclear Third Party Liability, Analytical Study, OECD-ENEA, London (1967).

[6] INTERNATIONAL ATOMIC ENERGY AGENCY, International Conventions on Civil Liability for Nuclear Damage, Legal Series No. 4, IAEA, Vienna (1966), Vienna Convention, Article V, and Paris Convention, Article 7.

[7] UNDP-IAEA, Pre-Investment Study on Power Including Nuclear Power in Luzon, Republic of the Philippines, General Report, IAEA, Vienna (1966) Chap. IX, p.143 et seq.

EXISTING AND PLANNED NATIONAL LEGISLATION ON NUCLEAR ACTIVITIES IN MEXICO

E. ORTIZ MONASTERIO
Mexican National Nuclear Energy Institute,
Mexico 18, D.F.,
Mexico

Abstract

EXISTING AND PLANNED NATIONAL LEGISLATION ON NUCLEAR ACTIVITIES IN MEXICO.

The Mexican constitutional and institutional frameworks for carrying out nuclear activities are described. Responsibilities in this field are vested in the Federal Government. The National Nuclear Energy Institute is vested with both promotional and regulatory functions. It performs licensing and control functions over the production and uses of radioactive materials as well as the establishment of nuclear installations. The Federal Electricity Commission is responsible for electricity generation. The implementation of nuclear power projects is accordingly part of its statutory functions. Mexico has legislation covering the exploitation of radioactive ores, the manufacture and trade of nuclear substances, the licensing of nuclear facilities and third party liability consistent with international conventions. Regulations are under preparation for protection of radiation workers and for licensing nuclear power plants.

1. CONSTITUTIONAL FRAMEWORK

Mexico is politically organized under a federal system in which the Federal Government and the several States incorporated as a nation have clearly defined jurisdictions. The Federal Government and the Government of each State have their own Executive, Legislative and Judiciary Branches. Each State has its own Constitution governing its internal affairs, which in no case can include provisions that contradict those of the Federal Constitution.

The Federal Constitution, in Article 73, defines the competence of the Federal Congress to legislate on a national basis with regard to a limited number of matters considered sufficiently important to affect the general interests of the whole country. Any rights that are not expressly granted by the Federal Constitution to the Federal Government must be considered as reserved to the States.

Nuclear activities in any country have bearing on a number of areas. The numerous applications of nuclear energy for peaceful purposes that have been developed in the last decades have greatly widened the areas in which governments must act, from both a legislative and a practical standpoint.

Although the Federal Constitution of Mexico does not contain any provision that restricts legislation governing nuclear activities to the Federal Congress, it does grant express powers to the latter to legislate in most of the fields that are connected with nuclear energy and its applications. For instance, nuclear ores fall under the provisions of the mining laws, and legislation in the mining field is federal; however, as the radioactive properties and contaminating effects of nuclear ores and substances may directly affect the health of human beings, each State's National Congress, which is competent to legislate on public health and labour matters, is also empowered to regulate the occupational hazards of persons working with radiation. Legislative action in the field of electricity is within the federal domain, and consequently the Federal Congress is competent to regulate the establishment of nuclear power plants and facilities.

The powers of each National Congress to legislate on trade (including patents), communications and related aspects do not preclude federal control of the various activities connected with the use, application and development of nuclear energy and nuclear ores, substances, equipment and facilities.

Everyone is aware of the importance of nuclear energy in today's world. If mankind is to achieve a lasting peace, good faith on the part of nations must prevail, and the use of nuclear materials must be properly safeguarded. Also, the great expectations placed on the peaceful uses of nuclear energy for the development of better economic conditions for different countries through international co-operation and assistance emphasize the importance of this source of energy. Here, again, all international activities of Mexico are, in accordance with its Constitution, to be performed by the Federation, through both the Executive and the Legislative Branches.

2. INSTITUTIONAL FRAMEWORK

The Executive Branch fulfils its administrative responsibilities through Secretariats and Departments, the number and activities of which are determined by a relevant law. Among the Secretariats (or ministries) more or less directly involved in nuclear activities are the following:

(a) The Secretariat of Foreign Relations, which is in charge of handling international affairs, including the negotiation and signature of treaties, conventions and agreements, as well as the procurement of technical information and assistance from abroad; the participation in international conferences and meetings, and the maintenance of relations with international organizations and agencies. All of these activities can in some way be related to the nuclear field.

(b) The Secretariats of the Navy and National Defence, which may in some cases act as consultative agencies in connection with military, naval and maritime aspects of nuclear activities.

(c) The Secretariat of National Patrimony, which plays a very important role with respect to nuclear activities, particularly insofar as deposits of radioactive ores are concerned. It is by law the custodian and administrator of all the mineral deposits in the country and it is responsible for assigning to official agencies the lands that are needed in connection with prospecting for and exploitation of radioactive ore deposits, all of which constitute national mining reserves that only government agencies are entitled to work out.

(d) The Secretariat of Industry and Commerce, which, among other duties, is responsible for the control of imports and exports, the granting of patents and the supervision of the electric industry, all of which activities have in many cases a bearing on nuclear activities.

(e) The Secretariat of Communications and Transportation, whose functions have relevance to nuclear activities, in particular with regard to the transport of radioactive materials.

(f) The Secretariat of Health, which, in view of the risks to public health arising from the use of radioactive materials, the handling of irradiating equipment and the operation of facilities containing such materials, has a statutory concern in all activities involving such hazards.

(g) The Secretariat of Labour, which plays an active role with regard to persons who, in the performance of their work, may be exposed to hazards due to the use or handling of radioactive materials.

Up to this point I have only referred to Ministerial Departments of the Executive Branch. However, they are not the only administrative organs through which the activities of the Federal Government are carried out. Secretariats and Departments of the Executive Branch constitute what is commonly designated as the 'centralized agencies'. But in some cases the Federal Government, in order to make the performance of its functions more efficient, creates another type of agency with a legal capacity and financial autonomy and whose staff is relatively independent of the centralized authorities. These governmental organizations are generally known as 'decentralized agencies', and among them we find two that are of primary importance in connection with nuclear activities.

2.1. The National Nuclear Energy Institute

2.1.1. Legal status and antecedent

The National Nuclear Energy Institute of Mexico was created by an organic law published in the Official Gazette on 12 January 1972. This law abrogated a previous one that had created the National Nuclear Energy Commission, dated 19 December 1955, and published on 31 December of that year.

Although the Institute was given the functions of the former Commission, the newly created agency was substantially different from its predecessor, both in its scope of activities and its structure.

Basically, the Institute is an agency of the Federal Government, vested with legal personality and financial autonomy.

2.1.2. Responsibilites

The Institute is authorized:

(a) To schedule, co-ordinate and promote the peaceful uses of nuclear energy, in order to bind them to the economic, social, scientific and technological development of the country;

(b) To carry out the prospecting for and the exploitation of radioactive ore deposits and other deposits related to nuclear industry, together with any other processes for the production of nuclear fuel, including reprocessing;

(c) To contract for the fabrication of fuel elements and the processing of irradiated fuel;

(d) To enter into agreements with other agencies or corporations for the supply of nuclear fuel for use by public utilities or for research and training;

(e) To co-operate or participate in the execution of projects of national interest in which nuclear techniques are employed;

(f) To determine, jointly with the Secretariat of Health and other agencies that may have authority, the basic norms for the handling of facilities or equipment which contain radioactive materials, including their transportation, for ensuring nuclear safety;

(g) To watch over the fulfilment of Mexico's obligations under international treaties and agreements relating to nuclear energy, and to report to the Federal Executive in that respect;

(h) To promote specific activities that may be carried out by universities, institutes or higher education centres in the field of nuclear energy;

(i) To act as the exclusive exporter of radioactive ores and nuclear fuel, with the prior authorization of the President of the Republic;

(j) To act as the exclusive importer of radioactive ores, radioactive materials and nuclear fuel, as well as to grant approval prior to the import, export or trade of equipment for utilization of nuclear energy, in accordance with relevant Regulations;

(k) To participate with other competent authorities in the authorization, supervision and control of the uses and handling of nuclear fuel;

(l) To authorize, control and supervise the siting, design, construction and operation of nuclear reactors;

(m) To authorize, control and supervise the production, possession and use of radioactive materials, in accordance with relevant Regulations;

(n) To disseminate information on the peaceful uses of nuclear energy and on progress in this field;

(o) To promote national and international exchange of information for the benefit of scientific and technological research in the nuclear field, and to foster the holding of conferences and meetings for the same purpose;

(p) To advise the Federal Government in all matters for which it is consulted in the field of ionizing radiations and nuclear energy; and

(q) To set up with other decentralized agencies and government corporations any co-ordinating scheme it may deem appropriate for the efficient fulfilment of its objectives.

2.1.3. Structure

The Institute is administered by a Board of Directors and a Director General, appointed by the President of the Republic. The Members of the Board are the Heads of several Secretariats whose functions are in one way or another related to those of the Institute. The National Polytechnic Institute, the National Autonomous University, the Federal Electricity Commission, the National Council of Science and Technology, and the Mexican Oil Company are thus represented on the Board.

The Board holds ordinary meetings every four months as well as extraordinary ones which, in the opinion of its members, may be necessary.

Meetings of the Board are convened by its Chairman and decisions are taken by majority vote, with the attendance of at least half the Board Members plus one. In case of a tie the Chairman has a casting vote.

The functions of the Board of Directors are as follows:

(a) To determine the activities and adopt the necessary resolutions for the efficient fulfilment of the Institute's objectives;

(b) To examine and approve the work programme submitted by the Director General;

(c) To approve the draft budget of the Institute for submission to the President of the Republic;

(d) To administer the Institute's properties and assets;

(e) To authorize contracts for the rendering of services, performance of technical studies, lease of equipment, auxiliary drilling work, product analysis, total or partial design of plants and equipment and the construction and installation thereof, civil engineering works and other analogous services and works;

(f) To establish permanent or temporary technical committees within the Institute for the study, co-ordination and execution of development programmes in the field of nuclear technology;

(g) To bestow honorary distinctions to outstanding professionals in the field of nuclear energy; and

(h) To delegate to the Director General any responsibility it may deem convenient.

The Director General is assisted by a Deputy Director General and a number of Directors, all of whom are appointed by the President of the Republic.

2.1.4. Financing

The Institute has its own properties and assets for the discharge of its functions. This is constituted by:

(a) Real estate properties and chattels, the right to exploit and use State properties assigned to the Institute by the Federal Government, and those acquired by the Institute under any legal title;

(b) Subsidies annually granted by the Federal Government; and

(c) Any donations and legacies it may receive and, in general, the income it may obtain for services furnished in accordance with its objectives.

2.2. The Federal Electricity Commission

The use of nuclear energy for generating electricity has made steady progress in the last few years. Mexico, as other countries with a growing industry, has increasing needs for electric power that can and has to be met through a nuclear power programme.

At present Mexico is at the initial stage of preparing for the installation of a 600 MW nuclear power plant.

Since 1960 the production of electricity has been vested in the government. Although there still exists a very limited number of small private utility companies, they are only a remainder of the past which sooner than later will disappear.

2.2.1. Legal status

The government agency in charge of electric power is the Federal Electricity Commission. It was created by a Presidential Decree published in the Official Gazette on 14 January 1949. It is a decentralized public agency of the Executive Branch and it has legal personality and financial autonomy.

2.2.2. Responsibilities

The Commission is vested with the following responsibilities:

(a) To make plans for developing the national electricity system and to establish the bases for its operation;

(b) To perform works for the generation, transmission and distribution of electric power;

(c) To acquire the necessary equipment and facilities as well as values and stocks connected with the electric industry;

(d) To participate with corporations or individuals in the formation of corporations engaged in electricity business;

(e) To participate in corporations dealing with the manufacture of equipment and materials for electric installations;

(f) To organize associations of electricity consumers for the purpose of securing the most favourable supply conditions;

(g) To take part in the electrification activities of other public or semi-public agencies; and

(h) To carry out any operations and to perform any acts connected with the discharge of its functions.

2.2.3. Structure

The administration of the Commission is entrusted to a Board of Directors composed of five members. The Chairman of the Board is the Head of the Secretariat of Industry and Commerce, and the other Board Members are appointed by the President of the Republic on the proposals of different Secretariats.

The Board of Directors, on the proposal of the President of the Republic, appoints a Director General and a Deputy Director General.

The annual budget of the Commission and its work programme must be approved by the President of the Republic after approval by the Board of Directors.

2.2.4. Financing

The properties and assets of the Commission are constituted by:

(a) The chattels, real estate properties and the right to exploit and use State properties;

(b) The national reserves of hydraulic energy;

(c) The sums of money apportioned to it by law; and

(d) The income obtained from its own properties and from any other sources.

3. LEGISLATION GOVERNING NUCLEAR ACTIVITIES

3.1. Radioactive ores

As early as 1945 the Secretary of Economy of Mexico issued a Declaration dated 22 August by means of which all the deposits of uranium and of any other radioactive ores in the country were incorporated into the national mining reserves. This was done to ensure control over both the production and distribution of such substances.

Subsequently, on 15 October 1946 the President of the Republic signed a decree amending the above Declaration and, while maintaining the said substances as national reserves, making them subject to exclusive exploitation by the Federal Executive.

The above Declaration and Decree were thus the antecedents to the Law Incorporating into the National Mining Reserves the Deposits of Uranium, Thorium and Any Other Substances from Which Fissionable Isotopes That May Produce Nuclear Energy Can Be Obtained. This law was passed on 31 December 1949, and published in the Official Gazette on 26 January 1950. The Regulations for the implementation of this Law were published on 17 January 1952.

Besides these Law and Regulations, the Organic Law Creating the National Institute of Nuclear Energy mentioned earlier also contains provisions regarding radioactive ores.

The basic principles governing radioactive ores are as follows:

(a) The prospecting for and exploitation of radioactive ore deposits are within the exclusive responsibility of the Federal Executive, and the National Nuclear Energy Institute is entrusted with such activities as well as any processing carried out with the substances obtained therefrom.

(b) The Secretariat of National Patrimony assigns to the Institute the lands it may request for the discharge of its functions in this area.

(c) Whenever radioactive ores appear in mineralogical association with other substances that are subject to a mining concession, no concessions are to be granted for the working of the latter substances without the express consent of the Institute.

(d) When the Institute gives its consent for the granting of such concessions, it also proposes working methods and conditions for the radioactive ores involved and the Secretariat of National Patrimony has overall responsibility to ensure that the prescribed procedures and conditions are complied with.

(e) Radioactive ores remain in all cases property of the nation.

(f) Any person or corporation that has information with regard to radioactive ore deposits must make it known to the Secretariat of National Patrimony. If the beneficiaries of mining allotments or concessions discover in their mining lands the existence of radioactive ores, they must give the corresponding notice within thirty days from the discovery.

(g) The National Nuclear Energy Institute is vested with exclusive rights for the import and export of radioactive ores.

3.2. Manufacture, use and trade of nuclear substances

Pursuant to its organic law, the Institute is responsible for:

(a) Carrying out any processes for the procurement of nuclear fuel;

(b) Contracting for the fabrication of fuel elements and the processing of irradiated fuel;

(c) Entering into agreements with government agencies or corporations for the supply of nuclear fuel for use by public utilities or for research and training;

(d) Determining, jointly with the Secretariat of Health and other agencies that may have authority, the basic norms for the handling of facilities or equipment that contain radioactive materials, including their transportation;

(e) Participating with other competent authorities in the authorization, supervision and control of the uses and handling of nuclear fuel;

(f) Authorizing, controlling and supervising the production, possession and use of radioactive materials; and

(g) Determining charges for nuclear fuel and radioactive materials to be supplied within Mexico.

3.3. Nuclear equipment and facilities

The organic law establishing the Institute provides that the Institute's prior approval is required for the import and trade of equipment in the field of nuclear energy. The Institute is also the regulatory body responsible for licensing, control and supervision of the siting, design, construction and operation of nuclear reactors. With regard to these activities, there are regulations in Mexico that are not yet in force and that will be discussed below in the section dealing with legislation in preparation.

3.4. Safeguards and safety

In the international field Mexico's nuclear activities are subject to the safeguards applied by the International Atomic Energy Agency. Mexico is a Party to the Treaty for the Prohibition of Nuclear Weapons in Latin America and to the Treaty on the Non-Proliferation of Nuclear Weapons.

The National Nuclear Energy Institute is entrusted with the responsibility for supervising the fulfilment of Mexico's obligations under international treaties and agreements relating to nuclear energy.

At the national level the Health Code and the Law on the Prevention and Control of Contamination grant powers to the Secretariat of Health to act in connection with matters related to nuclear energy insofar as they concern public health. Also, as already mentioned, the organic law establishing the Institute sets forth that the Institute and the Secretariat of Health shall jointly draw up regulations for the handling of facilities or equipment containing radioactive materials.

The Federal Labour Law provides for workmen's compensation in accordance with a classification of occupational hazards in the nuclear industry, in the mining of uranium and other radioactive ores, in the processing of such ores, in nuclear installations and in the utilization of radionuclides and irradiation apparatus.

3.5. Third party liability

As described at the beginning of this paper, the political system of Mexico is such that each of the States composing the Federation has the ability to legislate on its own internal matters. Civil matters, such as liability for damages, are within the legislative scope of each State.

There exists in Mexico a Civil Code for the Federal District and Territories and a Civil Code for each of the States. The provisions of the first mentioned Code have legal force in the Federal District and Territories on matters of common law and in the whole country with respect to federal matters.

In accordance with the Civil Code for the Federal District and Territories, the general principle that applies to liability for damages is that the party that is guilty must indemnify. However, Article 1913 of the said Code provides that whenever anyone makes use of mechanisms, instruments, apparatus or substances that are dangerous in themselves, he is liable for the damage caused by them, unless it is proved that such damage was caused by an inexcusable fault or negligence of the victim. This Code came into force in 1934 and was thus one of the first civil laws in the world to incorporate strict liability as a principle.

It must be noted that, since civil liability is a matter on which each State has the right to legislate, the provisions of the above-mentioned Code only apply to the Federal District and Territories. Nevertheless, many of the Civil Codes of the States also include similar provisions.

Furthermore, it should be mentioned that, notwithstanding this principle of strict liability, civil legislation on liability in Mexico maintains the right of recourse.

Mexico participated actively in the diplomatic conference that led to the adoption of the Vienna Convention on Civil Liability for Nuclear Damage in 1963. Although it is not a signatory to the Convention, the possibility that it may become a party thereto cannot be altogether discarded.[1]

4. LEGISLATION IN PREPARATION

4.1. Regulations on the safety of radiation workers

Mexico is a signatory to Convention 115 of the International Labour Organisation (ILO), which provides for the protection of workers against ionizing radiation. The Convention requires signatory countries to implement its provisions through enactment of national legislation.

The Regulations will apply to all activities involving ionizing radiation hazards, but will not cover the milling of radioactive ores, nuclear plants and accelerators, which are subject to other regulations.

Maximum permissible doses of radiation are set forth in these Regulations for the different organs and for individuals occupationally involved. They also contain rules for operations involving radiation hazards, protective devices, age limits, medical examinations, health records.

One particular innovation in these Regulations is that they contain a chapter dealing with the physical protection of radioactive materials, that is, the measures that must be taken to prevent such materials being stolen, lost, improperly used or exposed to any other kind of incident, specially during transport.

Also in accordance with the ILO Model Regulations, the Mexican Regulations include provisions regarding safety measures for the location, handling, storage and transport of sealed and non-sealed radiation sources, together with provisions concerning different activities connected with the use of such sources.

In addition to the provisions of the Model Regulations, the Mexican Regulations further contain procedural requirements for radiation source licensing, penalties and determination of responsibilities of the several authorities involved in the application of the Regulations.

4.2. Regulations on licensing of nuclear plants

Draft Regulations on Construction Permits and Operating Licences for Nuclear Plants, prepared by the National Nuclear Energy Institute, have

---

[1] Note by the IAEA Secretariat: A Law on Civil Liability for Nuclear Damage, establishing objective (or strict) liability of the operator of a nuclear installation and limiting his liability to 100 million pesos for any one nuclear incident, was promulgated by the President of the Republic on 29 December 1974 (Official Gazette, No. 41, 31 December 1974).

been reviewed by the IAEA Secretariat to ensure consistency with the Agency's recommended standards for the safe operation of nuclear power plants. These Regulations classify nuclear plants under two types:

(1) Production nuclear plants. These include:

(a) Nuclear reactors designed or used primarily for the production of plutonium or uranium-233;

(b) Any plant designed and used for the separation of uranium or plutonium isotopes, with the exception of facilities on a laboratory scale designed and used exclusively for experimental or didactic purposes;

(c) Any facility designed and used for the conversion or storage of nuclear materials or for the fabrication of fuel elements, with the exception of facilities on a laboratory scale used exclusively for experimental or didactic purposes;

(d) Any facility designed or used for the chemical processing of irradiated materials containing special fissionable material, with the exception of facilities on a laboratory scale designed and used exclusively for experimental or didactic purposes.

(2) Utilization nuclear plants. This term means any nuclear reactor that has not been designed or used primarily for the production of plutonium or uranium.

The permits and licences to be granted in accordance with these Regulations are:

(a) Permits for the construction, modification and decommissioning of nuclear plants;

(b) Permits for the import, export, transport and trade of nuclear equipment;

(c) Licences for the performance of nuclear pre-operational tests as well as for the operation of a nuclear plant.

There are two kinds of operating licences:

(i) Licences for development, research and application reactors;

(ii) Licences for production or utilization nuclear plants to be used for commercial or industrial purposes.

Each application for a construction permit must include a first-stage safety report in which the following minimum information is required:

(a) A description of the chemical, physical and metallurgical processes to be developed, including the quality and quantity of any radioactive effluent to be expected as a result of such processes;

(b) A description of the facility, based on the design criteria thereof as a unit and with respect to its components that are essential for the safe operation of the facility;

(c) A description of the site where the plant is to be located, including the use of the adjacent lands, the sources of water supply, the population density, the means of communication and the ecological conditions;

(d) The meteorological, hydrological, maritime, geological and seismological data that are necessary for an evaluation of proposed safety measures against radioactive hazards;

(e) An evaluation of the devices and measures aimed at preventing acts or incidents that may cause radioactive hazards or at ensuring protection against the consequences of such acts or incidents, should they occur;

(f) A description of the procedures for the control and disposal of solid, liquid and gaseous radioactive wastes;

(g) A description and evaluation of the quality control and warranty programme to be applied to the design, procurement, fabrication, construction and testing of structures, systems and components of the plant, both as a unit and separately, to determine their fitness and compatibility;

(h) A description of the measures to be taken during construction to guarantee the physical protection of nuclear materials to be used or stored at the plant;

(i) A preliminary description of the pre-nuclear test programme.

An Advisory Committee on Construction Permits and Operating Licences for Nuclear Plants has been established within the National Nuclear Energy Institute and vested with the responsibility of examining and evaluating the information submitted with a construction permit application. The Committee formulates its technical assessment for consideration by the Director General of the Institute, who, in turn, submits such evaluation together with his opinion to the Board of Directors of the Institute for decision.

The application for an operating licence cannot be filed until the construction permit has been granted, and such application must include a second-stage safety report comprising the following information:

(a) Updated information on all the data supplied in the first-stage safety report, with the indication of all changes made since the submission of the said report, including the results of all the environmental and meteorological monitoring performed since that time;

(b) The quality and quantity of radioactive materials expected as a consequence of the plant operation, and the means to control and limit the radioactive effluents and radiation exposure within the limits set forth in the corresponding regulations;

(c) A final analysis and evaluation of the design and performance of structures, systems and components;

(d) A description and evaluation of the applicant's programmes, including research and development programmes, if any, to demonstrate that the safety problems appearing at the construction permit stage have been resolved;

(e) A description of the applicant's operational organization, nuclear materials accounting system, responsibilities allocation, personnel qualifications and administrative procedures;

(f) A description of the proposed procedures for nuclear testing, routine and non-routine operations, start-up and turn-off, maintenance, supervision, periodical inspections of structures, systems and components, minimization of operational accidents, etc.;

(g) A description of plans and measures for coping with acts or incidents which may cause radioactive hazards.

A procedure similar to that described in connection with the construction permit applications is followed for the evaluation of an operating licence application. However, prior to the granting of an operating licence, the applicant must carry out the necessary pre-operational tests.

Pending the Advisory Committee's evaluation of an application, the Institute may grant a provisional construction permit, provided, however, that the missing information does not relate to vital safety items.

Further regulations will be prepared for other specific purposes in connection with nuclear plants, such as for plant operation and reactor operators. Guidelines have already been drafted with regard to the information that should be included in the first-stage and second-stage safety reports and the criteria that should apply in connection therewith.

It should also be mentioned that the Regulations for nuclear plant licensing contain specific provisions requiring compliance with the safeguards system of the International Atomic Energy Agency.

SAFETY ASPECTS OF NUCLEAR PLANT LICENSING IN CANADA

J.H.F. JENNEKENS
Nuclear Plant Licensing Directorate,
Atomic Energy Control Board,
Ottawa, Canada

Abstract

SAFETY ASPECTS OF NUCLEAR PLANT LICENSING IN CANADA.

The legislative authority is laid down in the Atomic Energy Control Act, 1946, declaring atomic energy a matter of national interest and establishing the Atomic Energy Control Board (AECB) as the competent body for regulating all aspects of atomic energy. The Act also vests a Minister designated by the Government with research and exploitation functions; thus, by Ministerial order, Atomic Energy of Canada Limited was established in 1952 as a State-owned company. The Nuclear Liability Act, 1970, channels all liability for nuclear damage to the operator of a nuclear installation and requires him to obtain insurance in the amount of $75 million, part of which may be re-insured by the Government. The licensing requirements comprise the issuance of a site approval, a construction licence and an operating licence. The AECB is assisted in its licensing functions by its Nuclear Plant Licensing Directorate and by the Reactor Safety Advisory Committee co-operating with each other in making extensive safety assessments of a licence application. A site evaluation report, a preliminary safety report and a final safety report are required in relation to the siting, construction and operation of a nuclear power plant. The Canadian reactor safety philosophy is based on the concept of defence in depth, implemented through a multi-step approach, which includes avoidance of malfunctions, provision of special safety systems, periodic inspection and testing, and avoidance of human errors. Specific criteria and principles have evolved in applying this basic safety philosophy and radiation protection standards are derived from international recommendations. Stringent control is exercised over the management of radioactive waste and management facilities must meet the engineering and procedural requirements of AECB before they can be placed in operation.

INTRODUCTION

On 11 April 1962 the reactor of the NPD (Nuclear Power Demonstration) Generating Station at Rolphton, Ontario, was started up. Thus began the first of a series of power reactor start-ups in Canada that has demonstrated the viability of the CANDU concept.

Over eleven years have elapsed since NPD achieved initial criticality. During that period many technical developments have occurred, as evidenced by the changes in reactor size from 20 MW(e) for NPD to 750 MW(e) for each of the four units of the Bruce Generating Station in Bruce County, Ontario.

These developments have not been made without the trials and tribulations that characterize any advanced technological programme. The important point is that as technical problems arose during the design, construction and operation of the first nuclear power stations in Canada they were resolved by a determined and co-operative effort. Part of this effort was directed at fulfilling the regulatory requirements arising out of the safety-related aspects of such problems but a greater effort has been expended in developing safety systems appropriate to the much larger stations now operating and being built. Not only are these stations much larger than earlier units but also they are being constructed in close proximity to centres of population.

Perhaps the best example of such effort is the unique 'negative pressure containment system' used at the Pickering Generating Station near Toronto, Ontario, and at the Bruce Generating Station.

Parallelling the technical developments on which the success of the CANDU programme has been based, there have been evolutionary changes in certain aspects of the reactor licensing in Canada. These changes have come about as a result of experience in applying a safety philosophy developed more than two decades ago and an increased knowledge and understanding of the performance of power reactor process systems and of the special safety systems incorporated into the design of such reactors. It is noteworthy, however, that the fundamental approach to reactor safety adopted by the Atomic Energy Control Board has, in principle, remained unchanged. Thus, not only has the CANDU concept been tested and proven successful but also the Canadian reactor safety philosophy has been equally tested and proven sound.

The purpose of this paper is to review some of the more important safety aspects of nuclear plant licensing. To place the subject matter in the Canadian context, a summary of the legislative basis and regulatory process in Canada would appear to be appropriate.

LEGISLATIVE AUTHORITY

Canada is a confederation of ten provinces with two vast and sparsely populated areas of the country (some 39% of Canadian territory) – the Yukon and Northwest Territories – remaining under national or federal control. The British North America Act (1867), with its more than 20 amendment Acts, is generally considered to be the Constitution of Canada. It provides for the establishment and functioning of political institutions at three levels of representative government in the Canadian Federation: the federal, provincial and municipal.

Under the provisions of the Act the Parliament of Canada is assigned 29 specific powers as well as legislative authority over "Such Works" as it declares to be "for the general advantage of Canada". In 1946 the Parliament of Canada passed the Atomic Energy Control Act, thus declaring atomic energy a matter of national interest and establishing the Atomic Energy Control Board (AECB) to administer the Act. The Act, which was subsequently amended in 1952, is a short document authorizing and defining the powers of the AECB, a body with five members, one of whom is appointed President and chief executive officer. Under the provisions of the Act the Board is empowered to make regulations governing all aspects of the development and application of atomic energy, to disseminate and control information and to offer scholarships and grants to promote research and the training of personnel. The Act also authorizes a Minister designated by the government to carry out research and the exploitation of atomic energy and provides him with extensive powers for this purpose, including the power to acquire or establish companies that are wholly owned in the name of Her Majesty in right of Canada and that are supported by funds appropriated by Parliament. Perhaps the best known example of these Ministerial powers was the establishment in 1952 of Atomic Energy of Canada Limited.

The only other legislation specifically enacted in respect of atomic energy is the Nuclear Liability Act. This Act, when brought into force later this year (1973), will place all responsibility for nuclear damage on the operator of a nuclear installation. It will require the operator to obtain insurance in the amount of $75 million (part of which may be re-insured by the government). It will also provide for the establishment of a Nuclear Damage Claims Commission to deal with claims for compensation when the government deems that a special tribunal is necessary. The Act recognizes that Canada may enter into international arrangements in respect of nuclear liability but Canada is not at present a party to any such arrangement.

THE SAFETY IMPLICATIONS OF NUCLEAR POWER

The major hazard presented by the operation of nuclear power stations arises from the large inventory of radioactive fission products produced and contained in the fuel. Although small quantities of these fission products may escape through pin-hole sized defects in the fuel cladding and eventually be released to the environment during normal operation of a station, the effect of such releases is very minimal. Experience has shown that such releases can be controlled and the effects minimized to such an extent that the levels of radiation in the environment outside the exclusion areas of nuclear power stations are indistinguishable from naturally occurring background radioactivity. Nevertheless, continued attention is paid to controlling and monitoring the effluents from nuclear power stations.

The second way by which fission products may escape from a nuclear power station is in the course of an accident. Because the implications of such a release are much more serious than that posed by normal operation, primary attention during the licensing process is directed at ensuring that the chance of a major release of radioactive fission products is negligibly small. Thus, the safety criteria and principles developed in Canada are designed to minimize the chance of mechanical failure of the fuel and to prevent or reduce to an acceptably low level the escape of fission products from the station should fuel failure occur.

THE LICENSING PROCESS

General outline

The licensing of nuclear power stations in Canada includes the issuance of a Site Approval and two formal licences, the Construction Licence and the Operating Licence. The requirement for such licences was specified in 1957 with the publication by the AECB of a Nuclear Reactors Order.

One year prior to the publication of this order the AECB established an advisory committee (known as the Reactor Safety Advisory Committee) to advise it on all aspects of the safety of nuclear reactors. The Committee is composed of senior engineers and scientists chosen because of their individual competence, together with technical representatives of relevant federal and provincial departments and local medical officers of health. The representatives vary, depending on the province in which a proposed nuclear power station is to be located. Every reactor licensed by the AECB has been the subject of an extensive review by the Committee.

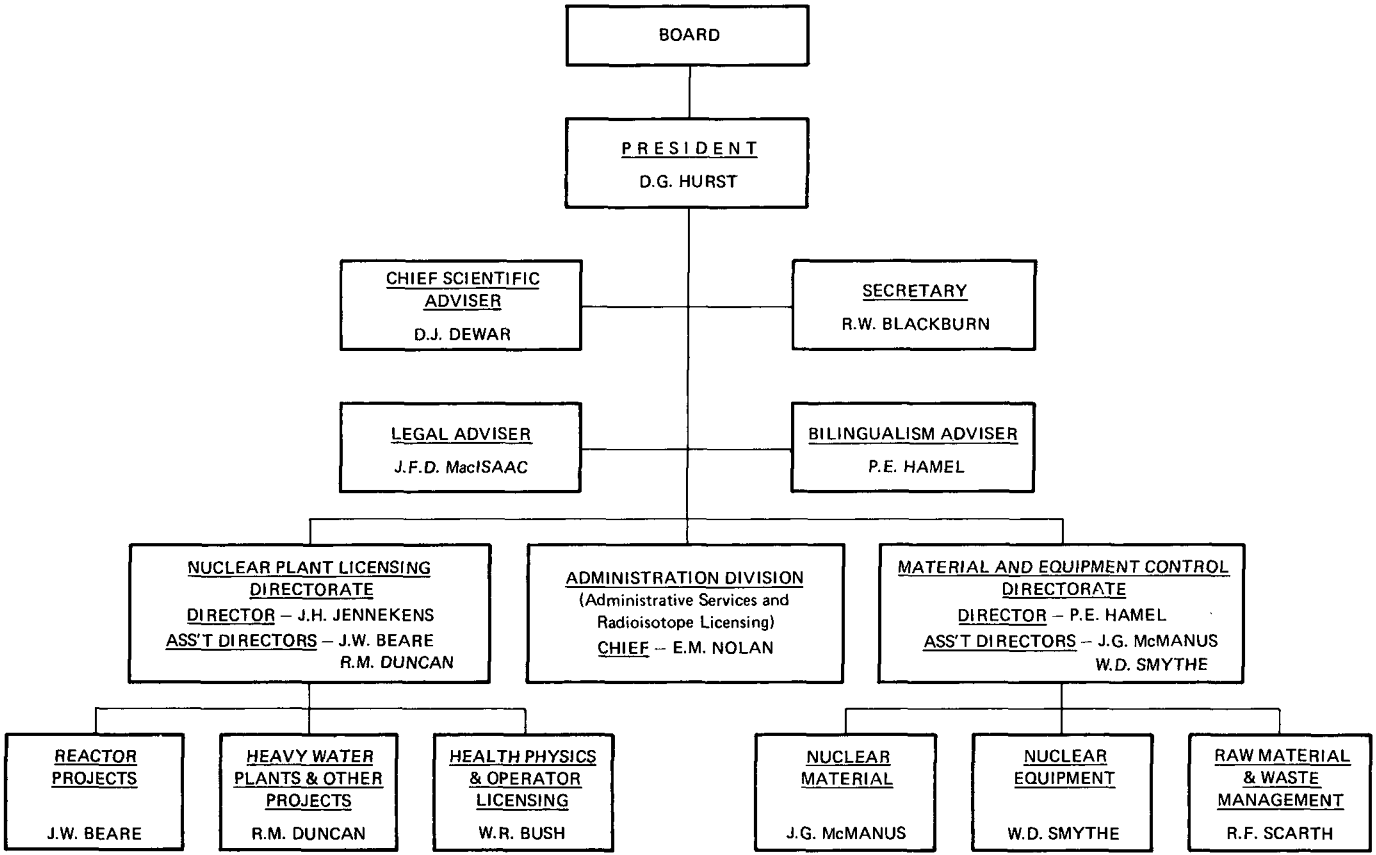

FIG. 1. Organization chart as of 1 October 1972, Atomic Energy Control Board.

With regard to the staff of the AECB itself and its role in the licensing process, reference should be made to the organization chart attached as Fig. 1. Officers of the Nuclear Plant Licensing Directorate carry out a detailed assessment of the design and proposed methods of construction and operation of each nuclear power station. They assist the Committee in its review, undertake inspection and compliance duties and approve design and operating procedure changes within the terms of the licences issued by the Board.

Site approval

The first step taken by a utility to secure regulatory authorization to proceed with a proposed nuclear power station is the submission of an application for Site Approval. A document known as a Site Evaluation Report must accompany the application and provide sufficient information to enable the AECB, on the advice of the Reactor Safety Advisory Committee, to determine the suitability of the site proposed. The report includes a summary description of the station, outlining the plant size, reactor type, basic process and safety systems, together with information regarding land use, present and future population density and distribution, principal sources and movements of water, water usage, meteorological conditions, seismology and geology. The issuance of a Site Approval represents the opinion of the Board that the site is considered to be suitable for the construction of a reactor of the size and type described in the Site Evaluation Report.

Construction licence

Following the issuance of a Site Approval, the utility's next step in seeking regulatory authorization is to submit an application for a Construction Licence. In so doing, the applicant also submits a Preliminary Safety Report, the purpose of which is to document the information essential to a comprehensive evaluation of all of the factors involved in ensuring that the health and safety of the public (including the station operating staff) would be protected should the station in question be constructed. The Preliminary Safety Report is a collation of siting and environmental data, design and procedural considerations, process and safety system descriptions and performance specifications and those safety analyses upon which the necessary licensing decisions can be made — basically those affecting the design of the containment and major process systems.

The Preliminary Safety Report is reviewed by the Reactor Safety Advisory Committee and by the staff of the Nuclear Plant Licensing Directorate. Staff of the Materials and Equipment Control Directorate and officers of provincial regulatory agencies concerned with such matters as boiler and pressure vessel design, construction and inspection are also consulted. During the review meetings are held with the designers to obtain such additional information as may be required for an in-depth assessment of the safety of the proposed station. If the Committee and the AECB staff are satisfied with the proposed design, they recommend to the Board the issuance of a Construction Licence. One condition included in the licence is a requirement that the Preliminary Safety Report be updated annually as the detailed design and construction of the station proceed.

The Committee meets again several times while construction is in progress, to consider details of design that are developed as construction proceeds. It may request additional information, or require that certain tests be performed during construction. Sometimes it requests design changes; for example, the unique 'negative pressure containment system' mentioned earlier was proposed by the designers as a result of the Reactor Safety Advisory Committee's insistence on a very high degree of safety. This system uses a large concrete building that is kept under vacuum and is connected by a concrete duct to each of the reactor containment buildings. If a large failure occurred in a piping system, the hot pressurized cooling water from the piping would flash to steam, which would then be drawn into the vacuum building through automatic self-actuating valves. This would prevent the steam pressure in the reactor building from increasing to a level high enough to force a significant amount of radioactive material out of the building into the environment.

Operating licence

When construction nears completion the utility may apply for issuance of an Operating Licence. In so doing, the utility submits a final Safety Report to document the 'as-built' design of the station, the updated analyses of postulated accidents and the capability of safety systems to prevent or limit the consequences of such postulated accidents.

The Reactor Safety Advisory Committee and the Board staff review the final design, results of tests and plans for operation. Only when it is determined that the plant has been designed, constructed, commissioned and staffed adequately and that it can be operated safely, does the Committee recommend to the AECB that an Operating Licence be granted.

At least one staff member of the AECB is located at a station during commissioning and remains at the reactor site after start-up until routine operation is achieved, to observe the various start-up tests and assess their results, to consider requests for changes in the method of operation, and to give the AECB independent assurance that the nuclear plant is being operated safely. The AECB staff and the Reactor Safety Advisory Committee continue their surveillance of the operation of the nuclear plant throughout its life.

The experience and educational qualifications of the key operating staff of a nuclear plant are examined by the staff of the Board in the light of requirements established by the AECB on the advice of a Reactor Operators Examination Committee. This Committee includes experts in reactor operation and radiation safety as well as representatives of the provincial licensing bodies for steam plant operators. In addition to possessing the necessary experience and educational qualifications, those nuclear plant operators designated as Shift Supervisors or Control Room Operators must also write examinations that cover the theoretical and practical aspects of operating the nuclear and conventional equipment, and of radiological protection.

THE CANADIAN REACTOR SAFETY PHILOSOPHY

The basic tenet of the Canadian reactor safety philosophy is one of defence in depth. Thus while the greatest proportion of the radioactivity produced in a nuclear power station is contained within the nuclear fuel itself, a metal sheath or cladding surrounds the fuel to prevent the release of fission products into the coolant. A second containment barrier is achieved by the provision of a high-quality primary coolant system, the components of which are designed, constructed and inspected in accordance with rigorous standards. A third barrier, the reactor containment system, constitutes a further barrier to the escape of fission products, thus illustrating the defence-in-depth principle.

An equally important aspect of the defence-in-depth philosophy of reactor safety are the measures taken to ensure that each of the three containment barriers is not breached. This involves a multi-step approach which includes:

(1) Avoidance of malfunctions in each of the reactor process systems that could lead to failure of the fuel cladding;

(2) Provision of special safety systems such as the reactor protective shut-down system, which independently shuts the reactor down should process parameters exceed certain limits;

(3) Periodic inspection and testing of process and special safety system equipment to ensure that a high standard of reliability is maintained;

(4) Avoidance of human errors that may defeat or impair the operation of either process or special safety system controls.

Avoiding process system malfunction requires compliance with the relevant engineering codes, standards and specifications for the design, manufacture, construction, testing and inspection of all components to ensure that a high standard of quality control is maintained.

In addition to the reactor protective or shut-down system, which is independent of the reactor power-regulating system, other special safety systems are included in the design of nuclear power stations. One of these is the emergency coolant injection system, which acts in conjunction with the protective shut-down system to prevent failure of the first containment barrier (the fuel cladding) in the unlikely event that failure of the second barrier (the primary heat transport system piping) should occur.

The requirement for a high standard of reliability of systems such as the reactor power-regulating system and of all special safety systems is itself very comprehensive and has often been used as an example of the defence-in-depth approach. It was the 1952 accident to the NRX experimental reactor at Chalk River that demonstrated the importance of this requirement. For example, the reliability required of a protective shut-down system is achieved by providing three completely independent 'channels' of protection. Any two channels in the system will perform the required protective function, thus allowing for the unavailability of the third without affecting the overall operation of the system. This triplication not only increases reliability but also permits testing of each channel individually (and therefore an assessment of system reliability) and allows routine maintenance work to be carried out during operation of the reactor. One additional and very important feature is the design of the protective shut-down system in such a way that should one channel be undergoing testing, the reactor will be automatically shut down should either of the remaining two channels detect an unsafe condition.

Avoidance of human errors has proven to be an extremely important part of the Canadian safety philosophy. The multiple consequences of a single error (either in design, construction or operation) may defeat the purpose or impair the operation of even a triplicated system. Recognition of this possibility at an early date further reinforced the importance of a defence-in-depth approach and has resulted in the application of this basic philosophy in the case of every CANDU power reactor. In practical terms the requirement means that a rigorous review of the proposed design, construction and operating procedures for each reactor must be carried out to ensure that the consequences of a human error will be limited to a single event that involves only one channel in a triplicated system or is protected against by one or more of the other systems available because of the defence-in-depth approach.

POWER REACTOR SAFETY CRITERIA AND PRINCIPLES

In applying the basic Canadian philosophy described above, a number of specific criteria and principles have evolved. Some of these are discussed further in later sections of this paper; however, they are listed below for ease of reference:

(1) Design and construction of components, systems and structures essential to or associated with the reactor shall follow the best applicable code, standard or practice and be confirmed by a system of independent audit.

(2) The design, quality and operation of all process systems essential to the reactor shall be such that the total of all serious failures does not exceed 1 per 3 years. A serious process failure is one that in the absence of protective action would lead to serious fuel failure.

(3) Special safety systems shall be physically and functionally separate from the process systems and from each other to the maximum extent practicable.

(4) Each special safety system shall be readily testable, as a system, and shall be tested at a frequency to demonstrate that its (time) unreliability is less than 10^{-3}.

(5) Radioactive effluents due to normal operation, including process failures other than the coincident or 'dual' failure mentioned in (7) below, shall be such that the dose to any individual member of the public affected by the effluents, from all sources, shall not exceed 1/10 of the allowable dose to atomic energy workers and the total dose to the population around the reactor site shall not exceed 10^4 man·rem per year.

(6) The effectiveness of special safety systems shall be such that for any serious process failure the exposure of any individual shall not exceed 500 mrem and of the population at risk, 10^4 man·rem.

(7) For any postulated combination of a single process failure and failure of a special safety system (known as a 'dual' failure), the predicted dose to any individual shall not exceed (i) 25 rem, whole body, (ii) 250 rem, thyroid, and to the population, 10^6 man·rem.

RADIATION PROTECTION STANDARDS IN CANADA

The Atomic Energy Control Regulations issued by the Board prescribe the maximum allowable doses of ionizing radiation to the public from non-medical uses of atomic energy. The basic limit is 0.5 rem (500 mrem) per year and is derived from the recommendations of the International Commission on Radiological Protection (ICRP). As recorded above, the Board has also stipulated population dose limits governing the release of radioactivity during normal operation of reactors and under postulated accident situations.

The recommendations of the ICRP are based on a conservative interpretation of the known and suspected effects of radiation on people. To indicate the significance of the allowable dose of 500 mrem per year, it can be compared with the dose of radiation that everyone in the world receives unavoidably from naturally occurring radioactive materials in the soil, rocks, air, and even in our bodies, and from cosmic rays. Everyone in North America receives between 70 and 200 mrem per year of radiation from natural sources. The dose from natural sources is 1000 mrem per year or even higher in small areas of India and South America. The people in these areas are being studied and no harmful effects have been detected so far.

In setting or computing the allowable releases the nearest and most sensitive individual is considered. For example, the limit for radioiodine is conservatively based on the milk drinking habits of a young child, assuming the milk is all produced in the vicinity of the nuclear plant and taking account of the concentration that occurs between the radioiodine on the grass and that in the milk.

The actual releases from operating plants are many times smaller than the allowable releases. For example, average releases to the environment in 1970 from the Douglas Point Nuclear Station were only 6/10 of a millicurie per day of radioactive iodine (one of the most biologically significant substances released) compared to an allowable release of 40 millicuries per day, and 30 curies per day of tritium compared to an allowable 7000 curies per day. (Tritium is a radioactive isotope of hydrogen that is produced in the heavy water of a reactor during reactor operation. A curie of tritium is not as biologically significant as a curie of iodine, therefore its allowable release is much higher.) Environmental monitoring carried out by the Federal and Provincial health departments has confirmed that radiation from these releases is negligible.

THE MANAGEMENT OF RADIOACTIVE WASTES

The management of wastes created by man's activities is neither new nor restricted to industrialized societies. The first major waste management facility constructed by man was a municipal sewer system built by the Romans to protect the health of citizens from the ravages of plagues. Until the large-scale generation of industrial wastes that accompanied the Industrial Revolution most man-made wastes were simply buried in the ground or discharged to nearby rivers and lakes. The short-sightedness of this practice persisted until recent times in spite of the recognition that the self-regenerative capacity of nature was not limitless.

Because of the very unique characteristics of radioactive wastes, including their long lifetime, rigorous controls have been instituted from the early days of atomic energy to ensure the protection of persons working in the field and of the general public. To date most radioactive waste management facilities in Canada are government-owned and operated, while all such facilities are government-supervised.

Since most of the radioactive materials produced in a nuclear power station are in the form of fission products in the irradiated fuel and since the current Canadian programme is based on the natural uranium fuel cycle in which the irradiated fuel does not require chemical processing, the management of radioactive spent fuel in Canada is relatively simple. At present irradiated fuel from CANDU stations is placed in long-term, underwater storage at each station. These storage bays have the capacity to contain irradiated fuel resulting from the operation of the stations for many years.

Other radioactive wastes result from the chemical purification of reactor coolants, the routine cleaning of equipment and from the collection of slightly contaminated clothing worn by plant operators. These wastes are generally of low or intermediate levels of activity and are placed in long-term storage in what are known as 'waste management facilities' at approved sites. Such facilities must meet the engineering and procedural requirements of AECB before they can be placed in operation. An important new requirement for all future waste management sites is that waste containing long-lived radionuclides be stored in such a manner as to permit its retrieval and transfer to other storage facilities should the need for transfer arise.

SAFETY CRITERIA AND PROCEDURAL STEPS CONNECTED WITH THE LICENSING OF NUCLEAR POWER PLANTS IN THE FEDERAL REPUBLIC OF GERMANY

L.F. FRANZEN
Institut für Reaktorsicherheit
der Technischen Überwachungs-Vereine eV,
Cologne,
Federal Republic of Germany

Abstract

SAFETY CRITERIA AND PROCEDURAL STEPS CONNECTED WITH THE LICENSING OF NUCLEAR POWER PLANTS IN THE FEDERAL REPUBLIC OF GERMANY.

The Federal Republic of Germany is a centralized confederacy of States, whose Constitution was amended in 1959 to define the respective responsibilities of the Federal and State authorities in the peaceful use of nuclear energy. Nuclear legislation is enacted at the federal level but its implementation is the responsibility of States. The Atomic Energy Act, 1959, sets forth licensing requirements that are more stringent than in any other technical field and, also, provides for a licensee's absolute liability for nuclear damage. The amount of his financial security is determined by the licensing authority, subject to review every two years. Other applicable provisions are to be found in the Radiation Protection Ordinance, 1960, the Nuclear Installations Ordinance, 1970, and a number of public laws governing planning, construction works, water use, electricity supply, trade, and transport, environmental protection, etc. The safety criteria used for licensing purposes, first developed as guidelines and based on the US criteria, were replaced by safety criteria for nuclear power plants approved in 1974. Safety criteria are supplemented by safety guides providing procedures for meeting specific safety requirements. Prescribed safety precautions include safety analysis of the siting and plant design, quality control, recurrent inspections and emergency precautions. The licensing process is conducted by State authorities, in consultation with and under the supervision of a responsible Federal Ministry, which is assisted in such duties by an Advisory Committee on Reactor Safeguards. The Reactor Safety Institute and other technical expertise are called upon for advice on safety assessments and for inspections connected with a licence application and enforcement. The licensing of a nuclear installation may consist in provisional decisions and partial licences related to siting and plant design prior to the granting of a construction or an operating licence. Public announcement of a proposed installation is required by law and objections thereto may be discarded by the licensing authority if unfounded, otherwise such objections are to be taken care of by means of licensing conditions.

INTRODUCTION

Like the United States of Mexico, the Federal Republic of Germany (FRG) is a centralized confederacy that consists of ten States — if one does not count Berlin. There is a Federal Government and there are ten State Governments with defined responsibilities in their respective areas. The legal prerequisites for the peaceful use of nuclear energy were established relatively late, since all activities in nuclear energy were forbidden by the allied military governments up to the year 1955. It took until 1959 for the constitution to be amended[1] to redefine the respective responsibilities of the Federal and State Authorities and to establish the necessary prerequisites.

[1] Gesetz zur Ergänzung des Grundgesetzes of 23 December 1959 (BGBl I pp. 813).

In accordance with the philosophy of as much centralism as necessary and as much federalism as possible, the responsibilities were defined in such a way that nuclear legislation will be enacted by federal legislative bodies, i.e. the Federal Parliament and Federal Council, but the implementation of the legislation is the responsibility of the States. In addition, the Federal Government has the right to issue, in agreement with the Federal Council, statutory ordinances and general administrative regulations and to give directives regarding the lawfulness and expediency with which the States carry out their duties.

1. ATOMIC ENERGY ACT

1.1. Purpose

The purpose of the Atomic Energy Act[2] is outlined in its first paragraph:

To further nuclear research and development and the use of nuclear energy for peaceful purposes;
To protect life, health and property from the hazards of nuclear energy and from the harmful effects of ionizing radiation, and to provide compensation for damage caused by nuclear energy or ionizing radiation;
To prevent danger to the internal or external security of the Federal Republic arising from the use or the release of nuclear energy;
To enable the Federal Republic to meet its international obligations in the field of nuclear energy and protection against radiation.

1.2. Protection

The detailed legal provisions of the Atomic Energy Act require authoritative control. For the peaceful use of nuclear energy licensing procedures are requested that are more stringent than in any other technical field in order to ensure leakproof control. Special fissionable materials (nuclear fuel), especially the uranium isotopes 233 and 235 and the plutonium isotope 239, are subject to far-reaching licensing requirements. They apply to

Import and export
Transportation
Handling (i.e. storage, treatment, processing or other uses)
Construction and operation of nuclear reactors, and other nuclear installations including non-stationary facilities.

The last-mentioned item deals with the licensing requirements of nuclear installations such as nuclear power plants and reprocessing plants. The pertinent paragraph 7 of the Atomic Energy Act requests that any person who conducts, operates or otherwise holds any stationary installation for the production or fission of nuclear fuel, or for the reprocessing of irradiated nuclear fuel, or who essentially alters such an installation or its operation,

---

[2] Gesetz über die friedliche Verwendung der Kernenergie und den Schutz gegen ihre Gefahren (Atomgesetz) of 23 December 1959 (BGBl I pp.814, last amended by the Bundesimmissionsschutzgesetz of 15 March 1974, BGBl I pp.721).

shall require a licence. Therefore, granting of such a licence is subject to meeting various licensing prerequisites that aim at the protection of employees, unrelated third persons and the general public. Paragraph 7 of the Atomic Energy Act provides that a licence shall only be granted:

> Where there are no known facts giving rise to any doubts as to the reliability of the applicant and the persons responsible for the construction, management and supervision of the operation of the installation, and where the said persons responsible for the construction, management and supervision possess the expert knowledge required;
> Where every necessary precaution has been taken in the light of existing scientific knowledge and technology to prevent damage resulting from the construction and operation of the installation;
> Where the necessary financial security has been provided to cover all legal liability to pay compensation for damage;
> Where all necessary protection is provided against interference or other intervention by third persons; and
> Where there are no overriding public interests against the siting of the installation, especially with regard to non-contamination of water, air and soil.

Further measures are provided in this paragraph for all Federal Authorities, together with all state, communal and other regional authorities whose jurisdiction is involved, to participate in the licensing procedure.

In this context it must be mentioned that the licence for a nuclear installation under paragraph 7 of the Atomic Energy Act, especially for the construction and the operation of a nuclear reactor, may only be granted where all licensing prerequisites are met. There is no legal claim given to the applicant where the licensing prerequisites are met as in other licensing provisions of the nuclear and radiation protection legislation. This provision ensures the legislator's preference of the protection of the public against any hazard arising from nuclear energy over the request of an applicant to construct or operate a nuclear installation.

1.3. Liability and financial security

The liability provisions of the Atomic Energy Act are farther reaching than the general liability regulations, especially those of the public law. Among other provisions, a licensee is subject to an absolute liability, i.e. a liability requiring only proof of causing damage and not proof of fault, if the above results in loss of life, personal injury or damage to any property. In addition to this absolute liability, the licensee and any other person causing nuclear injury or damage are subject to the general liability regulations on liability for fault.

Type, terms and amount of the financial security are provided for in the Financial Security Ordinance[3]. The financial security, which is usually in the form of a third party liability insurance, is dependent upon the coverage available on the insurance market at reasonable rates. The amount of financial security will be established by the licensing authority at the time of granting

[3] Verordnung über die Deckungsvorsorge nach dem Atomgesetz (Deckungsvorsorge-Verordnung), in the version promulgated on 10 November 1970 (BGBl I pp. 1523).

the licence and be established thereafter at regular intervals of two years. In establishing the financial security, the starting point is the coverage to be determined for the standard case. This is obtained from a basic amount dependent upon the maximum output of the nuclear reactor multiplied by a factor dependent upon the population density in the vicinity of this reactor. The standard coverage for a nuclear reactor of a thermal output of 400 MW amounts to DM 40 million. The population factor has a value between 1 and 2, depending upon the population density in the vicinity of the installation. In practice, the standard coverage for nuclear power plants being operated or under construction in the FRG amounts up to some DM 60 million. The German insurance companies have formed insurance pools and utilized international reinsurance to offer such large financial security.

Since the coverage provided by third party liability insurance may not suffice to cover any risk due to the operation of nuclear installations, the FRG has accepted in paragraph 36 of the Atomic Energy Act the indemnification of the licensee. According to these provisions, the indemnification applies to all liabilities to pay compensation for nuclear injury or damage, but is restricted in amount to DM 500 million. This provision has been introduced in the FRG by analogy to similar provisions in the United States of America. The reason for this measure was the cautious and reserved attitude of the utilities towards nuclear energy as a means of electricity generation. The guarantee should act as a visible sign and an indirect contribution to the promotion of nuclear technology. This concession to nuclear technology is limited in time and applies to nuclear installations licensed on or before 31 December 1980.

1.4. Penalty and fine provisions

A comprehensive catalogue of penalties and fines serves as protection against any misuse of nuclear energy and ionizing radiation.

2. OTHER LEGAL PROVISIONS

2.1. Radiation Protection Ordinance

A comprehensive treatment of the radiation protection requirements as far as radioactive materials are concerned is given in the First Radiation Protection Ordinance[4]. Recently, an X-Ray Ordinance[5] was issued, which, however, will not be dealt with here. A Second Radiation Protection Ordinance[6] concerns the prevention of injury or damage caused by ionizing radiation in schools, i.e. special cases of no interest in this context. The purpose of the Radiation Protection Ordinance is the protection of employees

[4] Erste Verordnung über den Schutz vor Schäden durch Strahlen radioaktiver Stoffe (Erste Strahlenschutzverordnung) of 24 June 1960 (BGBl I pp.430, in the version promulgated on 15 October 1965, BGBl I pp.1653).

[5] Verordnung über den Schutz vor Schäden durch Röntgenstrahlen (Röntgenverordnung), in the version promulgated on 1 March 1973 (BGBl I pp.173).

[6] Verordnung über den Schutz vor Schäden durch ionisierende Strahlen in Schulen (Zweite Strahlenschutzverordnung) of 18 July 1964 (BGBl I pp.500), last changed by paragraph 2 of the Zweite Verordnung zur Änderung und Ergänzung der Ersten Strahlenschutzverordnung of 12 August 1965 (BGBl I pp.759).

and the general public against personal injury or damage to property caused by ionizing radiation. The various protective provisions can only be enumerated. Among others, they contain provisions regarding:

Areas of restricted access and under surveillance
Maximum permissible doses for occupationally exposed persons
Maximum permissible doses for partial exposure
Maximum permissible doses for persons staying occasionally in areas of restricted access
Maximum permissible doses for persons staying permanently in areas under surveillance
Maximum permissible concentrations of radioactive material in the air of areas of restricted access
Protection of air, soil and water
Measurement of dose rates, local doses and personal exposure
Determination of radioactive contamination and incorporation of radioactive material into the human body.

All these provisions are of great importance in the design of nuclear power plants. Special equipment for the removal of radioactive material from air or water and a variety of safety features available for normal operation or accidental conditions are required so as not to exceed the maximum permissible doses and maximum permissible concentrations.

2.2. International radiation protection recommendations

The recommendations of the International Commission on Radiological Protection (ICRP)[7] deal in great detail with the various modes of exposure to ionizing radiation, maximum permissible doses and related items, as well as with the general bases of working conditions. Since the ICRP is an international body of recognized experts and not a governmental committee, their recommendations do not carry any legal obligation. Nevertheless, the ICRP recommendations are of great importance due to the factual authority of their authors. All the other international or supranational organizations and also the national legislation conform to the material contents of these recommendations.

The recommendations of the International Atomic Energy Agency (IAEA) are of special importance for transportation of nuclear materials, and they have influenced the provisions of all carriers.

The basic standards of the Organization for Economic Cooperation and Development (OECD) for radiation protection[8], as agreed upon by the steering committee of the then European Nuclear Energy Agency (ENEA), are just recommendations.

The European Community has established guidelines for basic standards for protecting the health of the population and employees against the hazards

[7] Recommendations of the ICRP, as of 17 September 1965 (ICRP Publ. No. 9). ICRP Publications No. 10 to 20 are already published, but not included in the German radiation protection legislation.

[8] Grundnormen der OECD für den Strahlenschutz in der Fassung des Beschlusses des Direktionsausschusses der Europäischen Kernenergieagentur (ENEA) der OECD of 25 April 1968, see announcement of 20 April 1970 (BGBl II pp. 208).

of ionizing radiations[9]. The basic standards, as concluded by the Council of the Community, have a farther reaching effect than just recommendations for the FRG and the other member countries. These basic standards are obligatory for the member countries regarding the objective to be achieved, but leave it to the national authorities to choose the appropriate forms and means of implementing them. The basic standards do not generate any rights or duties for the citizens in the member countries. They are directed to the countries themselves, which are obliged to issue the necessary legal and administrative provisions.

2.3. Public law provisions

Apart from meeting the licensing prerequisites of the Atomic Energy Act, other provisions of public law — especially legislation on construction work, water use, electricity supply, conservation of nature, clean air, trade and physical planning — have to be observed. This means that a licence for the construction and operation of nuclear installations will only be granted after all the other licences, grants and permits required under public law have been obtained.

2.4. International law provisions

Lastly, the large body of relevant international law must be considered, especially such obligations as stem from the Treaty establishing the European Community, which apply in part directly to the nuclear field. This mainly concerns reporting and information obligations, inspection authorizations, patent licences, etc. Such international law is justified not only for hazards that do not end at a country's border, but also for international co-operation in science and technology, trade and industry.

3. SAFETY REQUIREMENTS

3.1. Legal aspects

Because of the rapid development of nuclear energy in the past, the legislature did not specify the general licensing prerequisites as mentioned in the Atomic Energy Act in more detail. However, the known efforts in the United States of America in this respect have not been without effect on the German situation. This is easily demonstrated by the German safety criteria, which followed the American design criteria of 1965 and 1969. They were prepared by the Reactor Safety Institute of behalf of the Federal Ministry, discussed with representatives of industry and declared valid in a common effort of the Federal Ministry and the State Authorities. Since then they have been applied in licensing procedures. The same procedural approach to preparation and conclusion has been chosen for establishing the extent and intervals of recurrent inspections. The guidelines for radioactive

[9] EURATOM-Richtlinien zur Festlegung der Grundnormen für den Gesundheitsschutz der Bevölkerung und der Arbeitskräfte gegen die Gefahren ionisierender Strahlungen (Amtsblatt der Europäischen Gemeinschaften 1966, pp.3693).

releases due to design basis accidents and the guidelines for routine radioactive releases have a similar legal status. These guidelines interpret the requirements for "as low as practicable" radiation exposure according to the present state of technology. However, the situation with the recently published guidelines on the control of liquid radioactive releases[10], on measures for the environmental surveillance in the vicinity of nuclear power plants with light water cooled reactors[11], and on the required qualifications of nuclear power plant staff[12] is somewhat different. These guidelines were prepared with the same formal procedures, but they do not have the character of safety criteria.

To indicate the legal situation, one has to distinguish between legal and technical guides. Legal guides will be introduced by the legislature and usually specify a requirement to be met without giving the details of how to meet it. However, such requirements are frequently not given in sufficient detail.

This is convincingly demonstrated by the provisions of the Atomic Energy Act, which urgently need detailed interpretation. What name is given to such interpretations should be without interest; they gain legal power only if put into the framework of a statutory ordinance or at least a general administrative regulation. Technical guides do not stem from legal enactment or ordinance issue and cannot be specified by the authorities alone. They describe methods of how to meet the requirements specified by the legal guides. They are not compulsory for anybody, and better solutions can be offered or requested at any time. Furthermore, the responsible licensing authority is not relieved of its duty to examine the meeting of the safety requirements in each individual case.

3.2. Safety criteria

The German Safety Criteria of 1970 have in the meantime been replaced by the Safety Criteria for Nuclear Power Plants[13], which were jointly approved by the Federal Ministry and the State Authorities on 25 June 1974.

Before approval, all parties involved in licensing procedures, especially manufacturers and vendors, owners and operators, and independent experts, were given an opportunity for comment. These safety criteria were prepared as the technical part of a general administrative regulation still to be enacted. They have already been published in order to have the requirements contained therein uniformly applied as soon as possible. The safety criteria were especially developed for application to nuclear power plants with light water reactors. For all other types of nuclear power plants, however, they are

---

[10] Regeln für Messung und Kontrolle von Ableitungen radioaktiver Wässer aus Kernkraftwerken mit Leichtwasserreaktoren, IRS-Kurzinformation 1973/C/9, 29 March 1973.

[11] Richtlinien für Massnahmen zur Überwachung der Umgebung von Kernkraftwerken mit leichtwassergekühltem Reaktor, IRS-Kurzinformation 1974/C/20, 4 November 1974.

[12] Richtlinien für den Fachkundennachweis von Kernkraftwerkspersonal, IRS-Kurzinformation 1974/C/21, 7 November 1974.

[13] BMI, Sicherheitskriterien für Kernkraftwerke, approved by the Länderausschuss für Atomkernenergie, 25 June 1974.

strictly applicable for non-facility specific requirements and in principle for facility specific requirements. The following issues are dealt with in detail[13]:

> Quality assurance; testability; radiation exposure of the environment; radiation exposure in the plant; arrangement of the working area, working cycle, working environment; external impacts; protection against fire and explosion; access control, areas to be sealed; escape routes and means of communication; decommissioning of nuclear power plants (section 2);
> Reactor design; inherent safety; reactor pressure vessel internals (section 3);
> Pressure-containing enclosure of the primary coolant; residual heat removal during specified normal operation; residual heat removal after losses of coolant (section 4);
> Process monitoring and alarm systems; incident instrumentation; equipment for the control and shut-down of nuclear reactors; control room and auxiliary control equipment (section 5);
> Reactor protection system (section 6);
> Emergency power supply (section 7);
> Nuclear reactor containment; design basis of the containment; leakage tests of the containment; containment penetrations; heat removal from the containment (section 8);
> Ventilation systems (section 9);
> Radiation protection monitoring; activity monitoring of gaseous and liquid wastes; environmental monitoring (section 10);
> Handling and storage of nuclear fuels and other radioactive substances (section 11).

Some of the safety criteria will be discussed in more detail since they specify safety requirements not contained in the safety criteria of other countries. External impacts are among these. The wording of the safety criterion is as follows:

> External impacts
>
> All plant components necessary to ensure safe shut-down of the reactor and maintain it in that condition, to remove residual heat or to prevent possible release of radioactive substances, shall be designed and maintained in such a condition that they can fulfil their safety functions even in the event of the occurrence of natural phenomena that have to be taken into consideration, such as earthquakes, landslides, storms, floods and tides as well as the possible influence of biological organisms (e.g. bird flights, coolant system overgrown with mussels) or other external impacts such as obstruction by third persons, aircraft crashes, action of dangerous substances especially explosives, and surface damage. The design of these plant components shall be based on:
>
> 1. The most serious natural phenomena or other external impacts that according to the state of knowledge and technology must be taken into consideration at the site in question,

2. Combinations of several natural phenomena or other external impacts, as well as the combination of these impacts with fault conditions, in so far as their simultaneous occurrence as based on probability and degree of damage must be considered.

The discernible future development of the characteristics of the site shall be taken into consideration.

Another interesting criterion illustrating the safety philosophy as developed further in the FRG, specifies the requirement for the control room and auxiliary control equipment. The first section appears almost trivial and reads:

Control room and auxiliary control equipment

A control room shall be provided from which the nuclear reactor can be safely operated during specified normal operation and from which, in the event of the occurrence of incidents, measures can be taken to maintain the plant in a safe condition or to bring it into such a condition.

Apart from the control room, auxiliary control equipment shall be provided so that in case of failure of the control room – including the maintenance rooms of importance, e.g. distribution room (cable spreading area) and electronics room – the reactor can be shut down and maintained in a subcritical state, the residual heat removed and the essential plant variables monitored.

The control room and the auxiliary control equipment shall be segregated physically from each other, shall have separate power supplies and shall be protected against external effects so that they cannot fail simultaneously.

This essentially is a requirement for consistent precaution against common mode failures.

These examples are presented to demonstrate the basic safety philosophy, which should be a sound basis for a systematic and consequential approach to meet all necessary safety requirements. In accordance with the German definition of safety criteria, the wording is relatively abstract, so that they could serve as a first step for a later statutory ordinance. As long as there are only a few detailed guidelines supplementing the individual safety criteria, numerical values can be put into footnotes or appendices, which will not be part of the safety criteria.

3.3. Safety guides

Since the scope of the safety criteria is restricted to specifying safety requirements, but leaves it to the applicant as to how to meet these requirements, safety guides are required to show possible approaches. Each approach is necessarily dependent upon the existing scientific knowledge and technology. As a legislator would not be in a position to establish this state of the art, it is necessary that manufacturers and vendors, owners and operators, and independent experts should participate, since only close co-operation of all four interested parties will facilitate utilization of the knowledge necessary for establishing safety guides. To verify this intention, a Nuclear Safety Standards Committee has recently been established at the responsible Federal Ministry. This committee consists of ten members each of the above-mentioned parties and of ten additional members from organizations with special technical skills at their disposal. Its task is to have safety guides established and to further their application in those areas in which a consensus of the above-mentioned experts is to be expected. These safety guides can be elaborated by other standardization organizations, professional societies or its own subcommittees. The mode of approving a safety guide will be the same in each case: completed drafts will be published with a request for comment within three months. After deliberation of the comments received, formal approval by the nuclear committee will be given. The licensing authorities will usually consider the safety requirements as being met in those cases where the safety guides have been applied, unless serious objections have been raised since the original approval of the safety guides. To begin with the Nuclear Safety Standards Committee was engaged in defining its own working conditions and establishing a working programme. After that numerous orders for preliminary work on safety guides were given, the first results of which were presented in the form of preliminary studies. Their purpose was to investigate whether the selected topic would be fit for developing a safety guide, to propose the most suitable approach, and to define any conditions that should be observed. In most cases the work on the safety guides could then be started. A first draft safety guide has already been published for comment[14].

3.4. Standards and recommendations

Standards and recommendations are supposed to contribute significantly to establishing a rational order and to facilitating efficient working schemes as well as general standardization. Regarding the licensing of nuclear installations, they can be used to decide in individual cases whether or not the licensing prerequisites have been met.

The German Standards Committee is the most important organization engaged in working out standards. Its Technical Committee on Nuclear Engineering at present consists of three subcommittees and 34 working groups or integrated working groups. The subcommittees deal with terminology, symbols and warning signs, radiation protection technology, and reactor technology and safety. The subcommittee on reactor technology and safety is working on standards for reactor instrumentation and protection; criticality safety; reliability of nuclear installations; containment vessels; steel reactor pressure vessels; concrete structures in nuclear power plants; accessories for nuclear installations; piping; cleanliness requirements; water decontamination; ventilation and off-gas systems in nuclear installations; emergency power supply; recurrent inspections; air locks; hoists and lifts, water basins for nuclear installations; fuel element identification; leak rate testing; penetrations; shut-down reactivity; shut-down equipment; pumps for nuclear installations; and closure of containments in case of accidents. The following standards have been finally approved: warning symbol for ionizing radiation; nuclear engineering, definitions; principles

[14] Auslegung von Kernkraftwerken gegen seismische Einwirkungen, Teil I: Grundsätze (Entwurf), KTA-2201.1, issued Sep. 1974.

of criticality safety in processing and handling fissile materials; safety aspects in designing thermal reactors regarding the reactivity behaviour; accessible locks in nuclear power plants, requirements; shielding walls against ionizing radiation, lead tiles; nuclear installations, surface cleanliness of components; and radiation protection guidelines for the technical application of enclosed radioactive substances, transportation[15]. Approximately 400 experts are at present engaged in the preparation of further standards. As far as their results are related to safety issues, they are also utilized in the development of safety guides.

Since there is a large number of safety related guides, standards, and recommendations in the conventional technology, they are also applied in the design, testing and operation of nuclear installations. However, in each individual case it must be considered whether or not they are still applicable and sufficient to meet the safety requirements. If necessary, specific requirements for nuclear installations might be more stringent than otherwise usual. Among the conventional safety guides, standards and recommendations applied in this way are Technical Guides for Steam Boilers[16], Pressure Vessel Guides[17], Regulations for Prevention of Accidents [18], and numerous guides, leaflets and specifications of professional societies.

4. SAFETY PRECAUTIONS

4.1. Safety analysis

The most important document required to be submitted with the application for a construction permit or an operating licence is the safety report. This report must present a detailed description of the proposed site of the installation and an accident or safety analysis. This is a theoretical analysis of all conceivable accidental events and requires considerable effort and a systematic approach that is without parallel in any other industrial field. It has to be shown that the safety features provided will either prevent credible accidental sequences or mitigate their consequences in such a way that these accidents will not cause injuries among the population in the vicinity. All safety features must be designed for extreme loads and limiting conditions and act as an in-depth defence against the uncontrolled release of radioactive materials into the environment. The various barriers provided by the safety features are also an effective protection against those accidents whose cause and sequence have not been perceived in the theoretical analysis.

---

[15] Warnzeichen für ionisierende Strahlung, DIN-25400, issued May 1966; Kerntechnik; Begriffe, DIN-25401 including Blatt 10 to 16 and Beiblatt, issued between July 1965 and May 1973; Grundsätze der Kritikalitätssicherheit bei der Herstellung und Handhabung von Kernbrennstoffen, DIN-25403, issued Jan. 1970; Gesichtspunkte für eine sichere Auslegung von thermischen Reaktoren bezüglich des Reaktivitätsverhaltens, DIN-25405, issued June 1970; Begehbare Schleusen in Kernkraftwerken; Anforderungen, DIN-25406, issued March 1972; Abschirmwände gegen ionisierende Strahlung; Bleibausteine, DIN-25407, including Beiblatt, issued February 1974; Kerntechnische Anlagen; Oberflächensauberkeit von Bauteilen, DIN-25410, issued June 1974.

[16] Technische Regeln für Dampfkessel (TRD), Carl Heymanns Verlag KG, Cologne.

[17] Merkblätter der Arbeitsgemeinschaft Druckbehälter, Carl Heymanns Verlag KG, Cologne.

[18] Unfallverhütungsvorschriften des Hauptverbandes der gewerblichen Berufsgenossenschaften, Bonn.

The very essence of the safety analysis is the design basis accident. In the course of the analysis all conceivable accidents are analysed with regard to their sequences and their consequences. Since new and more complex accident mechanisms are easily conceived, a border line is quickly reached beyond which these hypothetical situations cease to be meaningful. A case in which five simultaneous but independent accidents are assumed to happen in a nuclear installation is not considered credible. Therefore, one defines a design basis accident for the necessary safety features by using pessimistic assumptions and utilizing all of the resources available within technical equipment and human knowledge. In the nuclear power plants at present being operated or under construction this design basis accident is usually equivalent to the sudden double-ended rupture of the largest primary coolant loop. The design basis accident must be mitigated by the safety features without endangering the environment.

A possible alternative to the design basis accident is the probability concept. In performing a safety analysis according to the latter concept a variety of accident sequences are systematically studied taking the failure probabilities of systems and components into consideration. Total probability and damage can then be given for each of these accident sequences. Multiplying the probability of occurrence and the resulting damage, one obtains a measure for the risk of a specific accident. Summing up the individual risks of all accidents gives the total risk of a nuclear installation.

At present a serious objection to the introduction of this type of analysis is the fact that a number of failure probabilities can only be estimated through the lack of reliable statistics or practical experience. Apart from this deficiency, the value of an average failure probability does not give any evidence on the date of the event in question.

Nevertheless, the reliability technique based on probability considerations has become very important in finding out weak points in systems and developing testing and maintenance strategies. An integral risk concept for nuclear power plants is considered to be the ultimate goal.

4.2. Quality control

As a result of safety analysis and evaluation, quality control measures will be proposed for all systems and components of relevance to safety, especially for the reactor pressure vessel, including its internal fuel and control elements. These quality control measures also include: all parts of the primary coolant system, all systems carrying radioactive fluids, the containment vessel and its safety features, the protection system, the control element drives, the refuelling equipment, the emergency power supply, and hoists and lifts. The term 'quality control' refers to all activities that are directed towards the physical realization of these systems and components. In the course of ensuring the required quality control, the systems and components of relevance to safety are tested for meeting the requirements resulting from safety analysis and evaluation. The results of these tests will be documented in reports, certificates, etc.; the following are distinguished within the framework of the overall quality control: preconstruction examinations; materials, construction and pressure testing; and acceptance and performance testing.

Preconstruction examination means examination of design, dimensioning, materials selection, production and manufacturing methods, circuitry schemes, assembly procedures, testability, accessibility for maintenance and repair, instrumentation planned etc. This work is based exclusively on technical reports, descriptions, drawings and blueprints. Materials, construction and pressure testing refers to the testing and evaluation of the physical verification regarding compliance with the documents checked in the course of the preconstruction examinations. Finally, acceptance and performance testing is the testing and evaluation of the completed systems and components, and their performance.

4.3. Recurrent inspections

After commissioning, nuclear power plants are subject to recurrent inspections within regular intervals. Manufacturers and owners must take this into account when designing and constructing a plant.

4.4. Emergency precautions

In spite of all safety analyses and safety features, absolute safety is not achievable for nuclear installations any more than for other technical facilities. A residual risk always remains of extremely improbable but still conceivable events that exceed the range of accidents provided for. However, it must be stressed that such considerations refer to extreme events only, and are so improbable that they are considered impossible in daily life and can therefore be neglected. These are the situations that necessitate the financial coverage and indemnification up to DM 500 million by the Federal Government, and emergency planning as for other hazardous installations.

5. LICENSING PROCEDURE

5.1. Mode of administration

Nuclear and radiation protection legislation is implemented in the Federal Republic of Germany by the States on behalf of the Federal Government. The States determine their own responsible authorities. In addition, the States issue administrative provisions for the implementation of the nuclear and radiation protection legislation. Although these provisions are nothing more than directives to the State Authorities, they are very important to the applicant because they give guidance regarding the proper application for licences and the regulatory positions in licencing and compliance procedures. The administrative provisions take into account the results of joint discussions held by the responsible supreme State Authorities and the responsible Federal Ministry.

Licences for the construction and operation of nuclear installations according to paragraph 7 of the Atomic Energy Act are granted by the supreme State Authorities, usually the State Ministries of Commerce in co-operation with other State Ministries. Furthermore, according to paragraph 19 of the Act, they are the supervisory authorities that ensure compliance with all pertinent provisions and, according to paragraph 9, they are the licensing authorities to licence treatment, processing and uses of nuclear materials other than those in installations requiring a licence.

The implementation of the Atomic Energy Act by the States on behalf of the Federal Government covers the following:

The determination of the responsible authorities is left to the discretion of the States

The issue of statutory ordinances, e.g. Nuclear Installations Ordinance, Financial Security Ordinance, and Radiation Protection Ordinance, is left to the Federal Government in agreement with the Federal Council

The State Authorities are subject to the directives of the responsible supreme Federal Authority

Federal Supervision extends to the lawfulness and expediency with which the States carry out their duties

The Federal Government can request reports and submittal of relevant files and documents.

5.2. Participants

As an applicant, the owner and subsequent operator of a nuclear installation submits his application to the responsible licensing authority of the State in which the installation shall be constructed. The application must be accompanied by the documents necessary for its examination, which in the case of turnkey orders are mostly prepared for him by the vendor.

The licensing authority examines the necessary prerequisites according to paragraph 7 of the Atomic Energy Act. It also consults other responsible authorities, provides for a public discussion of the planned installation, and consults experts to conduct comprehensive examinations and prepare safety reviews. The decision of the licensing authority can either be a refusal of the application or the granting of a licence. Usually, such a licence is subject to additional conditions to be fulfilled at a later date.

Before taking a decision, the licensing authority especially consults the responsible Federal Ministry. This Ministry examines the lawfulness and expediency of the licensing procedure, and requests submittal of all relevant documents. It calls upon its Advisory Committee on Reactor Safeguards, consults other Federal Authorities (unless they have already been approached by the licensing authority) and has other experts give their view if deemed necessary. The Federal Ministry informs the licensing authority of the results of its examination of each specific application and gives instructions that are to be taken into account.

The licensing authority usually consults the Technical Inspection Association operating in the State in question. If this association has no nuclear division of its own, it will be supported by the Technical Inspection Associations in other States that do have nuclear divisions. In addition, the Reactor Safety Institute is called upon and other experts, e.g. univerity institutes or research establishments, are consulted on any special questions that may arise in their area of competence. These experts conduct a comprehensive evaluation of the relevant documents (safety report, specifications, drawings, etc.), the site, and the installation itself, and prepare their reviews and statements for the licensing authority, e.g. on siting, concept, construction and operation of the plant.

The Advisory Committee on Reactor Safeguards has been established to advise the Federal Ministry on all basic questions of reactor safety. This committee usually advises on matters concerning specific projects as well. The advisory committee is at present comprised of 18 independent experts of high professional standing in the various disciplines involved with reactor safety. The results of their evaluations are reported to the Federal Ministry, which bases its instructions to the licensing authorities upon this information.

5.3. Partial licences

The legislature originally envisaged the granting of licences according to paragraph 7 of the Atomic Energy Act in such a way that the applicant should hold a construction permit before starting with the construction work and an operating licence before starting to operate the plant. However, experience has proved this approach to be impracticable because the authority requests final information on the item to be licensed at a time when the applicant is usually not in a position to present it. In addition, the licensing authority hesitates to make its final decisions too early, since any modifications requested subsequently could, according to paragraph 18 of the Act, entail financial compensation of the owner. The problem is aggravated by the fact that there is no distinction between the prerequisites for a construction licence and the prerequisites for an operating licence. Therefore, the licensing authority, when deciding upon the construction permit, also has to examine those prerequisites that are specific to the operating licence. For these reasons, and to enable the licensing authorities to take into account the most recent scientific knowledge and technology in reactor safety over the several year period of constructing a nuclear installation, the construction and operating licences are divided into several partial licences. The first partial licence is of special importance, since the authority licenses simultaneously the site and the safety concept of the whole plant, apart from the first constructional activities, e.g. pouring concrete into the foundations.

5.4. Provisional decisions

There is also a possibility to make provisional decisions, which was introduced by amending the Atomic Energy Act and inserting a new paragraph 7a after paragraph 7 dealing with the licenses for nuclear installations.

> "Upon application, a provisional decision may be given in regard to certain matters on which the granting of a licence relating to an installation within the scope of paragraph 7 depends, especially regarding siting. Such provisional decision shall become null and void, if the applicant fails to file an application for such a licence within a period of two years from the date on which such provisional decision became effective and final. This period may on application be extended for two years."

The provisional decision is distinguished from a construction or operating licence in so far as it grants no right whatsoever to the applicant to do something about the installation, e.g. to start with pouring concrete into the foundations. A provisional decision resembles more a policy statement. It answers initial questions of interest to the applicant concerning the following licensing procedure. The answers to these initial questions, however, are final.

Two typical questions are usually of special interest for the applicant, whether or not objections exist regarding siting and concept of the plant. A positive provisional decision on the siting means that the authority cannot reject the site during the further licensing procedure. However, it is free in its requirements for safety features of the plant and can request more than proposed by the applicant in the documentation for the provisional decision. A positive provisional decision on the concept means that the authority cannot reject the basic concept during the further licensing procedure. The statement on the basic concept holds and requirements can be put forward only within the framework of the approved concept. In this case the licensing authority is much more restricted than by a provisional decision on siting.

Notwithstanding all restraints, the licensing authority can revoke a valid provisional decision just as a valid licence if such revocation turns out to be necessary.

6. LICENSING ACTIVITIES

6.1. Application

The licensing procedure for nuclear installations, especially nuclear power plants according to paragraph 7 of the Atomic Energy Act, is more precisely determined in the Nuclear Installations Ordinance[19], which requires the following:

> The application for a licence shall be submitted in writing to the licensing authority of that State in which the installation is to be constructed.
> The application shall be accompanied by the documents required for its examination, especially
> (1) explanatory plans, drawings and descriptions;
> (2) a safety report that describes all hazards involved in the installation and the proposed safety features;
> (3) data to enable examination of the reliability and capability of the persons responsible for the construction, management and supervision of its operation;
> (4) proposals for the financial security to be provided for coverage of all legal liability to pay compensation for damage.
> Those documents containing an applicant's business or technical secrets shall be marked and submitted separately. However, the contents of these documents shall be described to the extent possible without

---

[19] Verordnung über das Verfahren bei der Genehmigung von Anlagen nach §7 des Atomgesetzes (Atomanlagen-Verordnung) as promulgated on 29 October 1970 (BGBl I pp.1518).

revealing secrets and in such a way that third persons are still put into a position to determine whether and to what extent they might be affected by the installation or its operation;
If the documents submitted do not meet the requirements, the licensing authority requests the applicant to complete them within an appropriate period, or to convince them, in the case of a technical secret, that this is not possible without revealing this guarded information.

6.2. Licensing authority

After consultation with all responsible authorities and taking into account all other relevant provisions of public law, especially those relating to building and water legislation, the licensing authority has to examine whether or not the licensing prerequisites according to paragraph 7 of the Atomic Energy Act are fulfilled. This examination requires a large team of experts in the various disciplines and has to observe the international status of safety requirements for nuclear installations. Therefore, the licensing authority usually consults experts. They are consulted during the whole licensing procedure, starting prior to the granting of the construction permit and continuing through the construction period, including the commissioning tests. After having obtained an unrestricted operating licence, a nuclear power plant is under continuous supervision by the responsible authority through its entire life.

The Nuclear Installations Ordinance explicitly requests a public announcement of the proposed installation and inquiry into possible objections of third persons. The licensing authority must announce the project in its official bulletin and in a daily newspaper of substantial circulation in the area where the installation is to be constructed. The announcement is to be referred to in the federal register.

The announcement shall:

State that an application for a licence has been recieved and where the relevant documents are available for inspection;
Invite everybody to present objections, if any, at a specified place and within a period of one month;
Determine date and place of the inquiry and point out that the objections raised will be discussed there and then, notwithstanding the absence of the applicant or of the persons raising objections.

Public announcement and exhibition of relevant documents are not required if there has been an earlier announcement and exhibition of relevant documents regarding the installation to be licensed, and a repetition would not reveal any circumstances that could be of interest to third persons.

Licence application and relevant documents are to be made available for inspection throughout that period of time provided for the raising of objections. The objections are to be discussed orally with the applicant and those persons raising objections. This is not valid for objections based on special civil law title and referred under legal procedure to the appropriate courts.

The decision of the licensing authority must also be forwarded to all persons raising objections. These objections have either to be taken up and included as licensing conditions or dismissed if the licensing authority considers them unfounded.

6.3. Experts

The licensing authority usually consults independent experts for evaluation and inspection. They are unrestricted in their choice of experts. In most cases they turn to the Technical Inspection Agencies, which have established nuclear energy divisions and, in addition, have founded the Reactor Safety Institute expressly for this purpose. They perform, on behalf of the licensing authority, detailed evaluations as well as tests and inspections on all equipment relevant to safety. These tests extend to the design, manufacture and performance of individual components as well as the performance of the installation as a whole. Stress analysis reports prepared by the manufacturer are verified, if deemed necessary, and compared with the results of other computer codes. These examinations usually result in licensing conditions requiring changes, additions or improvements of systems or parts of the nuclear installation or of the operating procedures.

6.4. Federal Ministry

The responsible Federal Ministry usually exercises its control for lawfulness and expediency in such a way that it examines the licence application and the most important documents. The Ministry has at its disposal the Advisory Committee on Reactor Safeguards. Its members are recognized experts of high professional standing in such disciplines as reactor physics, thermodynamics, chemical engineering, mechanical engineering, civil engineering, electrical engineering, health physics, biophysics, medicine, etc. They are supposed to deal with fundamental safety problems, but in all actual licensing procedures usually study whether or not the proposed safety features are adequate. The Committee's statements are passed on to the Ministry in the form of suggestions, which are prepared by subcommittees and concluded by the plenum.

Another valuable group of experts for the Ministry is the staff of the Reactor Safety Institute, which is consulted in numerous basic and applied questions, in the preparation of safety criteria, safety guides and rules, and in the management of research activities. Within the Reactor Safety Institute the secretariat of the Advisory Committee on Reactor Safeguards has been established as a clearing-house for information gathered from experts consulted by the licensing authorities and the Advisory Committee on Reactor Safeguards.

The Federal Ministry utilizes the advisory committee's suggestions, recommendations, and statements, as well as the results of recent research and information from foreign sources to give instructions regarding basic problems or specific projects to the State Authorities. No nuclear power plant has been licensed over the last years without the explicit consent of the Federal Ministry.

6.5. Procedural sequence

The procedural sequence of licensing a nuclear installation exhibits the following characteristics:

The participation of those authorities whose responsibility is affected is not restricted to a specific period of time;

The experts consulted by the licensing authority not only prepare statements on specific problems, but are continuously engaged in examinations and evaluations throughout the whole licensing procedure;

The first partial licence includes (apart from specified construction activities, e.g. excavation and pouring concrete into the foundations) the site and concept licence and is therefore of special importance. Site and basic safety concept are then accepted by the authority. Later changes of systems or parts of the installation can be permitted to a limited extent or requested by licensing conditions. In the case of a provisional decision on the site, the later licensing procedure will again start at the beginning except that the siting is excluded unless important siting features have deteriorated considerably in the meantime;

A licence to construct or operate a nuclear installation according to paragraph 7 of the Atomic Energy Act does not expire. However, modifications can be requested if deemed necessary. Finally, the licensing authority is obliged to revoke a licence in cases of substantial risk to employees, third persons or the general public.

CONCLUSIONS

Safety requirements and the means to meet these requirements do not differ very much from country to country. The administrative procedures differ considerably and vary from a strictly centralized to a more or less decentralized approach. Both have their merits, but nobody appears to be completely satisfied with the procedures applied. One reads about the necessity to streamline the licensing procedures, the waste of money by delayed licensing procedures, etc. However, a ready recipe fulfilling the present and future requirements is not available. The philosophy of as much centralism as necessary and as much federalism as possible has proved to be a sound one, but one country's system should not be copied for another country, since the prerequisites determining the distribution of responsibilities differ vastly. Therefore, different decisions should be expected. The right ones will ensure most effective performance.

THE LICENSING OF NUCLEAR POWER PLANTS IN THE UNITED STATES OF AMERICA WITH SPECIAL EMPHASIS ON ENVIRONMENTAL PROTECTION

Joanna M. BECKER
United States Atomic Energy Commission,
Washington, D.C.,
United States of America

Abstract

THE LICENSING OF NUCLEAR POWER PLANTS IN THE UNITED STATES OF AMERICA WITH SPECIAL EMPHASIS ON ENVIRONMENTAL PROTECTION.

The National Environmental Policy Act (NEPA), 1969, and its interpretation by federal courts have resulted in a significant change in the licensing of nuclear facilities in the USA. Application for a construction permit must be accompanied by a safety analysis report and an environmental report. Concurrently with safety reviews performed by the regulatory staff of the Atomic Energy Commission and the Advisory Committee on Reactor Safeguards (ACRS), an environmental review is carried out. Separate public hearings are held to consider the safety and environmental issues involved. After a decision is issued by the Atomic Safety and Licensing Board, a party may appeal to an Appeal Board and the Appeal Board's decision may be subject to review by the Commission. Application for an operating licence must include a final safety analysis report and a second environmental report, which again are reviewed by the Commission's staff and ACRS. An opportunity for public hearing is afforded upon completion of this review process. Apart from NEPA, the most important environmental protection statute involved in the licensing of nuclear power reactors is the Federal Water Pollution Control Act, which regulates discharges into navigable waters. Other applicable provisions are contained in the Clean Air Act, the Wild and Scenic Rivers Act and the National Historic Preservation Act.

INTRODUCTION

The protection of the public health and safety and the common defence and security in the peaceful uses of atomic energy has long been the primary statutory function of the United States Atomic Energy Commission (AEC) and the goal of its extensive licensing and regulatory programme. The Congress of the United States, in the Atomic Energy Act of 1954, charged the Commission with this responsibility and in the ensuing 17 years the Commission developed a body of regulations and procedures designed to ensure that safety and national security will take precedence over other considerations in the development of atomic energy. However, within the past three years rapidly expanding environmental legislation enacted by the American Congress, and judicial decisions construing that legislation, have broadened the AEC's mandate to cover licensing consideration of the total environmental impact of major nuclear facilities, particularly nuclear power plants.

Although there are a variety of actual or potential uses for nuclear power reactors — ship propulsion, generation of process heat and desalting of ocean waters, to name only the most prominent — their primary civil use has, of course, been the production of electrical energy. At present there are in the United States thirty licensed operating central station nuclear power plants ranging in capacity from 40 000 to over 800 000 electrical kilowatts; and there are under construction in our country an additional 56 nuclear plants ranging from 500 000 to over one million electrical kilowatts each. Moreover, it has been predicted that by 1980 25-30% of the total electrical generating capacity in the United States will be produced by nuclear power plants, with the figure reaching 50% by the end of this century.

Confronting each other in the United States today are, on the one hand, the growing public demand and need for electric energy and, on the other, the demonstrated necessity of preserving and protecting the environment. The reconciliation of those two social interests is the primary task involved today in the licensing of nuclear power reactors in the United States. The statutory framework underlying the licensing programme for nuclear power reactors will first be examined.

ATOMIC ENERGY ACT OF 1954, AS AMENDED [1]

While the benefits that can accrue to mankind from the application of nuclear-generated power are enormous, it was recognized from the outset of the American programme for nuclear power development that the potential radiological hazards associated with production of such power need to be controlled. These hazards arise from the routine generation of gaseous and liquid radioactive wastes during the course of operation of the reactor, and from the accumulation of 'fission products' in the reactor fuel.

The organic statute under which nuclear reactors are licensed in the United States is the Atomic Energy Act of 1954, as amended. Under that statute it is unlawful to construct or operate a "utilization facility" except under a lincence issued by the Atomic Energy Commission (AEC) [2]. A "utilization facility" is defined as "any equipment or device, except an atomic weapon, determined by rule of the [Atomic Energy] Commission to be capable of making use of special nuclear material (that is, fissionable material) in such quantity as to be of significance to the common defense and security, or in such manner as to affect the health and safety of the public, or any important component part especially designed for such equipment or device as determined by the Commission" [3]. The Commission has defined "utilization facility" as "any nuclear reactor other than one designed or used primarily for the formation of plutonium or U-233" [4], thus subjecting to licensing requirements nuclear reactors used for power production and other peaceful purposes. The Atomic Energy Act subjects not only reactors, but the fissionable material used as fuel ("special nuclear material") and the radioactive material produced in the fission process ("byproduct material") to the licensing and regulatory control of the Commission [5]. The Commission is enjoined by the Act to exercise its licensing and regulatory authority to protect the public health and safety and promote the common defence and security [6]. The Commission's jurisdiction under the Atomic Energy Act has been interpreted as confined to matters of <u>radiological</u> health and safety and common defence and security [7].

The statutory scheme of the Atomic Energy Act thus centralizes in a Federal agency, the Atomic Energy Commission, control over the construction and operation of nuclear reactors from the standpoint of radiological hazards and matters of national security. Although to some extent the States that make up our Federal republic may exercise jurisdiction over possession and use of radioactive materials, that is not the case with nuclear reactors [8]. No private person may build or operate a reactor without a Commission licence [9] nor may he accumulate the fuel for a reactor, or manipulate the controls as an operator without a Commission licence [10].

The reactor licensing process is, under the Atomic Energy Act, a two-step procedure. The Act requires the issuance of a construction permit before a utilization facility may be constructed [11]. Thereafter, upon (1) completion of the construction in compliance with the terms and conditions of the construction permit, (2) the filing of any additional information needed to bring the original application up to date, and (3) a Commission finding that the facility has been constructed and will operate in conformity with the application and the Commission's rules and regulations, and in the absence of good cause being shown why the granting of a licence would not be in accordance with the provisions of the Act, an operating licence may be issued to the applicant.

The Act requires the AEC to hold a public hearing on each application for a power reactor licence at the construction permit stage [12]. The hearing is subject to the provisions of our Administrative Procedure Act [13], which affords to parties in certain proceedings before Federal administrative agencies the protection of quasi-judicial procedures specified in that Act.

The Atomic Energy Act of 1954 requires that applications for licences for power reactors be reviewed by an "Advisory Committee on Reactor Safeguards", a committee composed of experts in various technical and scientific disciplines related to reactor safety [14]. The Act also permits the Commission to use, as the presiding officer at licensing hearings, a board composed of two technically qualified members and one member qualified in the conduct of administrative proceedings [15]. Boards are selected from a panel of qualified persons drawn from public or private life who serve for the most part on a part-time basis.

These two mechanisms are a means of keeping licensing and regulation of nuclear power reactors in the United States abreast of the technology. The Advisory Committee on Reactor Safeguards provides a formal channel for expert advice to the Commission in different scientific and engineering specialties. The atomic safety and licensing boards bring to bear at the public hearing stage the technical expertise of the persons responsible for conducting the hearing and making the initial decision on the grant or denial of power reactor licences. That decision, if it is not appealed against within the AEC by one of the parties to a licensing proceeding (the licence applicant, the AEC regulatory staff or some affected member of the public), becomes the final licensing decision of the Commission.

The final decision of the Commission may, under the Act, be reviewed by a United States Court of Appeals upon the petition of a party aggrieved by the decision [16].

The Act gives the Commission broad powers to adopt rules and regulations and to issue orders governing licensed activities and facilities [17]. It further provides for the imposition of criminal and civil penalties.

Another salient feature of the reactor licensing scheme set up by the Atomic Energy Act is the availability of indemnity for third party liability for damages that might arise from an accident at a nuclear reactor site. Section 170 of the "Price-Anderson" amendments to the Atomic Energy Act requires persons licensed to operate power reactors or other production and utilization facilities to have and maintain financial protection, in the form of insurance or otherwise, to cover public liability claims up to an amount specified by the AEC [18]. For large power reactors the amount is currently $95 million, the maximum amount available through private insurance. The AEC provides indemnity protection, over and above the amount of financial protection required, up to $500 million. The liability of the reactor operator is limited to the sum of the financial protection required and the indemnity, not to exceed $560 million. Insurance policies issued to provide the financial protection required by the Atomic Energy Act, as well as the Government indemnity agreements, cover off-site property of persons indemnified and nuclear risks in the transport of nuclear material to and from the facility site.

Regulations promulgated by the Commission to govern the licensing and regulation of nuclear materials and facilities provided licensing criteria based on considerations of common defence and security and radiological health and safety. The provisions of 10 CFR Part 50, which set out criteria for the issuance of licences for production and utilization facilities, required assurance of protection against radiological hazards. Part 50 also contains requirements pertaining to the common defence and security. In general, if those criteria and requirements, and those of any other pertinent parts of the Commission's regulations relating to radiological health and safety and common defence and security, were satisfied, the Commission imposed no other substantive conditions on the issuance of a facility licence, or operation under a licence.

These limitations on the extent of the AEC's licensing and regulatory jurisdiction came to an end with the enactment of the National Environmental Policy Act of 1969.

NATIONAL ENVIRONMENTAL POLICY ACT OF 1969

The National Environmental Policy Act of 1969 (NEPA) [19] was signed by President Nixon and became effective on 1 January 1969. It is the most general, the most interesting, and probably the most significant, of United States statutes directed toward environmental protection. That statute and its subsequent interpretation by the Federal courts in the United States have resulted in a significant enlargement of the jurisdiction of the Atomic Energy Commission and a profound change in its facility licensing processes.

This statute contains a broad statement of social policy directed generally at achieving a harmonious balance among technical, economic and environmental considerations in planning and decision making by our Federal Government. It directs that Federal agencies use all practicable means in their respective programmatic areas to take account of and further the statute's objectives.

All agencies of the Federal Government are required, among other things, to include in every recommendation or report on proposals for legislation and other major Federal actions "significantly affecting the quality of the human environment" a detailed environmental impact statement on specified environmental considerations.

NEPA also requires all agencies of the Federal Government, to the fullest extent possible, to: (1) utilize a systematic, interdisciplinary approach to ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision making that may have an impact on man's environment; (2) identify and develop methods and procedures that will ensure that currently unquantified environmental amenities and values may be given appropriate consideration in decision making along with economic and technical considerations; (3) develop and describe appropriate alternatives to recommended courses of action in any proposal involving unresolved conflicts concerning alternative uses of available resources; and (4) recognize the world-wide and long-range character of environmental problems and lend support to programmes designed to maximize international co-operation in anticipating and preventing a decline in the quality of the world environment.

It was early determined by the AEC that no additional statutory authority was required to permit the carrying out of its statutory measures under NEPA, and that its licensing of nuclear power reactors, among other facilities, comes within the coverage of NEPA. A licensing review regime for implementation of that Act was established in Appendix D to 10 CFR Part 50, the AEC regulation pertaining to the licensing of production and utilization facilities (nuclear reactors and fuel reprocessing plants).

The AEC's implementation of NEPA following its enactment relied on the establishing of environmental quality standards and requirements by appropriate Federal, State, and regional agencies having responsibility for environmental protection as the primary mechanism for preservation of environmental values and limited consideration of environmental matters in licensing hearings.

This regulatory regime underwent major changes on 9 September 1971 as a consequence of a landmark judicial decision interpreting NEPA as applied to AEC's reactor licensing functions. This is the so-called Calvert Cliffs case [20].

The impact of this new regulatory review regime was best summarized by AEC Chairman James R. Schlesinger in speaking of the meaning of these regulatory changes. Chairman Schlesinger said: "The effect of our revised regulations will be to make the Atomic Energy Commission directly responsible for evaluating the total environmental impact, including thermal effects, of nuclear power plants, and for assessing this impact in terms of the available alternatives and the need for electric power."

In brief, the Court's decision, among other things:

(a) Required that AEC implementation of NEPA in all licensing proceedings held after its enactment take into account an independent AEC assessment of water quality and other environmental factors. AEC could no longer rely on FWPCA water quality certification or on established Federal and State standards in other environmental areas, but must be prepared to set more stringent requirements of its own.

(b) Required that, in each individual case, particular economic and technical benefits of the licensing action must be assessed and then weighed against environmental costs; and that alternatives must be considered which would affect the balancing of values.

(c) Required Atomic Safety and Licensing Boards to give independent substantive review to NEPA matters in uncontested as well as contested cases.

The AEC responded to the Court's decree by revising its manner of implementing NEPA. Without going into the details of the complex revised regulations [21], their essential thrust can be summarized as follows:

(a) Through the mechanism of the detailed environmental impact statement required by NEPA, AEC will independently consider at the construction permit and operating licence stages of its regulatory process the full range of non-radiological as well as radiological environmental impacts of the proposed licensing action. (The principal non-radiological environmental effect of nuclear plant operation is that resulting from the discharge of heated waters used to cool the main condenser.)

(b) At each licensing stage there will be an individualized balancing (through a cost-benefit assessment) of facility environmental costs as against facility benefits (economic, technical, environmental); and consideration will be given to facility alterations or other alternatives that would minimize environmental costs.

The impact of NEPA, as administered pursuant to AEC's regulations revised to comply with the Court's decree, has been to alter drastically the licensing and regulation of nuclear power reactors in the United States.

THE LICENSING PROCESS IN ACTION

Having outlined the 'bare bones' requirements for the licensing of nuclear reactors provided by the Atomic Energy Act and the National Environmental Policy Act, I will now describe the implementation of those somewhat indefinite statutory instructions by the Atomic Energy Commission.

1. Review of application

A prospective applicant for a licence to construct and operate a nuclear reactor usually asks the Commission's regulatory staff for an informal evaluation of the suitability of one or more reactor sites that he is considering. As part of the AEC's response to the National Environmental Policy Act of 1969, AEC regulations prohibit any clearing of land, excavation or other substantial action that would adversely affect the natural environment of a site selected for a nuclear power reactor and construction of non-nuclear facilities (such as turbogenerators and turbine buildings) prior to the issuance of a construction permit [22]. However, (1) changes desirable for the temporary use of the land for public recreational uses, necessary borings to determine foundation conditions, or other preconstruction monitoring to establish background information related to the suitability of the site or to the protection of environmental values; and (2) procurement or manufacture of components of the facility are permitted. Among the activities that continue to be permitted prior to the issuance of a construction permit are geologic, seismic, hydrologic, and meteorologic investigations and such clearing and building of roads and physical structures as are reasonably necessary and in general conformity with the standard practices of the industry for the purpose of determining site suitability and for preconstruction environmental monitoring.

The application for a construction permit then is prepared by the applicant — usually an electric utility — with the help of the reactor manufacturer and the architect-engineer. The Commission's regulations describe the information that should be supplied by the applicant and set out criteria under which the Commission will issue a licence [23]. The application is required to demonstrate the financial qualifications of the applicant to build and operate the reactor. It must also contain a safety analysis report.

At the construction permit stage, that report must include [24]:

(1) A description and safety assessment of the site on which the reactor is to be located, with appropriate attention to features affecting facility design;

(2) A summary description and discussion of the reactor, with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations;

(3) The preliminary design of the reactor, including the principal design criteria; the design bases and the relation of the design bases to the principal design criteria; and information relative to materials of construction, general arrangement, and approximate dimensions, sufficient to provide reasonable assurance that the final design will conform to the design bases with adequate margin for safety;

(4) A preliminary analysis and evaluation of the design and performance of structures, systems, and components of the reactor with the objective of assessing the risk to public health and safety resulting from operation of the facility and including determination of (i) the margins of safety during normal operations and transient conditions anticipated during the life of the facility, and (ii) the adequacy of structures, systems, and components provided for the prevention of accidents and the mitigation of the consequences of accidents;

(5) An identification of and justification for the selection of those variables, conditions, or other items that are determined to be probable subjects of 'technical specifications' for the reactor, i.e. provisions placing limits and conditions on operations;

(6) A preliminary plan for the applicant's organization, training of personnel, and conduct of operations;

(7) A description and evaluation of the quality assurance programme to be applied to the design, fabrication, construction, and testing of the structures, systems and components of the reactor;

(8) An identification of those structures, systems or components of the reactor, if any, that require further research and development to confirm the adequacy of their design; and

(9) The applicant's technical qualifications.

At the same time that the applicant files his application he must also file an 'environmental report', which is used to aid the AEC in preparing its own 'detailed statement' on environmental considerations pursuant to the National Environmental Policy Act of 1969.

The AEC staff initially gives the application and the applicant's environmental report a brief review to determine if information on all required subjects has been supplied. When that has been decided, the application is 'docketed', unless the information is incomplete, in which case the application is returned to the applicant.

When the application for a construction permit is docketed, public notice is given, copies are made available to the public and are sent to interested State and local officials and the Advisory Committee on Reactor Safeguards (ACRS). Copies of the applicant's environmental report are also made available to the public and notice of its availability is published at this time.

Shortly after a construction permit application is docketed, a notice of hearing is issued to provide interested persons who may wish to participate in the licensing proceeding an opportunity to intervene early in the proceeding, thus making their participation more meaningful than would be the case if participation were not permitted until after the AEC staff and ACRS review of the application were completed.

The next step is the Commission's regulatory staff intensive review application. The objectives of this review are to: (1) obtain adequate technical information on the reactor design; (2) reach an understanding of the technical bases for the safety of the proposed plant; (3) initiate discussions on preparation of the technical specifications; and (4) permit the staff to make an independent safety analysis.

In conducting its safety review, the staff, to the extent necessary or appropriate for the particular application, seeks the advice of expert consultants from outside the Commission, including those from other Federal agencies that are experienced in evaluating environmental impact. The US Geological Survey is consulted with respect to the geological aspects of the site. The US Fish and Wildlife Service is consulted with respect to potential radiological effects on fish, other marine life and wildlife from operation of the proposed reactor. The National Oceanic and Atmospheric Administration and the Coast and Geodetic Survey are called upon for advice on meteorology and seismology. The US Army Corps of Engineers may furnish hurricane data on coastal areas to enable the Commission to determine whether special protective construction should be required. In addition to consultation with experts from Government agencies, the Commission staff may consult experts from universities and private organizations on special problems.

Concurrent with the Commission's regulatory staff consideration of the application in the licensing process is the review by the Advisory Committee on Reactor Safeguards. Collectively, the members of the Advisory Committee on Reactor Safeguards have competence in the major disciplines bearing on reactor safety. To facilitate the Committee's review, the Commissions's regulatory staff prepares a preliminary analysis of the application shortly after it is docketed. The preliminary analysis identifies the principal safety issues and provides a starting point for the detailed reviews by the staff and the Committee that follow. There continues to be an exchange of technical comment between the staff and the Committee as the review process goes forward. Both the utility representatives and the staff respond to questions from the Committee. After completion of its initial review the staff prepares a report to the Advisory Committee on Reactor Safeguards, discussing its evaluation of the major safety issues that have been identified.

When the Committee has concluded its own review it submits its recommendations in a letter to the Commission. The letter comments upon the safety of the project, spells out any areas of technical concern, and may make recommendations for research and development efforts in those areas.

Concurrently with its safety review, the AEC staff conducts the "environmental review" required by the National Environmental Policy Act, which has been previously described. Using the material submitted by the applicant in his environmental report, by persons who may have commented to the AEC on that report, and other information from a variety of sources, the staff prepares a "draft Detailed Statement" of environmental considerations. This draft statement contains an assessment of the following matters, which reflect the provisions of NEPA:

(a) The environmental impact of the proposed action
(b) Any adverse environmental effects that cannot be avoided should the proposal be implemented

(c) Alternatives to the proposed action
(d) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity
(e) Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

The draft statement also contains a preliminary cost-benefit analysis and an analysis of appropriate alternatives to the proposed permit in any case that involves unresolved conflicts concerning alternative uses of available resources (i.e. an analysis of alternatives that would alter the environmental impact and cost-benefit balance). A copy of the applicant's environmental report and of the draft Detailed Statement is then transmitted to Federal agencies designated by the Council on Environmental Quality as having "jurisdiction by law or special expertise with respect to any environmental impact involved" or as "authorized to develop and enforce environmental standards" and to the Governor or appropriate State and local officials, who are authorized to develop and enforce environmental standards, of any affected State with a request for comment. The public is also invited to comment.

After receipt of the comments, a final environmental statement is prepared by AEC staff, which includes a discussion of problems and objections raised by Federal, State and local agencies or officials and private organizations and individuals and the disposition thereof. The environmental statement also contains a final cost-benefit analysis, which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse impact, as well as the environmental, economic, technical and other benefits of the facility. That analysis, to the fullest extent practicable, quantifies the various factors considered.

While compliance of facility operation or construction with environmental quality standards and requirements, which have been imposed by other agencies having responsibility for environmental protection, are considered, the environmental impact of the facility is independently considered in the cost-benefit analysis, even if compliance with such standards and requirements has been certified by another agency (with some limitations, as I will discuss later). Furthermore, even though satisfaction of AEC standards and criteria pertaining to radiological effects is necessary to meet the licensing requirements of the Atomic Energy Act, the cost-benefit analysis does, for the purposes of the National Environmental Policy Act, consider the incremental environmental cost, from the standpoint of radiological effect, of the construction and operation of the facility.

On the basis of those evaluations and anlyses, the environmental statement includes a conclusion by the Director of Regulation of the AEC or his designee as to whether, after weighing the environmental, economic, technical and other benefits against environmental costs and considering available alternatives, the action called for is issuance or denial of the proposed permit or licence or its appropriate conditioning to protect environmental values.

Although the environmental review I have just described starts concurrently with the safety review, the AEC is making an effort to complete the environmental review at an earlier point in time. In developing draft environmental statements, the AEC uses the technical expertise of the Oak Ridge and Argonne National Laboratories.

Throughout the process just described, beginning with the receipt of the application, the documents that form the basis of the application and review, and almost all AEC documents, are made routinely available for public inspection. The letter of the Advisory Committee on Reactor Safeguards and the AEC staff's safety evaluation of the staff are also distributed to the interested State and local officials as soon as they are available. Furthermore, the meetings of the ACRS at which the application is discussed are, with some limitations, open to the public.

2. The hearing

The public hearing on a nuclear power reactor licence application is initiated by a notice setting out the issues to be considered at the hearing, which is published in the Federal Register (a daily publication by the Federal Government containing notices, rules and proposed rules issued by Federal agencies, Presidential proclamations, and Executive Orders) shortly after docketing of the application, as noted above. Under the Atomic Energy Act a public hearing must be held at the construction permit stage irrespective of whether the facility application is contested. In an uncontested case the issue to be decided is whether the application and record contain sufficient information, and the safety review of the application pursuant to the Atomic Energy Act and the environmental review conducted pursuant to the National Environmental Policy Act by the Commission's regulatory staff have been adequate to justify the issuance of a construction permit for the facility. If the case is contested, the issues are whether:

(1) The applicant has described the proposed design of the reactor and identified the major features or components for the protection of the health and safety of the public;

(2) Such further technical or design information required to complete the safety analysis and which can reasonably be left for later consideration will be supplied;

(3) Safety features or components requiring research and development have been described and a research and development programme will be conducted to resolve any safety questions associated with them;

(4) On the basis of the foregoing there is reasonable assurance that the remaining safety questions will be satisfactorily resolved at or before completion of the reactor and, taking into consideration the Commission's site criteria, the reactor can be constructed and operated at the proposed location without undue risk to the health and safety of the public;

(5) The applicant is both technically and financially qualified to design and construct the proposed reactor;

(6) The issuance of a permit for the construction of the reactor will not be inimical to the common defence and security or to the health and safety of the public;

(7) In accordance with the AEC's regulations implementing the National Environmental Policy Act of 1969, the construction permit should be issued as proposed.

Whether the proceeding is contested or uncontested, the hearing board also:

(a) Determines whether the requirements of the National Environmental Policy Act and the Commission's regulations pertaining thereto have been complied with in the proceeding;

(b) Independently considers the final balance among conflicting factors contained in the record of the proceeding with a view to determining the appropriate action to be taken;

(c) Determines whether the construction permit should be issued, denied, or appropriately conditioned to protect environmental values.

The environmental issues set out in the notice of hearing are usually considered at a hearing held separately from the radiological issues considered under the Atomic Energy Act, although the initial notice covers both areas.

Prior to the hearing several 'prehearing conferences' are held to consider whether persons should be permitted to intervene as parties, to identify and define key safety and environmental questions and any matters in controversy, to facilitate the disclosure and preparation of evidentiary material with a view to providing an orderly and complete hearing record and minimizing delay and to settle other procedural matters.

The purpose of the public hearing at the construction permit stage is to inform the public as well as to develop a record sufficient to support the issuance or denial of a construction permit by the Commission. In the absence of intervenors, the parties are the licence applicant and the Commission's regulatory staff, the latter's function being to represent the public interest in the licensing proceeding. Documentary evidence is presented and testimony, both prepared and oral, is given on the safety aspects of the reactor and on the applicant's technical and financial qualifications to construct and later operate it. The AEC staff's environmental statement is introduced in evidence. Any party may take a position and offer evidence on the environmental aspects of the proposed licensing action.

The Atomic Safety and Licensing Board is not expected in an uncontested case to conduct a de novo safety review of the application, but rather to determine the sufficiency of the information submitted by the applicant and to test the adequacy of the AEC staff's safety review of the application. The boards are expected to determine whether there are any significant gaps in the consideration of safety issues by the utility applicant and the Commission's regulatory staff.

In contested cases the hearing board determines the matters in controversy and makes its own technical judgement on these matters.

As noted previously, in any case independent consideration is given by the board of the final balance among the conflicting factors in the proceeding related to the environmental impact of the reactor.

3. Commission review

After an Atomic Safety and Licensing Board's decision is issued, a party may take an appeal to an Appeal Board as a matter of right. The Licensing Appeal Board reviews each initial decision by an Atomic Safety and Licensing Board, formally if an appeal is taken from the initial decision, or informally if no appeal is filed. The Appeal Board's decision is subject to review by the Commission, but only on the Commission's own initiative and only where significant safety or policy questions were deemed to be wrongly decided by the Appeal Board or Licensing Board.

4. Operating licence

When construction of the plant is nearing completion the utility applies for an operating licence. The application includes a final safety analysis report in which the technical information is brought up to date and presents information developed as a result of environmental and meteorological monitoring programmes during construction. It also includes plans for operating and for coping with emergencies.

A second environmental report is also submitted, which discusses the environmental matters only to the extent that the considerations differ from those discussed in the report submitted at the construction permit stage.

The AEC staff and the Advisory Committee on Reactor Safeguards again evaluate and make a public report on the reactor and the AEC staff again prepares draft and final environmental statements following the same procedures used at the construction permit stage. However, such statements cover only environmental considerations that differ significantly from those discussed in the statement prepared in connection with the issuance of the construction permit.

An opportunity for a public hearing is afforded upon completion of this review process, prior to final licensing action. The purpose of any such resulting hearing (which is also conducted before an Atomic Safety and Licensing Board and subject to the previously described appellate review procedures) is to resolve matters put in controversy by the applicant, the AEC staff, or an affected member of the public who has been permitted to intervene in the proceeding.

When the operating licence is issued, it requires compliance with all Commission rules and regulations and contains technical specifications that place limits and conditions on operation, including requirements for surveillance and tests by the licensee, limits on operational variables, and requirements for equipment important to safety. It may also contain "environmental technical specifications", which require the licensee to conduct operations in accordance with the alternative concluded to be the preferable one in the AEC's environmental statements, and additional appropriate environmental limitations.

When significant modifications in the reactor, changes in operating procedures, changes in technical specifications or other licence conditions become desirable or necessary, they must be authorized by the Commission.

In advance of reactor start-up the Commission must determine that persons who are to manipulate the controls of the reactor are qualified. Such individuals must be licensed by the Commission. They must first pass an examination on their knowledge of the specific reactor as well as general radiological safety principles and reactor theory.

5. The enforcement programme

After a facility operating licence has been issued, the reactor continues to be subject to regulatory surveillance. The purpose is to ensure that the reactor is operated safely and in accordance with AEC regulations and licence conditions. The Commission does this in two ways: first, by surveillance, in which any necessary changes in design or operation are evaluated and authorized by the AEC; and secondly, by periodic inspections during construction and operation.

In addition to regular inspections, the Commission investigates promptly any significant incident and determines what hazard exists, if any. It also makes sure that the licensee has taken, or is taking, timely and proper action to protect the public health and safety, or the environment. Reactor inspections are directed toward five principal areas. The areas are: (1) organization and management; (2) quality control; (3) test programme; (4) procedures; and (5) plant operations.

Inspection reports serve as the basis for action required to achieve compliance with the Commission's requirements or for improvement in safety of operations. These actions include licence amendments to require design changes in the reactor or changes in the technical specifications, notices of violation, conferences with licensee management, or, when necessary, the issuance of an order to protect the public health and safety, including the shut-down of a reactor until some important safety condition or requirement is met. If an inspection report shows that the reactor operation may not be in compliance with an environmental protection standard or requirement imposed by an agency other than the AEC, and which is not the subject of a licence condition, the AEC notifies that other agency so that it may take appropriate enforcement action.

SUBSTANTIVE STANDARDS FOR LICENSING AND OPERATION OF NUCLEAR POWER REACTORS

The statutory bases for licensing of nuclear power reactors and the procedures have been described. I will now outline the substantive standards for licensing of nuclear power plants. Only the standards for radiological health and safety security are spelled out in AEC regulations.

Under the AEC's regulations dealing with radiological health and safety the Commission must find, in licensing a power reactor, that there is reasonable assurance that the health and safety of the public will not be endangered by the reactor's operation [25]. The principal safety objective in the design and operation of nuclear reactors is to ensure that fission products remain confined at all times — either within the fuel or at least within the plant structure. The information supplied in the licence application and the staff's evaluation of that information form the basis for the AEC finding that there is reasonable assurance that the public health and safety will not be endangered by the operation of the reactor. Evaluation of the design of the reactor and the engineered safety features is accomplished through consideration of their performance in relation to the type of accidents that might be expected to occur or, more remotely, accidents postulated as possible occurrences even though their probability is very low. The applicant must show the plant's ability to contain fission products even in the event of those postulated accidents. Limitations on operation considered necessary by the AEC are imposed by licence conditions, including technical specifications.

The appropriateness of the site of the proposed reactor from the viewpoint of the public health and safety is determined by reference to the site criteria in AEC regulations [26]. Those criteria for reactor siting are designed to ensure a low risk of public exposure to radiation. The application of these criteria by the AEC has led, in general, to the location of reactors outside areas of high population density.

The AEC has also established in Part 20 of its regulations limits on the permissible concentrations of radioactive materials that may result from the routine operation of licensed reactors, in both gaseous and liquid effluents released to "unrestricted areas" — that is, areas beyond the plant site [27]. In addition, special provisions are usually incorporated in power reactor licences limiting the quantities of radioactive materials that may be released in air. A continuous monitoring programme by the licensee is necessary to ensure that the limits are not exceeded.

The Commission's limits on the concentrations of radioactive materials in effluents that may be released to unrestricted areas are based on radiation protection guides developed by the Federal Radiation Council (whose functions have been transferred to the Environmental Protection Agency). These guides are consistent with the radiation protection standards promulgated by the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

The objectives of Part 20 as related to the protection of the environment from releases of radioactivity in effluents from the normal operation of nuclear facilities are:

(1) To limit releases of radioactivity to the environment from each nuclear facility or other licensed activity so that exposures of the general public to ionizing radiation from the cumulative effects of all licensed atomic energy activities when added to other sources of exposure are not likely to exceed established radiation protection guides;

(2) To provide reasonable assurance that levels of radioactivity added to the environment are well below levels that are likely to result in perceptible adverse effects on the ecology of the environment;

(3) To provide reasonable assurance that appropriate efforts are made to maintain releases of radioactive materials in effluents to unrestricted areas as far below the limits specified in the regulations as practicable.

The principle followed in the Part 20 regulations is that the point of regulatory control of radioactivity is at the source prior to its release from a restricted area (i.e. an area that is controlled by a licensee for purposes of protection of individuals from exposure to radiation and radioactive materials). The regulations are administered so that resultant exposures to individual members of the public generally and to the population as a whole from nuclear activities from all important pathways of exposure are small fractions of recommended radiation protection guides and, in any event, are kept as low as technically and economically practicable.

For the great majority of licensed nuclear activities releases of radioactivity to the environment occur in volumes of air or water at concentrations well within the specific limits provided in Part 20. The types and quantities of radionuclides released are such that the dilution that will occur in the environment before persons are exposed to radioactivity under these conditions will limit exposures of individual members of the public to small fractions of radiation protection guides and limit average exposure of the public to much smaller fractions of these guides.

Part 20 reflects a clear recognition of the need to take into account the cumulative effect of all sources of exposures and that some nuclear activities (e.g. uranium processing mills, reactor fuel chemical reprocessing plants, nuclear power plants) may release volumes of liquid and gaseous effluents containing a mixture of radionuclides. A thorough and detailed assessment of the nature of the radioactive material released and its behaviour in the environment, such as reconcentration in the food-chain, may be required in these cases to ensure that all important pathways of exposure of people are identified and evaluated. In such cases the total quantity of each type of radionuclide released may be more critical with respect to limiting exposure than the Part 20 concentration limit in air and water. For this reason, Part 20 provides that, in addition to limiting concentrations in effluent streams, the Commission may limit total quantities of radioactive materials released in effluents during a specified period of time if it appears that in any situation the daily intake of radioactive material from all pathways of exposure (air, water and food), by a suitable sample of an exposed population group, averaged over a period not exceeding one year would otherwise exceed the daily intake resulting from continuous exposure to air or water containing one-third the concentration of radioactive materials specified as limits in the regulations. In effect, this provision would limit the dose to the critical organ of the suitable sample of an exposed population group from all sources of exposure to one-third the dose limit for individuals in the population recommended by the FRC, NCRP and ICRP. This provision is implemented if it appears likely that a sufficiently large quantity of radioactivity will be released that exposures to people off-site will be a significant fraction of radiation protection guides. In such cases an assessment must be made of the types and quantities of radionuclides released, their chemical and physical behaviour in the environment, important pathways to humans, population groups likely to be exposed and predicted doses to such groups. Quantity limits based on such a study would then be derived so that actual exposures to the public from all pathways would be well within radiation protection guides.

AEC regulations [28] require all AEC licensees to make every reasonable effort to maintain radiation exposures and releases of radioactivity in effluents to the environment as far below Part 20 limits as practicable, and to specify design and operating requirements to minimize quantities of radioactivity released in gaseous and liquid effluents from nuclear power reactors. The Commission has issued proposed numerical guides for design objectives and technical specifications for limiting conditions for operation of light water cooled nuclear power reactors to keep radioactivity in effluents as low as practicable. The proposed guides are at levels that are a small fraction of exposure guidelines recommended by national and international radiation protection bodies, such as the ICRP.

The proposed guides, which are in the form of a rule-making action, have been the subject of a public hearing at which both radiological health and safety issues and environmental protection issues have been raised.

The statutory standards for licensing of nuclear power reactors also include promotion of the common defence and security. No AEC regulation at present spells out in detail regulatory standards for the implementation of that statutory standard. However, such standards are in the process of development that would focus on protection against sabotage and against diversion of fissile material in design and operating procedures.

There are no substantive standards for environmental protection in AEC regulations. Although the AEC is charged with responsibilities by the National Environmental Policy Act, that Act has been construed, in judicial decisions, as a procedural statute rather than one imposing substantive standards [29]. The AEC's imposition of licence conditions or technical specifications is based not on statutory or regulatory standards, but on its conclusions reached, on the basis of a cost-benefit analysis, of the preferable alternatives from the standpoint of environmental impact. However, other statutes that either contain, or look toward the imposition of substantive requirements for environmental protection, are applicable to licensing of power reactors, although not primarily the responsibility of the AEC.

ADDITIONAL ENVIRONMENTAL PROTECTION REQUIREMENTS INVOLVED IN THE LICENSING OF POWER REACTORS IN THE UNITED STATES

Apart from NEPA, the most important environmental protection statute involved in the licensing of nuclear power reactors is the Federal Water Pollution Control Act (FWPCA) [30]. The most significant environmental impact from the operation of a nuclear power reactor, apart from the radiological effect, is the discharge of heated water from the condensers. Thus, the FWPCA is of considerable importance in the US regime for the protection of the environment in connection with the operation of power reactors and other large facilities.

The FWPCA, an extremely complex statute, has provisions for permits for discharges into navigable waters, effluent limitations, and certifications of compliance with water quality requirements, among other things.

While discharges into navigable waters and tributaries by power reactors and other sources are prohibited, the Environmental Protection Agency (EPA), which administers the FWPCA, may, with certain limited exceptions, issue permits for the discharge of any pollutant, including chemical wastes and heat, after opportunity for public hearing [31].

Permits can be issued if the discharge will meet all applicable requirements of certain sections of the Act [32] subject to certain limitations. Those requirements include:

(a) Effluent limitations involving application of the best practicable control technology currently available, or any more stringent limitations established pursuant to State or Federal law or regulation or required to implement any applicable water quality standard established pursuant to the Act. After 1 July 1983 effluent limitations involving application of best available technology economically achievable, including eliminating discharges of pollutants if found to be technologically and economically achievable.

(b) Prohibition of discharge of any radiological warfare agent or high-level radioactive waste into the waters of the United States.

(c) Standards of performance for new sources of pollution, including generating plants, the construction of which is commenced after publication of the standards. The standards of performance are those requiring the greatest degree of effluent reduction determined to be achievable through application of the best available demonstrated control technology, including, where practicable, a standard permitting no discharge.

(d) With respect to thermal effects and entrainment effects, if, after opportunity for public hearing, the operator demonstrates that any thermal effluent limitation will require limitations more stringent than necessary to ensure protection and propagation of shellfish, fish and wildlife in and on the body of water into which discharge is made, EPA (or the State) may modify the limitation accordingly. Any standard established must require that cooling water intake structures reflect the best technology available for minimizing adverse environmental impact.

(e) Effluent standards for toxic pollutants, which include pollutants which after discharge and upon exposure, ingestion or assimilation into any organisms, either directly or through food-chains, will cause death, disease, behavioural abnormalities, genetic mutations, physiological malfunctions, or physical deformations in such organisms or their offspring.

If a permit system proposed by a State is acceptable to EPA, the State rather than EPA issues the permits, subject to veto by EPA.

The FWPCA provides for the development by the States and submission to EPA of water quality standards for interstate and intrastate waters on a priority basis. Further, States must identify those waters within its boundaries for which certain controls on thermal discharges are not stringent enough to ensure protection and propagation of a balanced and indigenous population of shellfish, fish and wildlife. For such waters States must establish and submit to EPA total maximum daily heat loads and a priority ranking of the waters. The loads must include a calculation of the maximum heat input that can be made in each part of such waters and include a margin of safety. The load must be established at a level necessary to ensure protection and propagation of a balanced, indigenous population of shellfish, fish and wildlife. Similar provisions would apply to pollutants other than heat.

Federal agencies are prohibited from granting a licence or permit that may result in any discharge into navigable waters until the applicant has provided a certification from the State in which the discharge originates that the discharge will comply with such water quality and other standards [33]. Any certification must set forth effluent limitations and monitoring requirements necessary to comply with the Act and any other appropriate requirement of State law.

A specific provision of the FWPCA states the effect of the issuance of a permit or a certificate under FWPCA on the responsibility of other agencies in connection with the environmental review required by NEPA [34]. The AEC has construed this provision of the FWPCA as not affecting its responsibilities and authorities under NEPA except to the extent that there is a conflict with actions taken under FWPCA. That is:

(a) If and to the extent that there are applicable limitations or other requirements imposed pursuant to the FWPCA, the Commission will not (with certain exceptions relating to matters of State law) impose different limitations or requirements pursuant to NEPA as a condition to any licence or permit. The Commission will itself determine compliance with limitations or requirements promulgated pursuant to FWPCA where no prior compliance determination has been made under FWPCA or where a certain type of interim certification under section 401 of FWPCA has been provided.

(b) The AEC will not consider various alternatives where such action would constitute a review of similar consideration of alternatives under FWPCA and upset a limitation or requirement imposed as a result thereof or where a particular alternative has been required to be adopted pursuant to FWPCA.

(c) In considering the costs and benefits of a proposed action pursuant to NEPA, the AEC will continue to evaluate and give full consideration to environmental impact, but such evaluation and consideration will be conducted on the basis of discharges or other activities that are at the level of limitations or requisite promulgated or imposed pursuant to FWPCA.

Other environmental protection statutes have also had an effect on nuclear power plant operation. The Clean Air Act [35] vests the Environmental Protection Agency with authority, among other things, to promulgate emission standards for air pollutants from new stationary sources and emission standards for hazardous air pollutants from new as well as existing stationary sources of air pollution. However, the Environmental Protection Agency has exercised no direct licensing authority, as such, under the Clean Air Act.

The Wild and Scenic Rivers Act appears to require Federal licensing agencies to deny a licence for the construction of any project utilizing river water, including a nuclear power plant, if the project would adversely affect any rivers in the National Wild and Scenic Rivers System [36] or any rivers designated in the Act for potential inclusion in the System, and the National Historic Preservation Act of 1966 [37] requires Federal licensing agencies to take into account the effect of activities proposed to be licensed on any object included in the National Register of Historic Sites.

FUTURE DIRECTIONS FOR RECONCILING ENVIRONMENTAL PROTECTION AND POWER GENERATION

The proliferation of statutory requirements and intensified public interest in the environmental impact of all of our industrial activities, not the least of which are nuclear power plants, have the potential for delay in licensing of needed power generating facilities. Further changes have been proposed in the area of legislation to rationalize the procedures for environmental protection and balancing of conflicting goals. The most significant legislative proposal in this regard is that advanced by President Nixon and introduced in the 93rd Congress for an overall national system of power plant siting. This system would cover fossil and nuclear-fuelled plants alike (which is not the case today) and would require long-range pre-planning of power needs, 5-year advance selection of potential plant sites and an approval process for specific plant construction beginning 3 years before commencement of actual construction. Co-ordination of approvals required of agencies at the Federal and State level would be provided for dealing with environmental matters, and a balancing of overall environmental impact as against the public's need for electrical power would be performed by a State or local certifying agency which would assume the responsibility of complying with NEPA requirements in lieu of other involved agencies.

To many knowledgeable observers, such a restructuring of the general power plant siting regime will be needed if our country is effectively to meet and reconcile the mounting demands for electrical energy and the parallel demands for a cleaner environment.

REFERENCES

[1] 68 Stat. 919, 42 USC 2011 et seq.
[2] Section 101, 42 USC 2131.
[3] Section 11 cc., 42 USC 2014 (cc).
[4] Title 10, Code of Federal Regulations, Chapter 1 (hereinafter 10 CFR), Part 50, § 50.2(b).
[5] Sections 53, 63, 81; 42 USC 2073, 2093, 2111.
[6] Sections 103, 104, 161; 42 USC 2133, 2134, 2201.
[7] State of New Hampshire v. Atomic Energy Commission, 406 F. 2d 170 (1st Cir., 1970).
[8] Northern States Power Company v. State of Minnesota, 447 F. 2d 1143 (8th Cir., 1971).
[9] Section 101, 42 USC 2131.
[10] Section 107, 42 USC 2137.
[11] Section 185, 42 USC 2235.
[12] Section 189, 42 USC 2239.
[13] Title 5, United States Code, section 551-558.
[14] Section 182 b., 42 USC 2232(b).

[15] Section 191, 42 USC 2241.
[16] Section 189 b., 42 USC 2239(b), 28 USC 2342-2344.
[17] Section 161, 42 USC 2201.
[18] 42 USC 2210.
[19] 83 Stat. 853, 42 USCA 4331-5, 4341-7.
[20] 449 F. 2d 1109.
[21] 10 CFR Part 50, Appendix D.
[22] 10 CFR Part 50, § 50.10(b).
[23] 10 CFR Part 50, §§ 50.33, 50.34, 50.35, 50.40, 50.57.
[24] 10 CFR Part 50, § 50.34.
[25] 10 CFR Part 50, §§ 50.35, 50.40, 50.57.
[26] 10 CFR Part 100.
[27] 10 CFR Part 20, § 20.106.
[28] 10 CFR Part 20, § 20.1(c) and 10 CFR Part 50, §§ 50.34 a. and 50.36 a.
[29] Calvert Cliffs' Coordinating Committee v. Atomic Energy Commission, 449 F. 2d 1109 (D.C. Cir., 1971).
[30] 33 USCA 1251-1376.
[31] Section 402, 33 USCA 1342.
[32] Section 511(c) (2), 33 USCA 1371(c) (2).
[33] Section 401, 33 USCA 1341.
[34] Section 511(c) (2), 33 USCA 1371(c) (2).
[35] 42 USCA 1857.
[36] 16 USCA 1271-1287.
[37] 16 USCA 470.

WAYS AND MEANS OF INSURING AGAINST NUCLEAR RISKS

A. CAMPBELL MILES
British Insurance (Atomic Energy) Committee,
London, United Kingdom

Abstract

WAYS AND MEANS OF INSURING AGAINST NUCLEAR RISKS.

Despite stringent safety requirements imposed upon nuclear installations, the need for adequate insurance cover is motivated by the consideration that a nuclear accident could lead to very grave consequences. To marshal the large insurance capacity required, national pools were formed in many countries, which may enter into arrangements with other similar national pools to increase their own capacity with a view to an appropriate spread of the risks involved. In the absence of a national nuclear pool, application for nuclear insurance would normally be made to the national insurance market association concerned. Virtually every type of nuclear risk is insurable; various forms of material damage and liability insurances are available. The financial liability of nuclear operators is established by national legislation on the basis of international conventions. Insurance coverage is linked to the operator's amount of liability established by law. A third party nuclear liability insurance policy usually consists of three parts: Part I covers the operator's liability under his domestic nuclear legislation; Part II provides non-nuclear power for accidents on the site up to a separate liability limit selected by the operator; and Part III provides cover for costs. Other types of insurance deal with damage to the site and the installation (material damage), consequential losses, contingent liabilities of suppliers of goods and services (products liability), nuclear material in transit and nuclear-propelled ships.

INTRODUCTION

Insurers are accustomed to underwriting risks that are exceptional whether by reason of their size or hazards or both as, for example, those arising in connection with aircraft, oil tankers, bridges and tunnel construction, and costly factories engaged in hazardous activities. Over the decades insurers have built up the necessary experience and financial capacity to cover them in the conventional insurance markets and even the heaviest of such risks can usually be placed. The gradual growth of the business has meant that, with the increase in the magnitude of individual risks, there has been a corresponding spread of risk. This, to insurers, is an important factor because it follows that, with large numbers of similar risks all over the world, the probabilities of disastrous losses can be averaged out. Thus the fundamental and ancient principle of insurance that the misfortunes of the few should be borne by the many has been satisfied.

The development of nuclear energy did not, however, evolve slowly in this way. Comparatively suddenly this new source of energy introduced insurers to hazards unlike those with which industry has long been familiar, such as fire and explosion. The process of nuclear fission is accompanied by the production of intense and dangerous radiations which may be lethal to man and gravely damaging to property. Processes, industrial or otherwise, that, if something went wrong, involved the prospect of severe contamination of property or serious injury to people by radioactivity on a large scale were something quite new when insurers began to meet the need for covering nuclear risks in the 1950s. Radioactivity is a source of damage or injury that can be detected by none of the human senses. It may cause injury or illness that does not become manifest for a very long time after the subject has been exposed to radiation. Even if a nuclear incident causes no physical damage either to the installation itself or the surrounding property, the associated contamination may prevent access or use for quite a long time and the removal of the radioactivity may be a lengthy and expensive business.

The magnitude of the values at risk in a large nuclear installation such as an atomic power station taken together with the possible extent of compensation to third parties should an accident occur are very considerable. The value of just one reactor unit itself, apart from all the other plant and property on a nuclear power station, today may be of the order of £50 million, say $120 million, or more. The civil liability risks that could be involved in the worst possible circumstances may lead to the payment of damages representing greater financial liabilities for a single industrial plant than any hitherto encountered outside the field of natural disasters.

Of course, governments and the operators of nuclear installations impose stringent safety requirements but realists recognize that there is no complete guarantee against accidents and, in the case of processes involving nuclear energy, a comparatively minor failure of equipment or human error could, in certain circumstances, lead to very grave consequences. Therefore, faced with the threat of widespread and disastrous harm to people and their property, remote though one hopes it might be, national governments have, as nuclear energy has come to their countries, addressed themselves to the control of such activities and to legislating comprehensively to establish the liabilities of operators and fix the financial limits of such liabilities. At the same time international concern was manifested firstly by the preparation and introduction of the so-called Paris Convention on civil liability in this field followed by the International Atomic Energy Agency's own Convention on such liabilities to which further reference will be made later in this paper.

INSURANCE PROBLEMS AND POSSIBILITIES

Concurrently with the evolution of the principles of liability for nuclear risks, insurers gave much thought to the practicability of providing the necessary insurance cover through normal channels. The usual insurance practice in regard to the insurance of large risks embraces a system of reinsurance whereby an insurer can lay off or reinsure with a reinsurance underwriter any proportion of a risk that he is not prepared to take on his own account. In modern practice this is done by a 'blind treaty' system. This is a contract between an insurer and a reinsurer whereby the latter accepts any risks of a specified class without prior notification. Because the original insurance may be divided among a large number of insurers, some reinsurers may be placed on risk from a number of different sources in respect of the same original insurance. In the case of nuclear installations the small number of insurances in respect of both installations and third party cover and the high values at risk make such a system unworkable because certain reinsurers could, in some circumstances, find themselves faced with an excessive accumulation of shares in an individual risk in a field of activity in which the special hazards are perhaps not fully understood and, therefore, the potential losses not easily assessed.

Consequently, insurers came to the conclusion that the only practical method of underwriting nuclear installation risks was a net line basis by which each insurer or reinsurer accepts fixed maximum amounts for his own retention and does not pass any of that acceptance through any reinsurance or retrocession facilities.

SOURCES OF INSURANCE

To marshal the large insurance capacity necessary, national pools were formed in many countries. Commercial organizations proposing to build and operate a nuclear installation such as an atomic power station or their brokers usually approach their national pool and discuss with them the question of insuring the installation and the third party risks involved. In turn, the national pool may decide to consult with similar pools formed in other countries on the question of augmenting their own capacity so as to provide an appropriate spread of the risks involved.

In the absence of a national nuclear pool application for nuclear insurance cover would normally be made to the national insurance market association concerned. They will know how to obtain any advice or assistance they themselves might require from insurers already engaged in international nuclear insurance. Even though the capacity of the national insurance market, when formed into a pool, might be very limited, they nevertheless have an important role to play. They will, of course, be familiar with insurance customs and the relevant legislation applicable at the time. Moreover, their offices could provide a base from which the claims work arising from a major incident could be organized with help, if necessary, from other pools. This international collaboration of the various pools is made possible only to the extent that premiums, as well as sums due as compensation and costs, are readily and rapidly transferable.

RISKS THAT MAY BE INSURED AND THE ASSESSMENT OF HAZARDS

Virtually every type of nuclear risk is insurable. Some of the minor ones, such as radioisotopes used for medical or industrial purposes, X-ray machines and laboratory equipment using nuclear materials that are not capable of going critical (i.e. starting a chain reaction), are generally covered under conventional insurance policies of various kinds. But all other types of nuclear installation, whether it be a small research reactor, a large power producing reactor, a fuel fabricating, enrichment or reprocessing plant or an experimental prototype reactor, would usually be insured in the nuclear pools. Various forms of material damage and liability insurances, of which further details are given later in this paper, are available. Insurers are conscious that the market for nuclear insurance is limited and, therefore, the pools can be relied upon to make every possible effort to provide a reasonable degree of cover even for the most unattractive of experimental and prototype installations.

NUCLEAR REACTOR HAZARDS

The main hazards associated with nuclear reactors can be sumarized as follows:

(a) 'Run-away', i.e. overshoot of power caused by lack of control of the nuclear reaction resulting in a possible 'melt' of the fuel elements and consequent release of fission products.

(b) Overheating, which may be caused by a variety of reasons such as excessive power, loss of coolant, obstruction of the cooling circuits, and which may be widespread or localized in position.

(c) Explosion, which might arise through
   (i) a build-up of pressure;
   (ii) chemical reaction where incompatible substances are brought together.

(d) Possible changes in the qualities of materials used in the reactor and circuits due to long-continued radioactive bombardment.

(d) Breakdown of the reactor structure from any cause which may result in the uncontrolled emission of fission products to the atmosphere.

In order that insurers may be able to assess the risks they are being asked to undertake, they require full technical and underwriting information. This would include:
- (i) Type of installation and, if a reactor, its design, thermal capacity and use
- (ii) Nature of nuclear fuel and, if relevant, moderator, coolant or heat transfer medium
- (iii) Control mechanism and safety monitoring equipment
- (iv) Safety margins allowed in containment design
- (v) Geographical situation and prevailing weather conditions
- (vi) Operating safety code and training and discipline of operators
- (vii) Fire protection.

These considerations apply basically to the assessment of material damage risks but are equally relevant to a consideration of liability risks. In the case of the latter further matters have to be taken into account such as the nature and value of the property in the vicinity, the concentration of population, the direction and strength of the prevailing wind and the extent to which rivers, lakes or seas may be affected by the release of radioactive effluents.

FIXING THE AMOUNT OF LIABILITY AND THE CORRESPONDING INSURANCE REQUIREMENTS

Resulting from the national and international consideration given some years ago to establishing the responsibilities and financial liabilities of nuclear operators, as mentioned earlier, the member countries of the International Atomic Energy Agency prepared the Vienna Convention about which you have heard so much. This, as you know, provides that the minimum amount of an operator's liability should be set at US $5 million. Most countries have adopted the higher limit of $15 million or, in some cases, $50 million per incident. As you will know, the amount for which an operator is obliged, by national legislation, to provide insurance cover may be less than the total amount of his legal liability, in which case the margin would usually be covered in some way by the State.

The provisions of an insurance policy issued pursuant to the Convention must be such as to cover an operator's liability in the following respects:

(a) It must cover claims made within 10 years of the incident

(b) It may include compensation for damage in respect of nuclear substances in transit

(c) It may cover the damage to the means of transport but at least $5 million in respect of any one nuclear incident must be available for other compensation.

The insurance or other financial security may only be used to meet an operator's Convention liability, which is essentially one of tort. The security cannot be used to meet an additional liability that an operator may assume under contract, for which separate insurance arrangements would need to be made.

Although, under the Convention, it is open to each country to impose a limit on the liability of its operators subject to the minimum of $5 million in respect of any one incident, insurers must know the limit of their liabilities in respect of any one site. Insurance coverage therefore is only available on the basis of one fixed amount for a particular installation. This amount is reduced by each claim payment unless reinstated by agreement, assuming the necessary insurance capacity is available. There is nothing in the Convention that prevents this, providing that the cover available is not reduced or exhausted as the result of a first incident without appropriate measures being taken to ensure the financial security up to the minimum amount is available for subsequent incidents.

One practical way of meeting this problem is to be found in the United Kingdom's Nuclear Installation Act of 1965 and perhaps I may be permitted to illustrate the position by reference to that law. Section 16(1) limits the amount payable by a UK operator in respect of one occurrence to £5 million, which is considerably more than the minimum of $5 million provided for under the Convention. Under Section 19, which makes compulsory provision for insurance or other financial security, an operator is required to provide such cover as may be considered appropriate by the Government either by insurance or other means for damage arising either from an occurrence on the site or involving nuclear matter in the course of transport on his behalf. For each site the amount of cover is to be an aggregate of £5 million normally spread over the period of the operator's responsibility, that is to say, the period beginning with the granting of the licence and ending with its termination. In the event of a grave occurrence the Ministry would, however, issue a direction and the licensee's existing cover would be regarded as ear-marked to meet claims arising out of that occurrence (or out of any minor escape of radioactivity before that occurrence). The licensee, assuming that he is permitted to go on using the site, must then provide fresh cover of £5 million against anything happening in a new 'cover period'.

THE INSURANCE POLICY

Liability insurance

A typical policy covering the third party liability of an operator is divided into three parts. Part I, broadly speaking, covers the operator's liability under his domestic nuclear legislation. Under the Convention, nuclear damage means injury or damage arising out of or resulting from the radioactive properties, or a combination of those, and any toxic, explosive or other hazardous properties of nuclear matter. Where damage caused by a conventional occurrence is not reasonably separable from that caused by a nuclear incident, such damage is considered to be damage caused by the nuclear incident. It may be noted that any person who suffers damage caused by a nuclear incident, including employees of the operator, is covered by the Convention and, therefore, must be covered by a policy insuring the operator.

Operators also usually want cover for purely conventional liability damage. It was considered advisable for this non-nuclear damage to be covered by the same insurers as those providing cover for the nuclear risks. In view of this, Part II of a third party liability policy provides non-nuclear cover in respect of accidents on the site for a separate limit of liability which the insured selects in the ordinary way. There is usually a Part III under which cover is given for costs, subject to a limit of, say, 10%, in respect of costs arising under Part I; costs with regard to the non-nuclear cover given by Part II may, as is usual for conventional third party insurance, be unlimited.

Material damage insurance

An operator knows only too well that having spent considerable sums of money on the building and fuelling of a nuclear installation, all or much of this may be lost if there is a serious incident. In consequence, insurance must be made available in respect of damage to the installation by the ordinary perils, e.g. fire, lightning, explosion, impact with aircraft and in suitable cases such special risks as flood, earthquake, riot and civil commotion and malicious damage.

In addition, provision has also to be made in respect of damage that may arise from the nuclear hazards. The first of these can be described as "Excessive temperature within the nuclear reactor consequent upon a sudden uncontrolled unintentional and excessive increase or release of energy or upon the failure of the cooling system". Depending on the circumstances, this could lead to a partial or even total loss of the reactor from a fuel melt-down.

A further consideration is the possibility of radioactive contamination of the insured's property on the site outside the reactor itself. That is, all his property outside the reactor external shield and the primary circuit. To make the operator's protection as complete as possible, the policy may be so worded that cover includes additional costs of decontamination and isolation of contaminated parts.

The policy specification may describe the sums insured on the basis of a blanket amount for all buildings and contents, or they may be individually specified as with an ordinary fire policy. If the blanket method is used, there must be division between the reactor and ancillary buildings and other buildings on the site. Nuclear fuel is always an individual item.

In most countries insurers prefer to specify quite clearly the forms of damage or perils that they will cover in this policy as well as those that they specifically exclude, although in some other countries insurers may use rather different forms of policy.

As in the case of civil liability, it is recommended that both nuclear and other perils be insured in the one policy. The need for this is particularly acute in respect of the risks of damage to the installation itself. Insurers have no historically established named peril with which to express the nuclear cover they provide. The centre of a working reactor can operate in conditions of such great heat as to be tantamount to 'fire'. A reactor incident could arise from conditions which might technically be tantamount to an 'explosion'. Since both 'fire' and 'explosion' are two of the perils intended to provide non-nuclear protection, descriptive headings have had to be established to identify the nuclear cover. But clearly, it could be most difficult after an event to decide with certainty just which came first. Cover for both in the same policy with the same insurers is thus obviously advisable.

The usual form of material damage policy issued to a licensee in the United Kingdom provides a considerable measure of protection for suppliers of goods or services to a nuclear installation. The insured is required by the terms of the policy to agree, to the extent that he is entitled to be indemnified under the policy, that he will not claim indemnity from any person regardless of fault, negligence or breach of any condition or warranty in respect of damage to the insured's property on the site caused by any radioactive contamination or by fire, explosion or excessive temperature each originating within the reactor, and with regard to damage to the reactor or associated buildings caused by fire, explosion or excessive temperature, however arising and wherever originating. The insurers for their part undertake similarly that they will not enforce any rights or seek from other parties any indemnity to which they would otherwise have been entitled.

Other types of insurance cover

Although the great bulk of demand for nuclear insurance is related to either cover against direct damage to the installation or cover for the operator's nuclear and other liabilities to third parties, including, very often, his employees, certain additional classes of insurance customarily available to industry may be required by the operators of nuclear installations. Whether or not such additional policies could be granted, would depend very much upon the availability of insurance capacity, which, as explained earlier, has to be strictly limited in order to enable insurers participating in such insurances to establish quite clearly their net commitments on each nuclear installation.

Consequential losses

The losses of an industrialist whose premises are destroyed by fire extend beyond the cost of repairs. While these are being carried out staff often have to be paid as usual although production and sales may have stopped altogether. This applies, of course, to an accident at a nuclear power station resulting in an interruption of the electricity output. An accident resulting in the shutting down of a reactor usually results in loss of profits and/or standing charges. There is the interruption pending decontamination of the premises. There may be a time lag in obtaining the approval for the resumption of operation. There may well be delay in obtaining replacement of parts, particularly where there is damage to precision and scientific instruments and specialist plant and materials. Radioactivity may prevent or hamper the fire fighters in dealing adequately with a fire or engineers repairing the plant. Cover for financial losses arising from the consequent interruption of operations is in principle available subject to insurance capacity remaining after the material damage insurance requirements have been met.

Where a power reactor is concerned, the objective would be to devise a basis of cover sufficient to meet all (or the bulk of) the 'fixed expenses' with which the operator has to contend, even though for the time being the reactor is shut down and the proceeds from the sale of the electricity are no longer available. The actual form of policy would be similar to that written in the national market concerned for comparable conventional risks, subject to such modifications as may be necessary when dealing with a nuclear installation.

As usual the consequential loss policy would cover precisely the same range of perils as the underlying material damage policy. It would be customary to establish a period of so many months during which, subject to an initial franchise (exclusion from responsibility) of a suitable initial period, the cover would operate. If required, and subject again to the availability of the necessary insurance capacity, a consequential loss cover could be drawn on a sufficiently wide basis as to include within its scope loss of net profit as well as standing charges.

The extent to which in the event of a stoppage the installation operator would be able to bring into operation less efficient generating stations though at correspondingly higher cost than normal would be for examination as well as, for example, his possibility of purchasing a supply of electricity from other sources.

The basis of rating would normally be a percentage of the reactor rate as charged for the material damage policy. The extent of the 'indemnity period' would be a significant factor. If this were to exceed twelve months, the sum insured – representing the annual standing charges and/or net profit – would need to be increased proportionately.

Contingent liabilities of suppliers of goods and services

Another form of insurance for which a demand is sometimes encountered is in the field of contingent liabilities. Outside the world of nuclear insurance there are many forms of additional indemnity cover, which may be granted to concerns or persons who have, or might have, a legal liability in connection with any accident at an insured establishment that causes injury or damage to third parties. Such insurances might relate to the liability of suppliers or manufacturers for their products or services supplied to nuclear installations. They might also relate to the liability of persons providing professional consultancy services, such as insurance brokers or civil engineers. But, under the Conventions liability for 'off-site' nuclear hurt or damage is channelled to the operator of the installation and, in general, it is the intention of Convention-type nuclear legislation everywhere thus to concentrate all liability to third parties, including that of the suppliers and advisers, on to the operator.

Suppliers to an operator in a contracting State are thus protected. Moreover, it would seem that this protection also applies to damage that may be caused to the reactor itself or to property on the site used in connection with the operation of the installation or for the purposes of the construction of the installation. Were it not for this provision, suppliers might be liable under an action for negligence. Circumstances might arise, however, that would leave suppliers of goods or services exposed to certain claims as, for example, in respect of components supplied for 'foreign' reactors. Even though the country of domicile of the supplier has Convention-type legislation, it by no means follows that other countries his goods or services may reach would have followed suit. Considerable costs may be incurred in defending a third party claim brought against a supplier, even although this might be a bad claim in law.

One of the problems facing insurers in connection with requests for products liability or the other forms of contingent liability covers described is that of accumulation of liabilities in respect of a particular site where the operator's own liabilities are insured, or might be insured, by the national nuclear insurance pool. It could happen, even, that a supplier of products would not necessarily know in which of the nuclear installations his goods were being used. Thus, insurers might find themselves involved not only in the operator's own liability insurance but could also face additional claims through some form of contingent liability insurance. Therefore, such policies, whether issued to suppliers or others, would normally have to fix a much lower limit of indemnity than that granted for the operator's own liability requirements to enable insurers to keep their overall potential commitments in relation to each installation within reasonable bounds.

TRANSPORT RISKS AND NUCLEAR-PROPELLED SHIPS

The insurance of nuclear material in transit and, though as yet on a very limited scale, of nuclear-propelled ships are classes to cover usually handled by specialist marine insurers, sometimes through a market pool and sometimes by more traditional methods.

CONCLUSION

It will, I hope, be apparent from what I have said that insurers have made very special efforts to meet the demands of this relatively new and challenging field of nuclear energy. International collaboration has been extensive; the British pool, for one, has already been consulted on nuclear insurance matters in respect of some 40 different countries, spread over all five continents. All the existing pools will be ready to make their experience and expertise available to such nuclear insurance pools as may be formed in your countries as the use of nuclear power spreads in South America.

Countries may be confident, therefore, that the international insurance support to which they have been accustomed in the more conventional field should continue to be available to them, through the medium of the atomic pools, as they embark on the new venture of nuclear power and its associated activities.

LES PROBLEMES PRATIQUES DE LA RESPONSABILITE CIVILE RELATIVE AUX INSTALLATIONS NUCLEAIRES

F. LACROIX
Commission permanente du risque atomique
du Comité européen des assurances,
Bruxelles, Belgique

Abstract–Résumé

PRACTICAL PROBLEMS OF THIRD PARTY LIABILITY CONNECTED WITH NUCLEAR INSTALLATIONS.
A special regime of liability for nuclear damage was established by the Paris Convention, 1960, and the Vienna Convention, 1963. The same basic principles are embodied in both Conventions. Some discrepancies, however, still exist between them despite the adoption of an additional protocol to the Paris Convention in 1964 for harmonization purposes. Practical problems facing insurers and suggestions for suitable solutions are presented. International transport of nuclear material raises, in particular, complex issues. With regard to civil liability arising out of the carriage of nuclear material by sea, a possible conflict between maritime transport conventions and nuclear liability conventions was resolved by the Brussels' Convention, 1971. Wider ratification of the nuclear conventions appears to be the only way for coping with some remaining difficulties, in particular with respect to nuclear material in transit.

LES PROBLEMES PRATIQUES DE LA RESPONSABILITE CIVILE RELATIVE AUX INSTALLATIONS NUCLEAIRES.
Un régime spécial de responsabilité civile relatif aux dommages nucléaires a été institué par les Conventions de Paris, en 1960, et de Vienne, en 1963. Ces deux conventions énoncent les mêmes principes fondamentaux. Il existe encore des différences entre elles, bien que la Convention de Paris ait été modifiée par un protocole additionnel signé à Paris le 28 janvier 1964 pour prévenir tout conflit éventuel avec la Convention de Vienne. L'auteur signale quelques problèmes pratiques qui se posent aux assureurs et suggère des solutions. Les transports internationaux de matières nucléaires, en particulier, posent des problèmes complexes. En ce qui concerne la responsabilité civile liée au transport maritime des matières nucléaires, la Convention de Bruxelles, signée en 1971, a supprimé une possibilité de conflit entre les conventions maritimes et les conventions nucléaires. La ratification des conventions nucléaires est, semble-t-il, le seul moyen de vaincre les quelques difficultés qui subsistent, en particulier en ce qui concerne les matières nucléaires en transit.

Répondant au souhait exprimé par les organisateurs de ces journées d'études, j'examinerai, du point de vue de l'assurance, quelques problèmes pratiques de responsabilité civile relatifs aux installations nucléaires.

Après avoir rappelé succinctement les principes fondamentaux sur lesquels sont basés tous les accords internationaux relatifs à la responsabilité civile dans le domaine nucléaire, j'étudierai les problèmes posés par les installations nucléaires fixes; j'aborderai ensuite ceux concernant les transports internationaux de matières nucléaires.

1. LES CONVENTIONS INTERNATIONALES

Dans leur «Précis des Assurances terrestres en Droit belge» (Bruylant, Bruxelles, 1970) MM.R. Carton de Tournai et P. Van der Meersch s'expriment comme suit: «Etant donné la complexité possible de l'enchaînement des faits générateurs d'un accident nucléaire et la nature des lésions qui peuvent ne se manifester que longtemps après l'accident, les concepts traditionnels de la responsabilité personnelle et de la preuve de celle-ci méconnaîtraient, en la matière, les difficultés que rencontreraient les victimes à faire valoir leurs droits. Ces difficultés s'aggraveraient encore du fait qu'un sinistre du genre peut exercer ses ravages sur le territoire de plusieurs pays et est appelé, dès lors, à être apprécié sous l'angle de systèmes juridiques différents et parfois opposés. Il s'avérait donc opportun de mettre au point un régime spécial de responsabilité civile internationalement applicable».

C'est en se basant sur ces raisons que seize pays européens agissant dans le cadre de l'Organisation de coopération et de développement économiques (OCDE) ont signé le 29 juillet 1960 la Convention de Paris. Cette Convention, entrée en vigueur le 1^er^ avril 1968, est appliquée par huit pays. A l'initiative de l'Agence internationale de l'énergie atomique (AIEA), la Convention de Vienne, de portée quasi mondiale, a été signée le 21 mai 1963. Faute d'un nombre suffisant de ratifications, cette Convention n'est pas encore entrée en vigueur.

Les deux Conventions citées mettent en œuvre les principes fondamentaux suivants:

- la responsabilité est objective et résulte du risque, indépendamment de toute faute;
- elle est canalisée sur l'exploitant de l'installation nucléaire; des dispositions spéciales règlent la question de la responsabilité lors du transport de matières nucléaires;
- elle est limitée dans son montant qui ne peut pas être inférieur à cinq millions de dollars par accident nucléaire;
- elle est limitée dans le temps qui est, en principe, de dix ans à compter de la date de l'accident, un délai supérieur pouvant toutefois, sous certaines conditions, être fixé par la législation nationale;
- obligation pour l'exploitant d'avoir et de maintenir une assurance ou une autre garantie financière correspondant au type et aux conditions déterminés par l'autorité publique compétente.

Le régime d'exception institué par les Conventions de Paris et de Vienne est limité aux risques de caractère exceptionnel. Chaque fois que des risques, même liés à des activités nucléaires, peuvent être normalement soumis aux règles et usages du droit commun, ils restent en dehors du domaine des Conventions. C'est ainsi que les dommages causés lors de la préparation, de la fabrication, du stockage et du transport d'uranium naturel ou appauvri et ceux résultant de l'utilisation de radioisotopes en dehors d'une installation nucléaire restent régis par le droit commun.

En vertu de l'Article 2 de la Convention de Paris, celle-ci ne s'applique ni aux accidents nucléaires survenus sur le territoire d'Etats non contractants, ni aux dommages subis sur ces territoires.

En ce qui concerne la Convention de Vienne, qui ne contient pas de disposition semblable à celle de l'Article 2 de la Convention de Paris, le Comité permanent sur la responsabilité civile[1] a été d'avis que la Convention

[1] Voir document AIEA CN-12/SL/9 § 5 du 27 août 1964, et Actes officiels de la Conférence internationale sur la responsabilité civile en matière de dommages nucléaires (Vienne, 29 avril - 19 mai 1963), Collection juridique, n°2, AIEA, Vienne (1964).

de Vienne s'applique seulement entre les Parties contractantes et ne crée ni droits ni obligations pour les Etats non contractants. Le Comité a notamment été d'avis que le dommage nucléaire subi sur le territoire d'Etats non contractants ne serait pas considéré comme un dommage couvert par la Convention de Vienne, même si l'accident nucléaire causant ce dommage survenait sur le territoire d'un Etat contractant, ou en haute mer, ou au-dessus.

Bien que la Convention de Paris ait été modifiée par un protocole additionnel signé à Paris le 28 janvier 1964 pour prévenir tout conflit éventuel avec la Convention de Vienne, signalons qu'il existe encore certaines différences entre les deux Conventions.

2. LES INSTALLATIONS NUCLEAIRES FIXES

En vertu des Conventions, l'exploitant d'une installation nucléaire est, d'une part, responsable de tout dommage nucléaire dont il est prouvé qu'il a été causé par un accident nucléaire survenu dans cette installation nucléaire ou mettant en jeu des matières nucléaires provenant de cette installation et, d'autre part, tenu d'avoir et de maintenir une assurance ou une autre garantie financière couvrant sa responsabilité pour les dommages nucléaires.

Dans leurs grandes lignes, les contrats émis par les assureurs nucléaires européens ont été adaptés aux caractéristiques de ce droit nouveau. Les polices émises par la plupart des assureurs de l'Europe continentale couvrent les conséquences pécuniaires de la responsabilité civile non contractuelle encourue par l'exploitant d'une installation nucléaire à raison des dommages causés par un accident nucléaire mettant en jeu des combustibles nucléaires, produits ou déchets radioactifs détenus dans l'installation ou en provenant. Toutefois, ces polices ne couvrent pas la responsabilité civile pour les dommages causés par des matières nucléaires qui se trouvent hors de l'installation nucléaire, si l'accident survient au cours ou à l'occasion du transport de ces matières.

Plusieurs problèmes se sont posés aux assureurs à l'occasion de la rédaction de ces polices.

a) Le premier concerne la définition de l'installation nucléaire. Les Conventions précisent qu'«installation nucléaire» signifie:

- tout réacteur nucléaire à l'exclusion de ceux qui font partie d'un moyen de transport;
- toute usine utilisant du combustible nucléaire pour la production de matières nucléaires et toute usine de traitement de matières nucléaires, y compris les usines de traitement de combustible nucléaire irradié;
- tout stockage de matières nucléaires, à l'exclusion des stockages en cours de transports.

Or, actuellement, la plupart des installations nucléaires comportent plusieurs «installations nucléaires» au sens des Conventions. Les centrales électro-nucléaires sont pour la plupart constituées par plusieurs réacteurs et les centres d'étude comprennent en général plusieurs réacteurs expérimentaux ou de recherches, des installations de stockage de déchets radioactifs et parfois des établissements de fabrication de combustibles nucléaires.

L'application littérale des Conventions entraînerait la nécessité, pour les assureurs, de donner une garantie distincte pour chacune de ces «installations nucléaires». Aussi les assureurs demandent-ils que les Etats fassent usage de la possibilité offerte par la Convention de Vienne précisant que l'Etat peut considérer comme une seule installation nucléaire plusieurs installations nucléaires se trouvant sur le même site et dont un même exploitant est responsable.

Par ailleurs, les assureurs souhaitent que l'autorité nationale compétente précise ce qu'il faut entendre par site d'une installation en la définissant par exemple par son périmètre.

b) L'exploitant n'est pas responsable, en vertu des Conventions, du dommage nucléaire causé à l'installation nucléaire elle-même ou aux biens qui se trouvent sur le site de cette installation et qui sont ou doivent être utilisés en rapport avec elle. L'interprétation de ces dispositions a donné lieu à de nombreuses discussions. Certains estiment qu'il n'existe aucune responsabilité pour ces dommages. D'autres pensent qu'il peut exister une responsabilité en dehors des Conventions et qu'elles permettent la conclusion de contrats spéciaux pour régler la responsabilité des fournisseurs et autres personnes pour de tels dommages. Mais la question de savoir qui sera responsable en l'absence de tels contrats n'est pas résolue. Les assureurs demandent que les autorités compétentes précisent dans les lois nationales d'application des Conventions l'exclusion formelle de toute responsabilité des fournisseurs et autres personnes pour de tels dommages, sauf dans le cas d'un contrat écrit. Les assureurs signalent, en outre, qu'ils ne sont pas en mesure d'assurer par des polices multiples la responsabilité de plusieurs fournisseurs pour ces dommages. Ils rappellent que la souscription par l'exploitant d'une police d'assurance des dommages matériels avec un large abandon de recours résoud le problème, quelles que soient les dispositions légales existantes.

c) Le montant maximum de la responsabilité civile de l'exploitant est fixé par la loi nationale. Ce montant ne peut pas être inférieur à cinq millions de dollars par accident nucléaire. En pratique, les assureurs accordent une garantie par accident nucléaire égale au montant fixé par la loi, mais les polices prévoient également un montant de garantie par installation pour une durée déterminée. Ce dernier montant, qui est supérieur à celui fixé par accident, constitue la limite maximum de l'engagement des assureurs, quel que soit le nombre des accidents nucléaires survenant dans l'installation pendant la période considérée.

Par ailleurs, les assureurs souhaitent que les autorités compétentes envisagent la possibilité de moduler le montant maximum de la responsabilité de l'exploitant à l'importance réelle du risque. Ils estiment que les risques potentiels existant dans les grandes centrales nucléaires ne sont pas comparables à ceux créés par de petites usines de fabrication de combustibles nucléaires, par exemple.

d) Les polices prévoient, en général, que la responsabilité couverte est celle qui résulte du droit applicable à l'accident nucléaire. Elles stipulent, en outre, que les jugements rendus par le tribunal d'un pays qui n'a pas adhéré à la Convention ne donnera lieu au paiement des indemnités par l'assureur que si ces paiements sont rendus exécutoires dans un pays ayant adhéré à cette Convention. Il s'agit de l'indemnisation des dommages subis sur le territoire d'un Etat non contractant dont je parlerai plus longuement dans le chapitre des transports internationaux de matières nucléaires.

3. LES TRANSPORTS INTERNATIONAUX DE MATIERES NUCLEAIRES

a) L'exploitant d'une installation nucléaire n'est pas seulement responsable du dommage causé par un accident nucléaire survenu dans son installation; sa responsabilité peut s'étendre également au dommage causé par un accident nucléaire mettant en jeu une matière nucléaire qui provient ou émane de cette installation ou encore qui est envoyée à cette installation. Nous abordons ici l'assurance de la responsabilité découlant du transport des matières nucléaires et les problèmes complexes qu'elle soulève.

b) Ainsi que je l'ai rappelé, seule la Convention de Paris est actuellement en vigueur entre huit pays européens. Or, les transports internationaux ne se limitent pas aux territoires de ces seuls pays et il est normal que les exploitants souhaitent obtenir une garantie complète qui couvre les demandes d'indemnisation introduites en vertu de tout régime juridique susceptible de mettre en cause leur responsabilité. Mais le droit applicable aux accidents nucléaires survenant dans les pays non contractants n'est pas toujours connu avec précision et les assureurs nucléaires se trouvent en porte à faux, n'ayant parfois qu'une connaissance approximative de la limite de leurs engagements. Les difficultés sont encore accrues par le fait que certains pays exigent une assurance émise par une compagnie d'assurances habilitée à couvrir des risques dans leur propre pays. Il en résulte souvent la nécessité pour l'exploitant de souscrire plusieurs polices successives au cours d'un même transport auprès d'assureurs différents. Pour résoudre ces problèmes, il serait nécessaire que le régime spécial institué par les Conventions soit applicable dans la plupart des pays.

c) Les Conventions instituent un régime unique de responsabilité de l'exploitant, tant pour les accidents survenant dans son installation que pour les accidents survenant en cours de transport. En fixant le principe d'une obligation d'assurance, les Conventions permettent tout aussi bien à l'exploitant de faire couvrir sa responsabilité pour les deux catégories d'accidents par un seul et même contrat que de souscrire un contrat distinct pour chaque catégorie. Les deux solutions sont utilisées, mais à l'heure actuelle, la majorité des assureurs de l'Europe continentale se prononcent en faveur de contrats distincts.

d) La police peut revêtir la forme soit d'une police particulière pour chaque transport, soit, ce qui est généralement le cas, d'une police-abonnement. Dans le champ d'application des Conventions de Paris et de Vienne, ces polices couvrent, dans les limites précisées au contrat, les conséquences pécuniaires de la responsabilité civile non contractuelle encourue par l'exploitant du fait des dommages causés par un ou plusieurs accidents nucléaires survenant au cours ou à l'occasion du ou des transports garantis. Bien que l'exploitant soit tenu, aux termes des Conventions, de disposer d'une garantie pour chaque accident nucléaire, jusqu'à concurrence du montant maximum de la responsabilité, la limite d'engagement des assureurs est stipulée pour l'ensemble des conséquences des accidents nucléaires, survenant au cours d'un même transport garanti (garantie par transport).

e) La responsabilité couverte par la police est celle qui résulte du droit applicable à l'accident nucléaire. Si ce dernier survient sur le territoire d'un Etat non contractant ou si les dommages sont subis sur ce territoire, les Conventions de Paris et de Vienne ne sont, en principe, pas applicables. Mais l'exploitant peut être rendu responsable des dommages causés sur la base du droit applicable. Les polices d'assurance couvrent dans ce cas la responsabilité non contractuelle encourue par l'exploitant ou par d'autres assurés désignés dans le contrat, mais uniquement dans la mesure où les dommages sont causés par un accident nucléaire au sens des Conventions nucléaires et sous les mêmes conditions d'assurance (mêmes limitations dans le montant et dans le temps, et mêmes exclusions).

Mais ici un problème se pose aux assureurs. L'Article VII, paragraphe 3, de la Convention de Vienne stipule que les fonds provenant d'une assurance ou de toute autre garantie financière sont exclusivement réservés à la réparation due en application de cette Convention. Il en résulte que l'exploitant aurait besoin d'une deuxième garantie pour indemniser les dommages ne tombant pas sous l'application de la Convention de Vienne. La mise à la disposition de l'exploitant de deux montants de garantie susceptibles de se cumuler pose aux assureurs un problème de capacité de souscription jusqu'à présent non résolu.

f) Les Conventions de Paris et de Vienne ont exclu la responsabilité de l'exploitant pour les dommages au moyen de transport à bord duquel les substances nucléaires se trouvent au moment de l'accident nucléaire. Mais elles ont accordé aux Etats contractants la faculté d'introduire à nouveau cette responsabilité, par voie législative, à condition qu'en aucun cas l'inclusion des dommages au moyen de transport n'ait pour effet de réduire la responsabilité de l'exploitant pour les autres dommages à un montant inférieur à 5 millions de dollars. Dans les divers marchés, les contrats d'assurance relatifs à la responsabilité de l'exploitant pour les transports de matières nucléaires stipulent, en principe, l'exclusion des dommages au moyen de transport, mais prévoient la possibilité d'une réinclusion moyennant le paiement d'une prime adéquate. En conséquence, si la loi nationale inclut les dommages au moyen de transport dans la responsabilité civile de l'exploitant, les assureurs de la responsabilité civile couvrent ces dommages jusqu'à concurrence d'un montant limité par les Conventions. Compte tenu de cette limitation de garantie, le problème ne se trouve certes pas résolu de manière satisfaisante pour les transporteurs. Ce n'est que dans la mesure où les dommages subis par les autres lésés n'atteignent pas un montant trop élevé que l'armateur, par exemple, sera indemnisé des dommages subis par son navire.

Cependant, les Conventions de Paris et de Vienne prévoient une exception à la responsabilité exclusive de l'exploitant nucléaire. Cette exception a pour conséquence de permettre de retenir la responsabilité du transporteur en vertu des Conventions internationales de transport. De l'application concurrente du droit nucléaire et du droit maritime, il peut donc résulter une double responsabilité, celle de l'exploitant, précisée par les Conventions nucléaires, et celle du transporteur, découlant du droit maritime. La responsabilité de l'exploitant nucléaire, qui n'est en aucune manière affectée par celle retenue à charge du transporteur, est couverte dans les conditions que je viens de rappeler. Mais étant donné la possibilité pour les transporteurs maritimes d'être rendus responsables sans limitation aux termes des Conventions internationales et des lois nationales applicables dans le domaine du transport maritime, ceux-ci ont exigé une garantie illimitée de la part des exploitants nucléaires. Les assureurs ne sont pas à même de fournir cette garantie et les transports par mer de matières nucléaires ont été rendus pratiquement impossibles.

Pour résoudre ces difficultés, une Convention relative à la responsabilité civile dans le domaine du transport maritime de matières nucléaires a été signée à Bruxelles, le 17 décembre 1971. Dans sa première partie, l'Article premier de cette Convention exonère le transporteur de sa responsabilité en vertu du droit maritime pour les dommages causés par un accident nucléaire si l'exploitant d'une installation nucléaire est responsable en vertu de l'une ou l'autre des Conventions de Paris ou de Vienne. Pour que le transporteur puisse être exonéré de sa responsabilité pour les dommages nucléaires, il suffit donc que l'exploitant qui expédie les matières nucléaires ou celui qui les reçoit soit responsable en vertu de l'une de ces Conventions, ce qui exige qu'actuellement le pays de l'exploitant expéditeur ou celui de l'exploitant destinataire ait ratifié la Convention de Paris qui est la seule a être en vigueur.

Mais les Conventions nucléaires ne s'appliquent ni aux accidents nucléaires survenus sur le territoire d'Etats non contractants, ni aux dommages subis sur ces territoires. Il en résulte que pour les dommages en cause, il n'existera pas d'exploitant responsable en vertu de ces Conventions, que l'Article premier, paragraphe a, de la nouvelle Convention ne pourra pas s'appliquer et que le transporteur pourrait être rendu responsable en vertu du droit maritime. Néanmoins, les transports de matières nucléaires seront réellement facilités dans de nombreux cas par l'entrée en vigueur de la nouvelle Convention, mais je crois que certaines difficultés ne pourront être résolues que par la ratification rapide des Conventions nucléaires par la plupart des Etats intéressés. Je pense en particulier aux problèmes découlant du transit des matières nucléaires à travers le territoire des pays non contractants.

Telles sont les quelques réflexions que je souhaitais développer. Le sujet est loin d'être épuisé et beaucoup d'autres problèmes pourraient être soulevés.

Malgré toutes les difficultés qui subsistent, les assureurs ont répondu à toutes les demandes de couverture qui leur ont été adressées, tant pour l'assurance des installations fixes que pour celles des transports internationaux de matières nucléaires. Je formule le souhait que, par votre action personnelle dans vos pays respectifs et à l'aide des conseils de l'Agence internationale de l'énergie atomique, vous puissiez contribuer à l'élimination des difficultés qui subsistent et nous rendre ainsi la tâche plus aisée.

NOTES ON THIRD PARTY LIABILITY FOR NUCLEAR DAMAGE IN CONNECTION WITH THE CONSTRUCTION OF THE FIRST NUCLEAR POWER PLANT IN BRAZIL

A.C. SIMÕES
National Nuclear Energy Commission (CNEN),
Rio di Janeiro, GB,
Brazil

Abstract

NOTES ON THIRD PARTY LIABILITY FOR NUCLEAR DAMAGE IN CONNECTION WITH THE CONSTRUCTION OF THE FIRST NUCLEAR POWER PLANT IN BRAZIL.

Responsibilities for the construction and operation of the first nuclear power plant have been transferred from the National Nuclear Energy Commission to Electrobrás, a public undertaking set up for this purpose. In view of such transfer of responsibilities and the implementation of further nuclear power projects, liability for nuclear damage has to be regulated in a way consistent with international conventions. A working group associating representatives of national authorities and public utilities was entrusted with the task of drafting rules for co-ordinating their respective activities in relation to the execution of the first nuclear power project; these rules were issued by Ministerial order in 1970. The working group also prepared a draft law on civil liability for nuclear damage, based on the Vienna Convention. This draft law has reached its final stage and, after promulgation, will enable Brazil to ratify the Vienna Convention.

The commencement of construction work on the first Brazilian nuclear power plant at Angra dos Reis has had significant repercussions in the field of Brazilian nuclear law and bears out the need to elaborate a new juridical system aimed at providing an adequate framework for the wide-scale utilization of nuclear energy. Nuclear activities in Brazil for industrial purposes have been developed on the initiative of the National Nuclear Energy Commission (CNEN), which has played a pioneering role in technological research and in preparing the basic conditions for the effective utilization of nuclear power. The CNEN, as an autonomous agency connected with the Ministry of Mines and Power, has an independent juridical status of public law and financial autonomy and is responsible for the implementation of all phases of the national nuclear energy programme.

Perhaps because it is a Government agency, the question of third party liability for nuclear damage has not arisen earlier as a factor entailing a pressing need for innovation in the traditional juridical institutions in so far as such liability arising from nuclear installations of the CNEN, if excessive, would ultimately be shouldered by the Federal Government itself.

The rapid development of power reactors of greater size and generating capacity has, however, given new dimensions to the problem and has led CNEN to reformulate its initial plans. Rather than construct and operate the first nuclear power plant itself, it has decided to transfer that task to Eletrobrás (Centrais Elétricas Brasileiras S.A.), a semi-public company organized as a share corporation and with Federal Government participation to the extent of 51% of the voting stock.

The agreement signed on 25 April 1963 between the CNEN and Eletrobrás S.A. embodied in writing this new policy and, at the same time, gave priority to studies for the establishment of a new juridical system aimed at providing rules for nuclear liability. This was due, among other things, to the fact that although Eletrobrás S.A. is a semi-public company set up on the initiative of the government and is also connected with the Ministry of Mines and Power, from a juridical standpoint it belongs to the private corporations to which the rules of private law apply.

As a holding company Electrobrás S.A. controls a number of subsidiary companies in which it holds a minimum of 51% of the stock and which are operating in different regions of Brazil. Of these subsidiaries, Centrais Elétricas De Furnas, S.A. has been selected to construct and operate the first nuclear power plant, not only because its area of activity is the South-Central Region of Brazil where the plant is to be located, but also because Furnas was considered to be in the best technical and operational position for such an undertaking. Furnas is a corporation that holds a concession for federal public power supply, under share control of Electrobrás. It is included in the range of state public service companies but juridically it comes under private law.

In view of the legal issues involved, as early as 1969 CNEN set up a working group that brought together technicians and jurists from its own organization together with those from Eletrobrás, Furnas, and the Waterways and Electrical Power Department. The group drew up rules for co-ordinating the activities of these agencies in the construction and operation of the first nuclear power plant. These rules were approved by the Ministry of Mines and Power under Dispatch No. 108/70.

The working group also drew up a draft law on third party liability for nuclear damage that adopted the basic principles of the Vienna Convention as follows:

(a) Exclusive liability of the operator of a nuclear installation for any nuclear damage caused by nuclear accidents occurring in his installation or caused by nuclear materials during transport from or to his installation, under the conditions stipulated in Article II of the Vienna Convention;

(b) The operator's liability is independent of any fault or negligence on his part, and only a link of causation between the accident and the damage has to be proved by the victim;

(c) The operator is exonerated from liability in relation to a victim causing the nuclear accident intentionally or by gross negligence;

(d) Non-application of these rules to workers in a nuclear installation, who shall have their rights covered by special legislation on workmen's compensation;

(e) Non-application of these rules to damage caused to the nuclear installation itself or to items intended for use in the installation, or to the means of transport on which the nuclear material giving rise to the nuclear accident is located;

(f) Limitation of the operator's liability to an amount equivalent to US $50 million;

(g) A criterion of pro rata application with preference being given to personal damage over material damage;

(h) The Federal Courts are competent to deal with suits relating to compensation for nuclear damages;

(i) The operator's liability is limited to ten years from the date of the accident; in the case of an accident caused by materials stolen, lost or abandoned, the extinction period is not to exceed 20 years from date of theft, loss or abandonment of such materials;

(j) The operator is required to maintain insurance or other financial guarantees to cover his liability.

The draft law in question is in the final study phase in the Ministry of Mines and Power. After conclusion of the studies in question, it will be submitted to the President of the Republic who will forward it to the National Congress. The objective is to have the law voted on and promulgated reasonably far in advance of the delivery of nuclear fuel for the operating tests at the nuclear power plant, which should take place in 1976 in line with the time-schedule for construction.

We expect to be then in a position to ratify the Vienna Convention, which still requires a fifth instrument of ratification to enter into force.

The preliminary construction work for the plant started in 1971 at Angra dos Reis, on the coast of the state of Rio de Janeiro, with preparations for the building area and improvement of the access roads. At the same time an evaluation was made of the bids presented under an international call for tenders, following which a construction contract was signed in April 1972.

Excavation work has been completed and construction is proceeding on the foundations for the building that will house the pressurized water reactor operating with enriched uranium and having a generating capacity of the order of 600 MW(e).

The facility should be totally completed and ready to receive the fuel elements by 1976, when it is expected that power from the unit will be fed into the distribution network.

Within the purview of the draft law on nuclear liability, Furnas will be the operator of the nuclear power plant under construction, CNEN being responsible for the establishment of regulations and for control and supervision of the nuclear aspects of the plant.

CNEN has already drawn up rules for siting power reactors (CNEN Resolution No. 09/69), regulations for issuing licences (CNEN resolution No. 06/72), basic safety rules, and is completing draft rules for radiological protection, covering transport, handling and storage of radioactive materials, thus completing the necessary regulatory work for ensuring the safe implementation of the first nuclear power project in the country.

Concurrently, the National Private Insurance Council, a mixed standard-issuing body composed of representatives from both the public and the private sectors, is engaged in studies on nuclear insurance. In accordance with the Brazilian insurance system, it is the duty of the Reinsurance Institute of Brazil (IRB) to establish rules on co-insurance, reinsurance and reversion, including the distribution of risks amongst Brazilian companies where the insurance coverage is provided by a government company, as well as placement of coverage abroad. The law stipulates the possibility of undertakings by the Federal Government, through the IRB, with respect to catastrophic risks coverage, provided such action is construed to be in the interests of the economy and security of the country. This means that the field is left open for the State's guarantee and intervention with regard to insurance against nuclear risks, although no definite decision has been taken on the matter.

IAEA SAFEGUARDS AND THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS*

R.M. STEIN
Legal Division,
International Atomic Energy Agency,
Vienna

Abstract

IAEA SAFEGUARDS AND THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS.

IAEA safeguards responsibilities stem from specific statutory provisions. Different types of agreements are concluded by the Agency with Member States for safeguards application: project agreements, safeguards transfer agreements, unilateral submission agreements. States party to the Non-Proliferation Treaty are required to enter into safeguards agreements with the Agency. The principal objective of NPT is horizontal non-proliferation as opposed to vertical non-proliferation. The background to NPT, the basic undertakings provided for therein and their scope of application are described. An analytical study is made of the structure and content of safeguards agreements connected with NPT. Annexes giving the status of safeguards agreements, whether under NPT or not, and of ratification or accession to NPT, and the parties to the Tlatelolco Treaty are also included.

INTRODUCTION

The subject of IAEA safeguards and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT)[1] is one of the utmost importance today. To see more clearly the context of the Agency's role in this connection, I should first like to discuss IAEA safeguards in general – IAEA safeguards as they existed and continue to exist, both before and after the NPT and then speak about the Treaty and the safeguards that are being applied in connection therewith.

1. IAEA SAFEGUARDS

1.1. Statutory basis

Of the legal documents that form the bases for IAEA safeguards there is, first, the Statute of the Agency itself, which provides that there will be a system of safeguards that may be applied in various instances; Article III. A.5 provides that "the Agency is authorized to establish and administer safeguards designed to ensure that special fissionable and other material, services, equipment, facilities, and information made available by the Agency or at its request or under its supervision or control are not used in such a way as to further any military purpose". This is a basic statutory obligation

---

* The Annexes have been updated to take in changes up to December 1974.

[1] IAEA, Legal Series No. 9 "International Treaties Relating to Nuclear Control and Disarmament", Vienna, 1975, pages 35-40.

vested in the Agency. One can see that, in fact, there is a slight difference between the original objective, which remains the objective of safeguards applied in respect of materials, services, etc. supplied by or through the Agency, and safeguards that are to be applied under the NPT.

The Statute goes on to provide that safeguards may be applied either at the request of the parties to a bilateral or multilateral arrangement, or at the request of a State, to any of that State's activities in the field of atomic energy. Consequently, we have safeguards that are applied automatically and in a mandatory way by the Agency by means of project agreements when the Agency is involved in the supply of material or equipment. Another possibility is that parties to an agreement of some kind may request that the Agency apply safeguards in connection therewith. Finally, a single State may simply request that safeguards be applied to certain, or all, of its nuclear activities.

1.2. Types of agreements

Project agreements always include safeguards provisions accompanied by an Annex that provides for the application of Agency safeguards. It might be mentioned that, at present, in our project agreement where a country that benefits from the assistance of the Agency is already a party to NPT and has concluded an agreement for safeguards in connection therewith, we provide in the project agreement that the safeguards being applied in connection with NPT will satisfy our requirements; but we also include a proviso that, if for some reason the country should withdraw from NPT, we shall then agree on safeguards provisions in line with the Agency's statutory obligation[2]. Agency safeguards thus began, primarily, in the realm of project agreements.

Safeguards transfer agreements are of a different kind (this is a term which we have created and which merely refers to the second part, which I read from Article III.A.5 of the Statute: that is, parties to a bilateral agreement may request that Agency safeguards be applied thereto). A great number of bilateral co-operation agreements exist between, in particular, the United States of America and many countries in the world and between the United Kingdom or Canada and other countries. The parties to many of these agreements have requested, at one time or another, that the Agency accept the responsibility of applying safeguards in connection with such agreements. Most of these bilateral agreements have specific provisions in respect of safeguards and usually provide that the country that is supplying the material or the equipment will apply its own safeguards in the country to which the material or equipment is supplied. The Agency, through a trilateral agreement, then takes the responsibility of applying its safeguards to the material and equipment in the receiving country; often there is a reciprocal arrangement whereby if material is returned to the supplying country, the Agency may apply safeguards in the supplying country as well but this provision is not necessarily included in all transfer agreements.

Beginning in the mid-1960s, a number of safeguards transfer agreements were signed and brought into force. A current list of project agreements and safeguards transfer agreements under which the Agency is applying

---

[2] See, e.g., INFCIRC/206, part II, Article IV.

safeguards is reproduced in Annex A. Some of these agreements, which show very recent dates, are, in fact, agreements that existed earlier and have either been renewed or amended. This is really where Agency safeguards were, so to speak, run in, or did their teething. This is where we learned how to apply safeguards in fact, because whilst it is very nice to have a treaty and other provisions which you find in the Statute as well providing for the application of safeguards, it is quite another thing to actually apply them; as one can imagine, there are a number of legal and — even more important — technical questions that must be resolved before one can apply safeguards.

Safeguards are not simply a political question. They are, perhaps, in the first instance, a political question, but the real application of safeguards is very much a technical question with certain political aspects. The application of safeguards means that the Agency is actually controlling the use of atomic energy to a great extent within a country and sending inspectors to that country, although traditionally this kind of thing, in fact, would have been refused — and some years ago it was — by many countries. Today, it is being accepted by more and more countries, either through safeguards transfer agreements or through the NPT safeguards agreements.

There is still a third statutory category, which we often refer to as unilateral submission agreements, and we have had a few of these. The Agency concluded such agreements with the United Kingdom and with the United States of America to exercise safeguards on certain facilities in these countries. They were, at that time (they have both expired now), really more for the purpose of training and development in safeguards than anything else, because we were able to safeguard certain facilities that were of great technical interest in these countries. We have some other unilateral submissions, the most recent of which is one from Argentina, which was approved in June 1973 by the Board of Governors and is in connection with the Atucha power plant[3]. We also had what we referred to as a unilateral submission by Mexico[4] but which was replaced by a later agreement signed in connection with both NPT and the Tlatelolco Treaty[5].

That was then the scope of Agency safeguards, broadly speaking, until the Non-Proliferation Treaty. They were quite important by the time the NPT was signed, but they were, nevertheless, always partial safeguards, with the one exception of the Mexican agreement signed in 1968; but until that time we had had no agreement that was a general safeguards agreement. I mean thereby that under safeguards transfer agreements, for example, or project agreements, safeguards were applied to particular material or to particular equipment, or to a reactor to be supplied pursuant to that agreement. The safeguards attached to that material, equipment or facility followed the material if it were to go somewhere else, and followed the material that was produced by using that initial material and subsequent generations thereof; but, nevertheless, these safeguards were limited in scope. In fact, in many countries the safeguards being applied under these

---

[3] INFCIRC/168.

[4] INFCIRC/118.

[5] INFCIRC/197. — See, for the text of the Tlatelolco Treaty, IAEA Legal Series No. 9, pages 17-33. A list of States party to that Treaty is reproduced in Annex C.

limited kinds of agreements are general safeguards in that they constitute safeguards on all, or almost all, activities in the country — or at least any activities that would be susceptible of leading eventually to the production of nuclear weapons. And this is the case in many countries where we have what one may refer to as 'partial safeguards', which, in fact, at the moment, are practically complete safeguards even though the country has not submitted all material to IAEA safeguards.

2. THE TREATY ON THE NON-PROLIFERATION OF NUCLEAR WEAPONS

2.1. Framework of the negotiation

Discussions on the NPT took place later. Actually, the formal negotiation of the Treaty took place in Geneva at the Disarmament Conference, but the NPT, just as had been the case for the Moscow Partial Test Ban Treaty, was negotiated largely outside the Conference. In the case of NPT, although much of the negotiation took place directly between the United States and the USSR, a number of Non-Nuclear-Weapon States were not prepared to accept that the provisions of a Treaty concerned principally with the Non-Nuclear-Weapon States be decided without them. The nuclear powers were constrained to consult much more widely than had been the case with the elaboration of the Moscow Treaty. The Conference of the Non-Nuclear-Weapon States held in Geneva discussed various drafts and there were also a great number of bilateral contacts by the nuclear powers with Non-Nuclear-Weapon States. Many suggestions were made and the draft that was finally presented, as I recall in 1967, took account of many of the objections that had been raised by Non-Nuclear-Weapon States; the final text then reflects very largely the preoccupations of the Non-Nuclear-Weapon States. For some, it does not reflect them enough — for others, it does. But this Treaty is a legal/political compromise as any treaty of this kind must inevitably be.

2.2. Principal purposes of NPT

The NPT itself is concerned primarily, as the title says, with the non-proliferation of nuclear weapons. However, reference is often made to two kinds of non-proliferation, vertical non-proliferation and horizontal non-proliferation. Vertical non-proliferation means that a particular country might, or might not, increase the number of its nuclear weapons; horizontal proliferation means that there may be proliferation of the number of countries that have nuclear weapons.

The NPT is one which aims primarily at horizontal non-proliferation because it limits the number of Nuclear Weapon States, which is the official term of the Treaty. It limits it to those States that had exploded a nuclear device on or before 1 January 1967. In fact, there are only five such States recognized by the terms of the Treaty: the USA, the USSR, the United Kingdom, France and China. Three of these countries have signed and ratified the Treaty — in fact, they are the promoters of the Treaty — and two, France and China, have not signed the Treaty; in fact the latter have made it well known, and China has made it very well known recently, that at least at the moment they have no intention of signing the NPT. The position of France is a bit more nuancée in that the French Government has stated that it would not sign the NPT, in particular since this was a treaty that provided for actual nuclear disarmament. However, the French Government stated that it would conduct itself as if it had actually become a party to the Treaty and I think that this may quite fairly be said to be the case, because we have signed safeguards agreements with France where France has supplied nuclear material since the coming into force of NPT[6]. But clearly, of course, France is not legally bound by NPT — France has, instead, voluntarily undertaken a moral obligation related to the Treaty.

2.3. Basic undertakings

With respect to the basic undertakings of the Treaty itself, I should like to make a brief analysis of these, perhaps grouped in my own particular way, but which may help to understand generally the Treaty. Of course, the Treaty is a very short one indeed, and one could talk about every single word because each word virtually has its legal importance. Rather than do that, however, I should prefer to take them in general groupings.

There are first what I think might be called, and this is not an official term at all, the basic undertakings of the Treaty. These are found in Articles I, II and III of the Treaty. The first undertaking, or group of undertakings, really is that of the Nuclear-Weapon States, i.e. those States that had nuclear weapons before 1967. Each Nuclear-Weapon State undertakes not to transfer to any recipient nuclear weapons or other explosive devices or, and this is quite important, control over such nuclear weapons or other explosive devices, directly or indirectly. The Treaty goes on to say that they shall not encourage, assist, etc. Non-Nuclear-Weapon States in acquiring weapons or explosive devices. It is important to know, first, that in the opening part of the Treaty it is stipulated that Nuclear-Weapon States will not transfer such weapons or devices to any recipient whatsoever — that means to anyone, any State, and includes Nuclear-Weapon States for that matter. The terms are quite clearly distinguished from the terms that are used later, because the provisions go on to say that these countries will not assist, etc. any Non-Nuclear-Weapon State to manufacture, acquire, etc. such weapons or devices. There is, therefore, a difference between the two obligations of the Nuclear-Weapon States. It is probably important to mention as well, and this was really part of the negotiation of the Treaty, the problem of the transit or stationing of nuclear weapons in a Non-Nuclear-Weapon State. NPT provides not only that Nuclear-Weapon States will not transfer nuclear weapons or devices to any recipient whatsoever but that will not transfer the control of such weapons or devices to any recipient either. The word "control" was very carefully chosen, because in fact it was clearly understood, and this was an important point, that Nuclear-Weapon States might still continue to have their own nuclear weapons in the territory of a Non-Nuclear-Weapon State to the extent that they maintained control over such nuclear weapons. This had to be understood and was, in fact, a crucial point for the Nuclear-Weapon States because of the defence agreements to which they are party. This may be considered as a weakness of the Treaty but, on the other hand, quite

---

[6] See, e.g., the Safeguards Transfer Agreement of 1972 between the IAEA, France and Japan, INFCIRC/171.

frankly, it is very unlikely that a Nuclear-Weapon State would hand over control of nuclear weapons to a Non-Nuclear-Weapon State. After all, they have established a de facto and de jure monopoly. Why should they give them to some other State? This does not make sense. So this is a provision that is being respected and undoubtedly will continue to be respected. The Non-Nuclear-Weapon States undertake in Article II — this may be considered as the other side of the coin — that they will not receive nuclear weapons or explosive devices and they will not manufacture them etc; it is exactly the opposite of the undertaking by the Nuclear-Weapon States.

Then, in Article III, paragraph 2, it is stated that each State party to the Treaty will not provide material, equipment, etc. unless that material shall be subject to safeguards as required in this Article. There, again, we have what I have called a basic undertaking of all States party to NPT.

2.4. Scope of undertakings

It is important to consider the scope of the undertakings involved. In Article III, paragraph 1, in fine, one can see that safeguards are to be applied to all nuclear material (this is very important) in all peaceful nuclear activities. Then, we have the territorial scope of application, which is defined as covering material within the territory of the State (this is relatively easy to understand) or under the jurisdiction of the State (this becomes more complicated, although jurisdiction is a fairly well defined term in international law, so that jurisdiction could quite clearly be elsewhere than in the territory). Presumably, if nuclear material is within the territory of the State, there will be jurisdiction at the same time, as it is, in fact, one of the requirements of the concept of territory for the State to have control or jurisdiction over its territory. But jurisdiction could mean something else — it could mean very simply a nuclear-powered ship or a ship with nuclear weapons. This could be considered by some to be under the jurisdiction of the State — without going into some very interesting legal problems on jurisdiction of ships, aircraft and other means of transport, let us accept that, in a general way, they are under the State's jurisdiction. In any case, this means that first there is "territory", then "jurisdiction", which goes a bit further — and, finally, yet another concept that is rather special, that is, peaceful nuclear activities carried out under the State's "control anywhere". This is very broad and the term is not defined anywhere in the Treaty. Some States wanted it to be defined, whilst others did not want it to be defined, although there was apparently some understanding as to what this means. It will be difficult to know in practice precisely what this means and, undoubtedly, this will have to be done on an ad hoc basis; that is, if we ever did have a nuclear activity that is not in the territory of a State or under its jurisdiction, the question would arise as to whether the activities were nevertheless under its control.

Another way to look at the Treaty is to analyse its scope in terms of activities. It is important to remember that the activities covered are peaceful nuclear activities, and this gives us the key to a very vital point of the Treaty. In general, the Treaty prohibits military activities by Non-Nuclear-Weapon States, but does not prohibit all military activity. It prohibits military activities to the extent that such activities involve nuclear weapons or nuclear explosive devices. It does not prohibit activities that are neither of the above, that is, that are not activities involving nuclear weapons or nuclear explosive devices. Why nuclear explosive devices? Because it is generally considered, and this is a point of great importance, that the technology for developing and constructing nuclear weapons is essentially the same as that for creating a 'peaceful' nuclear explosive device. The difference only comes at the end; that is, in what kind of 'package', so to speak, one puts the explosive device. The device itself may be intended for peaceful uses or for military uses, but the intent is that of the user. One simply does not really know until the last moment whether the peaceful nuclear device will be used for that or for military purposes. Now, admittedly one cannot simply take this device and suddenly transform it into a bomb, but the difference between having a device to create a nuclear explosion, and having this in the form of a nuclear weapon, especially in the sense of a bomb, is not such a great one. Of course, there is a difference between a nuclear explosive device and the very sophisticated nuclear weapons that are being developed today, because the latter require still another form of technology aside from the nuclear part of it. But it is generally recognized that the various technical considerations for developing and manufacturing a nuclear explosive device are the same as those used for creating a nuclear weapon, because in the essential stage it is exactly the same. For that reason, the Treaty refers to nuclear explosive devices.

What does this mean in fact? It means that nuclear material might be used for propulsion of a military ship of some kind — the classic example is that of a nuclear submarine. The ship would have a reactor that would propel it and the ship itself would be a military ship by definition. This kind of activity is not prohibited by NPT. However, certain arrangements have to be made when the material is to be used for such purpose, and these arrangements are referred to in the safeguards agreement concluded between the country and the Agency. There are other possibilities — the limitation always being that if the material is not used for a nuclear weapon or for an explosive device, it may nevertheless be used for a military purpose. The concept of military purpose does place some restriction on it. For example, (but this question is not answered) if a reactor of some kind were being used in a military installation, one could say that it was being used for some military purpose; on the other hand, one could say, perhaps, that it was being used for a peaceful purpose if it were being used simply to supply electricity. What is the reactor really doing? Is the nuclear material serving a military purpose? Naturally, one can take the hypothesis further and relate it directly to some military purpose. So one can think of activities as being those that are prohibited squarely by the Treaty and those that are not prohibited but, again, are undefined; it becomes an a contrario reasoning practically — you know what you cannot do but when it comes down to doing something else, the question will then be whether it is among those things that are not prohibited. It might, of course, have been quite difficult to define this precisely, although some people would have preferred just that.

2.5. The application of safeguards

The application of safeguards themselves is provided for in Article III. NPT stipulates that the safeguards should be applied to all nuclear material. This is important because the safeguards are not applied directly under the NPT to nuclear facilities or equipment. They are applied indirectly to facilities or equipment by the obligation to apply them to the material itself because, quite clearly, without material the facility or equipment cannot produce a nuclear weapon. It is also stated in Article III that Non-Nuclear-Weapon States – and this is very important because it does not apply to Nuclear-Weapon States – undertake to accept safeguards in an agreement negotiated and concluded with the IAEA.

From a strictly legal point of view, since the IAEA is not a party to NPT – NPT is an international agreement among States – the reference here is a legal obligation between the contracting parties to the Treaty to conclude still a further agreement with the IAEA. It means, for example, and this is a fine legal point, that the Agency considers the agreement concluded to be agreements in connection with NPT; they are not, as far as we are concerned, concluded strictly pursuant to NPT because there is an obligation undertaken by the State but not by the IAEA. This has other implications – it means that since the Agency is not a party to NPT, the Agency is not in a position either to tell any State that it must conclude an agreement or that it must do so within a certain time, although, in fact, there are provisions in Article III on the time limit for negotiating and concluding agreements for safeguards. Some States are in default on the time limit from the strictly legal point of view. These have been accepted in a rather broad way, and the responsibility for seeing that States do, in fact, conclude an agreement lies primarily with the State that has undertaken to do it, and, secondly, with the other contracting parties to the Treaty. Other contracting parties to the Treaty have at various times and in various forms recalled to other parties of the Treaty that have not yet concluded agreements, that perhaps they ought to do it. And the effect has been that very steadily throughout the last few years we have negotiated more and more agreements[7].

2.6. Peaceful nuclear explosions

Another article in the Treaty specifically refers to peaceful nuclear explosions and that is Article V. However, it is a bit different from the corresponding article in the Tlatelolco Treaty. Without wanting to comment on that, I shall simply underline the effect of Article V of NPT. First, it must be recalled that Non-Nuclear-Weapon States may not themselves undertake nuclear explosions – this is quite clear – under the NPT as they are not allowed to possess a nuclear explosive device. However, they may have the full benefit of a peaceful nuclear explosion, and this point was one of great importance to Non-Nuclear-Weapon States in the negotiation of the Treaty. They said essentially: "If you are going to require that we abandon the possibility of having nuclear explosive devices, at least we ought to retain the benefits."

NPT stipulates further that if there are to be peaceful nuclear explosions for the benefit of Non-Nuclear-Weapon States, they must take place under appropriate international observation and through appropriate international procedures. Thus, the peaceful nuclear explosive device would clearly have to be supplied and here we come again to Article I, which I mentioned earlier, in particular, the word "control". The Nuclear-Weapon State that had been requested to carry out the explosion would retain the control of the nuclear explosive device at all times. This is clear from Article I, which says that the nuclear explosive device may not be put under the control

[7] See Annex B on the status of NPT safeguards agreements.

of a Non-Nuclear-Weapon State, and it is clear from Article V because the Treaty provides that this shall take place under appropriate international observations and through appropriate international procedures. Discussions have taken place in the Agency and two documents have been issued; the first is on the question of what constitutes appropriate international observation[8], and the second directs itself more to the international procedures[9]. It was recognized by the various experts who took part in the discussions that the Agency was the appropriate international organization that was being alluded to in Article V. The experts therefore concluded that the appropriate international observation should be done by the Agency and that the appropriate international procedures should include procedures agreed with the Agency. Eventually, when there are peaceful nuclear explosions, these will be done in very close connection with organs of the Agency, which will observe and ensure, among other things, that control is not transferred from a Nuclear-Weapon State to a Non-Nuclear-Weapon State.

The important element too, is that the Non-Nuclear-Weapon State must be able to derive the full benefit of the explosion. Full benefit is considered in a general way to be the result of the nuclear explosion rather than what one can learn from just having an explosion. One of the uses for peaceful nuclear explosions – one which has been experimented both in the USSR and in the USA – is to free natural gas, which is sometimes found very far underground. One could use a classic explosive device, but it would simply take much longer and might, in fact, not be quite as useful as a nuclear device, so they have developed rather small devices to be able to limit quite precisely what happens when the nuclear device is exploded. This is the kind of experimentation that has been going on, and this is the kind of nuclear device that opens the cavity and allows the gas to be taken by man to be used. Non-Nuclear-Weapon States that have such a source of natural gas could then benefit from the explosion to be able to obtain the use of that gas, but the idea is not that the Non-Nuclear-Weapons State would, at the same time, learn something about peaceful nuclear explosions – this is knowledge that should not, according to the Treaty, be passed on to the Non-Nuclear-Weapon State.

3. NPT SAFEGUARDS AGREEMENTS

NPT provides that safeguards agreements are to be signed by the Non-Nuclear-Weapon States and the IAEA. As the Agency already had its own safeguards system[10], which was being used for the various types of agreements that I referred to earlier, the first question that came to mind was: "Is this system suitable for agreements to be concluded under NPT?". This required serious and long consideration and, in fact, there was a growing feeling in 1969 and in 1970 that perhaps it was not really appropriate, and

---

[8] INFCIRC/169.

[9] Annex B to Agency document GOV/1691.

[10] INFCIRC/66/Rev. 2.

perhaps by building on the basis of what we had learned through our earlier system — the system that we still apply to non-NPT agreements — we might develop the system yet further.

3.1. The Safeguards Committee (1970)

A decision of the Board of Governors created what is known as the Safeguards Committee or, more specifically, the Safeguards Committee (1970) because it began its work in 1970. The Safeguards Committee was established just about the time of the entry into force of NPT on 5 March 1970. The Committee was set up as a Committee of the Board of Governors, which is the Governing Body of the IAEA. The Committee was to be open to participation not only by Board members but by all Members of the Agency. The first meeting took place in June 1970. In fact, more than 50 Member States of IAEA, plus a number of others who came as observers, took part in the meetings of the Safeguards Committee, and I must say that the Safeguards Committee was an extraordinary example of international co-operation.

The Committee had before it the difficult task of advising the Director General on the structure and content of safeguards agreements to be concluded. This involved very delicate political, technical and legal questions. Many people wondered if a Committee, and a Committee composed of representatives of 50 countries, could actually agree on advice to the Director General, or whether we might not have 50 different sets of advice to give to the Director General, or at least a dozen. In fact, the Committee was able to decide on one set of recommendations for use by the Director General, and those who participated in the work of the Committee — I was amongst them — would testify to the extraordinary degree of competence and the spirit of co-operation that was witnessed in that Committee.

3.2. Structure and content of agreements

As someone said during the course of the meetings of the Committee "We are virtually negotiating the contents of agreements in Committee" — and this proved to be quite true. The recommendations of the Committee, as published in INFCIRC/153, the 'Blue Book', form the basis for all agreements we have concluded in connection with the Treaty so that, to a great extent, much of the negotiation took place in the Safeguards Committee from June 1970 until the spring of 1971 in various series of meetings. It was, in fact, a collective negotiation, and, as you know, the more partners there are in a negotiation the more difficult it becomes. Nevertheless, more than 50 partners plus the Agency were able to agree in the course of the 'negotiation' meetings, which were of an extremely high level of intellect and of mutual respect for the competence of the other participants. Discussion took place in and out of the meetings — very passionate discussions sometimes — and finally the Committee did decide on its recommendations. The great value of the Committee was that we were able to elaborate an improved system of safeguards to be used in connection with NPT and that there was agreement already between more than 50 countries; in fact, among those 50 countries were the most important countries in the field of nuclear energy. This has, of course, simplified our negotiation of individual agreements very greatly because we have a basis that is agreed in advance.

The document itself is divided essentially into two parts. This is not simply a question of form. Part I discusses the fundamental legal obligations of the agreement; I say fundamental, because quite clearly every obligation in the agreement is a legal obligation, but the idea was that Part I, which is more brief, ought to form the basis for the technical part as well. It includes the basic undertakings for safeguards and some of the fundamental provisions on the application of safeguards. Quite clearly there are provisions as well in the form of final clauses: the entry into force, the duration of agreement, amendments and so forth. But Part I also refers in certain articles to Part II because Part II stipulates in paragraph 27 that the agreement should provide that the purpose of Part II is to specify the procedures to be applied to implement the provisions in Part I; thus Part II cannot deviate in any way from Part I and must be within the general framework that is established by Part I.

Safeguards is a field in which one cannot separate law and scientific and technical knowledge; as in many other instances, lawyers are called upon to deal with highly technical problems, just as is the case in some economic or technical organizations and, of course, this complicates our task to some extent, and at the same time makes it more interesting. One of the problems too is to come to an understanding between scientists and lawyers in order that each understand a little bit the problems of the other, because lawyers are writing agreements for scientists. If we do not understand at least something about what we are writing, the agreement is probably not going to be very good, and if the technical people have no understanding at all for the legal problems, they might ask us to do some things that are quite impossible for us to do legally. This is the necessary mutual understanding between people concerned with the strictly legal implications and those concerned with the technical implications — and on both sides I think we have learned quite a bit.

Now let us take up very briefly some of the most important provisions of NPT safeguards agreements[11]. The agreement provides for the basic legal undertakings and for the way in which safeguards are to be implemented. Then, a provision of extreme importance is included in Article 7 because, for the first time in Agency safeguards, it is stipulated that a country must establish and maintain a system of accounting for and control of nuclear material. This means that the Agency recognizes the great utility of a national system of materials control as an essential element in international safeguards. I think it should be made clear that we make a distinction, which derives from our interpretation, and one which is generally accepted, of the NPT itself, that NPT calls upon the Agency to apply international safeguards in the countries that are party to the Treaty. Only the Agency is called upon by NPT to do this — no other control organization is asked to intervene. This was an important consideration when we concluded an agreement with EURATOM to carry out safeguards in the EURATOM countries[12]. It equally had its importance, but very fortunately and in a farsighted way, in the Treaty for the Prohibition of Nuclear Weapons in Latin America, which includes a specific provision whereby safeguards are applied in a double

---

[11] The standard texts of NPT safeguards agreements and protocols thereto are set forth in Annexes A and B to Agency document GOV/INF/276, respectively.

[12] INFCIRC/193

system: in the first instance, the safeguards are to be those of the IAEA, and this has simplified very greatly our negotiations with countries that are party to both treaties; in the second instance, supplementary safeguards may be applied through the Organization for the Prohibition of Nuclear Weapons in Latin America (OPANAL).

The system of accounting for and control of nuclear material in a country may go from a rather simplified system to a very sophisticated system in countries that have a great quantity of nuclear material. The Agency is to take account of that system, and this will depend, of course, very much on the system itself; countries are now establishing systems for the first time and we are helping them. In fact, we are searching with them for the best structures, the best substantive content of a national system of materials control; but as far as the Agency is concerned, whether or not the State concerned actually considers that it is carrying out national safeguards, the Agency has the task of carrying out international safeguards. We cannot take account directly of the fact that a country may be applying its own safeguards, because NPT is aimed at preventing diversion of nuclear material from the stated uses to prohibited uses. Even if the State safeguards in the same way as the Agency, we cannot, however, be completely dependent on their saying to us: "The material in our country is safeguarded — it has not been diverted", because then there would be no international safeguards. This would serve very little purpose, in that the very point is that the Agency must verify that the country has not diverted material nor has anyone in the country diverted material. It is thus difficult for us to recognize, for safeguards purposes, a system of national safeguards. However, the fact that a national system will go further than simply accounting for material and will actually have a safeguards objective as well may contribute to the way in which we recognize the utility and effectiveness of that system. This will be largely a subjective judgement based on each particular system, although we are now working out general guidelines as to the way in which we can do this. But you will understand, as lawyers, the distinction we have to make between the safeguards required by NPT, which are international safeguards, and the extent to which we may or may not be able to take account of safeguards applied on a national level.

Article 14 of the safeguards agreement provides a mechanism for the non-application of safeguards to nuclear material to be used in non-peaceful, but non-prohibited, activities. Those are the activities to which I referred earlier. One can see from the text itself the rather complicated procedures that are envisaged. This, again, is the case where a country says to the Agency: "We have certain material in peaceful activities; we want to use that material for an activity that is not prohibited by the Treaty"; and a procedure is envisaged to allow them to do that. The difficulty is that we cannot safeguard that material because we are not asked to safeguard it. On the other hand, we cannot lose it completely from view, because then we just would not know what has happened to it at all, and it might later go from that activity, which is military but not prohibited, to some other activity of which we have no knowledge at all, and which might be a prohibited activity.

A compromise had to be found between the Agency's not safeguarding that material, and at the same time, not losing sight of the material or knowledge of the material completely. This is the purpose of Article 14.

Another interesting provision, which from a legal point of view is perhaps unique, is Article 17. This defines the international responsibility of the parties to the safeguards agreement. This is perhaps the first time that an international organization has accepted a wide international responsibility for damage that might arise in the implementation of its tasks. Article 17 provides that in these cases responsibility will be settled according to international law. This, of course, is only a very general provision, I admit. However, the Agency had never done this before. I think one will not find any international organization that in an agreement has said specifically that it will accept a certain international responsibility if damage is caused. It is known that States do not like to accept specifically some kind of international responsibility, even if it is not defined. Usually States say "well, we may or may not do something if there is damage, but then we shall decide how it is to be done". Often compensation in such cases is paid but not necessarily based on responsibility. Sometimes, of course, there are agreements that call for arbitration or some other kind of settlement before international tribunals, in which case there may be a responsibility assigned. But this is done after a claim is made and after legal process, while here the Agency has said in advance that it recognizes a certain responsibility if damage is caused. Of course, all of the procedural and substantive problems will then arise if there is to be a claim. There are also provisions for more amicable settlement of the claim and, eventually, the possibility of arbitration if the more informal procedures are not successful. However, I thought it was worthwhile pointing out that this Article does, for the first time in our experience, provide a recognition by both sides that there may be some kind of international responsibility.

With respect to Part II this concerns the technical implementation of safeguards, and essentially they are the basic steps in safeguards. First one must have the information on design of installations — the facilities where material will be used. Secondly, it is necessary to have a system of records in the nuclear facilities to account for the material. Then, a system of reporting for the facilities to the IAEA. The facility normally reports to the Government agency, which then reports to the IAEA.

This part also contains provisions on inspectors, which are obviously the most delicate ones. These provisions allow the Agency to send inspectors to the country to verify that what has been stated in the records and reports is actually that, when it is said that certain material is there that it is there. We can see for ourselves. This is an essential part of international safeguards.

3.3. Protocols

As regards the agreements that concern only minimal quantities of nuclear material, this is the situation where a State that is required to sign an NPT safeguards agreement has, in fact, only a minimal quantity of nuclear material. The State concludes with the Agency the safeguards agreement itself — the agreement that is derived from the 'Blue Book' — and also concludes a Protocol, which provides that most of the provisions of that agreement — not all — are temporarily suspended until such time as the State actually has nuclear material. The idea — it might seem rather a complicated way to come to a simplified solution — but the idea is this:

we want to provide the necessary framework in a standard and uniform way — the same way for every Non-Nuclear-Weapon State; but we recognize that in the case of countries that are just beginning in nuclear energy — that have only small quantities of nuclear material — it would be unreasonable to want to apply all of the provisions of the Safeguards agreement to only very small quantities. By the Protocol we accept that some of the most essential provisions of the agreement remain in force, but the others are suspended until such time as the country reports to the Agency that it has material going beyond the recognized minimal quantities, and at this time the full agreement automatically comes into force. The advantage of this simplified approach is that we do not have to negotiate a second agreement with the country when it is in fact moving from the stage of minimal quantities to rather more important ones. The agreement is concluded in advance, notification takes place, and the day on which the additional material arrives in the country the full agreement comes into force so that we are in a position to apply full safeguards immediately. This was considered to be essential.

4. RELATIONSHIP BETWEEN NPT SAFEGUARDS AND THOSE CONNECTED WITH THE TLATELOLCO TREATY

I should also like to say a word about the relationship between safeguards in connection with NPT and those in connection with the Treaty of Tlatelolco. As many States are party to both treaties and in both treaties there is an obligation to conclude an agreement with IAEA, it was thought to be more rational to conclude only one agreement instead of two — and I think on the face of it one can agree that this is more logical. The problem then was to determine whether or not the same agreement could satisfy both treaties, and it was concluded that safeguards applied under the agreements could do so. In fact, we have had two different forms of agreement to take care of the situation. The first one concluded was with Uruguay[13]. Uruguay preferred to have an additional Protocol that recognized that the safeguards being applied under the NPT agreement would satisfy the requirements under the Tlatelolco Treaty[14]. It provides that "the safeguards set forth in the safeguards agreement" (that is, NPT) "shall also apply as regards Uruguay in connection with the Tlatelolco Treaty".

Subsequently, Mexico, which already had a safeguards agreement, but only under the Tlatelolco Treaty, submitting all peaceful nuclear activities to Agency safeguards[4], concluded an NPT safeguards agreement with the Agency[5]. The 'Blue Book' did not exist when we concluded the first agreement with Mexico so clearly it could not have been this kind of agreement. But, for the purpose of having all NPT safeguards agreements basically the same, a new agreement was negotiated without any difficulty with Mexico. We used another device in this agreement to recognize the safeguards in connection with the Tlatelolco Treaty; that device was to make specific reference in the Preamble and in Article 1 of the NPT safeguards agreement to the effect that these safeguards were also to be considered as valid

[13] INFCIRC/157.

[14] INFCIRC/160.

in respect of the Tlatelolco Treaty. This was even a more simple way of having one agreement to satisfy the requirements of both treaties and the same form was then accepted by Costa Rica and the Dominican Republic, which negotiated agreements subsequently[15]. Perhaps we might say that the more standardized form now is to put the double reference to the Tlatelolco Treaty and the NPT in one agreement. But either possibility, of course, exists.

I might mention, too, that we have concluded an important agreement with EURATOM and its Member States[12], which is an adaptation of the standard type of agreement. The basic safeguards agreement with EURATOM is identical to all other NPT safeguards agreements, with the exception of formal changes. We have negotiated as well a Protocol with EURATOM that provides for co-operation arrangements between the Agency and the EURATOM safeguards system. This was a special case in that the European Communities exist since 1958 and that a regional safeguards system had been elaborated and has been applied since 1959. A requirement was then to find some way of co-operation between the two safeguards systems and at the same time to allow for the application of Agency safeguards in the territory of EURATOM countries. This was done and the agreement was approved by the Board of Governors in September 1972.

[15] See, e.g., INFCIRC/201.

ANNEX A

AGREEMENTS PROVIDING FOR SAFEGUARDS OTHER THAN THOSE IN CONNECTION WITH NPT, APPROVED BY THE BOARD AS OF 31 DECEMBER 1974

Party(ies) [a]	Subject	Entry into force	INFCIRC
Project Agreements			
Argentina	Siemens SUR-100	13 Mar. 1970	143
	RAEP Reactor	2 Dec. 1964	62
Chile	Herald Reactor	19 Dec. 1969	137
Finland [b]	FiR-1 Reactor	30 Dec. 1960	24
	FINN sub critical assembly	30 July 1963	53
Greece [b]	GRR-1 Reactor	1 Mar. 1972	163
Indonesia	Additional core-load for Triga Reactor	19 Dec. 1969	136
Iran [b]	UTRR Reactor	10 May 1967	97
Japan	JRR-3	24 Mar. 1959	3
Mexico [b]	TRIGA-III Reactor	18 Dec. 1963	52
	Siemens SUR-100	21 Dec. 1971	162
	Laguna Verde Nuclear Power Plant	12 Feb. 1974	203
Pakistan	PRR Reactor	5 Mar. 1962	34
	Booster rods for KANUPP	17 June 1968	116
Philippines [b]	PRR-1 Reactor	28 Sep. 1966	88
Romania [b]	TRIGA Reactor	30 Mar. 1973	206
Spain	Coral I Reactor	23 June 1967	99
Turkey	Sub-critical assembly	17 May 1974	
Uruguay	URR Reactor	24 Sep. 1965	67
Viet-Nam [b]	VNR-1 Reactor	16 Oct. 1967	106
Yugoslavia [b]	TRIGA-II Reactor	4 Oct. 1961	32
	KRSKO Nuclear Power Plant	14 June 1974	213
Zaire [b]	TRICO Reactor	27 June 1962	37
Transfer Agreements (Agreements for transfer of safeguards under bilateral co-operation agreements between the indicated Parties)			
Argentina/USA		25 July 1969	130
Australia [b]/USA		26 Sep. 1966	91
Australia [b]/Japan		28 July 1972	170/Corr. 1
Austria [b]/USA		24 Jan. 1970	152
Brazil/USA		20 Sep. 1972	110/Mod. 1
Canada/Japan		12 Nov. 1969	85/Mod. 1
Canada/India		30 Sep. 1971	211
China, Republic of/USA		6 Dec. 1971	158
Colombia/USA		9 Dec. 1970	144
Denmark [b]/UK		23 June 1965	63
Denmark [b]/USA		29 Feb. 1968	112
France/Japan		22 Sep. 1972	171
Greece [b]/USA		13 Jan. 1966	78
India/USA		27 Jan. 1971	154
Indonesia/USA		6 Dec. 1967	109

Party(ies) [a]	Subject	Entry into force	INFCIRC
Iran [b]/USA		20 Aug. 1969	127
Israel/USA		15 June 1966	84
Japan/USA		10 July 1968	119
Japan/UK		15 Oct. 1968	125
Korea, Republic of/USA		19 Mar. 1973	111/Mod. 1
Pakistan/Canada		17 Oct. 1969	135
Philippines [b]/USA		19 July 1968	120
Portugal/USA		19 July 1969	131
South Africa/USA		28 June 1974	98
Spain/USA		28 June 1974	92
Sweden/USA		1 Mar. 1972	165
Switzerland/USA		28 Feb. 1972	161
Thailand [b]/USA		10 Sep. 1965	68
Turkey/USA		5 June 1969	123
Venezuela/USA		27 Mar. 1968	122
Viet-Nam [b]/USA		25 Oct. 1965	71
Unilateral submissions			
Argentina	Atucha Power Reactor Facility	3 Oct. 1972	168
	Nuclear Material	23 Oct. 1973	202
	Embalse Power Reactor Facility	6 Dec. 1974	
Chile	Nuclear Material		
China, Republic of	Taiwan Research Reactor Facility	13 Oct. 1969	133
Mexico [b]	All nuclear activities	6 Sep. 1968	118
Panama [c]	All nuclear activities		
Spain	Nuclear Material	19 Nov. 1974	
United Kingdom	Certain nuclear activities	14 Dec. 1972	175

[a] An entry in this column does not imply the expression of any opinion whatsoever on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

[b] Application of Agency safeguards under this agreement has been suspended as the State has concluded an agreement in connection with NPT.

[c] At present Panama has no significant nuclear activities. The Agreement is concluded under Article 13 of the Treaty for the Prohibition of Nuclear Weapons in Latin America.

ANNEX B

SITUATION ON 31 DECEMBER 1974 WITH RESPECT TO THE SIGNATURE OF, RATIFICATION OF, OR ACCESSION TO, NPT BY NON-NUCLEAR-WEAPON STATES, AND THE CONCLUSION OF SAFEGUARDS AGREEMENTS BETWEEN THE AGENCY AND THESE STATES IN CONNECTION WITH NPT

Non-Nuclear-Weapon States that have signed, ratified or acceded to NPT [a]	Date of ratification or accession [a]	Safeguards agreement with the Agency
Afghanistan	4 Feb. 1970	Under negotiation
Australia	23 Jan. 1973	In force: 10 July 1974
Austria	28 June 1969	In force: 23 July 1972
Barbados		Under negotiation
Belgium		Signed: 5 April 1973
Bolivia	26 May 1970	Signed: 23 Aug. 1974
Botswana	28 Apr. 1969	Under negotiation
Bulgaria	5 Sep. 1969	In force: 29 Feb. 1972
Burundi	19 Mar. 1971	
Canada	8 Jan. 1969	In force: 21 Feb. 1972
Central African Republic	25 Oct. 1970	
Chad	10 Mar. 1971	
China, Republic of	27 Jan. 1970	
Colombia		
Costa Rica	3 Mar. 1970	Signed: 12 July 1973
Cyprus	16 Feb. 1970	In force: 26 Jan. 1973
Czechoslovakia	22 July 1969	In force: 3 Mar. 1972
Dahomey	31 Oct. 1972	
Denmark	3 Jan. 1969	In force: 1 Mar. 1972
Dominican Republic	24 July 1971	In force: 11 Oct. 1973
Ecuador	7 Mar. 1969	Signed: 2 Oct. 1974
Egypt		
El Salvador	11 July 1972	Approved by the Board
Ethiopia	5 Feb. 1970	Under negotiation
Fiji	14 July 1972	In force: 22 Mar. 1973
Finland	5 Feb. 1969	In force: 9 Feb. 1972
Gabon	19 Feb. 1974	Under negotiation
Gambia		
German Democratic Republic	31 Oct. 1969	In force: 7 Mar. 1972
Germany, Federal Republic of		Signed: 5 April 1973
Ghana	5 May 1970	Signed: 23 Aug. 1973
Greece	11 Mar. 1970	Provisionally in force: 1 Mar. 1972
Guatemala	22 Sep. 1970	Under negotiation
Haiti	2 June 1970	Approved by the Board
Holy See	25 Feb. 1971	In force: 1 Aug. 1972
Honduras	16 May 1973	Approved by the Board
Hungary	27 May 1969	In force: 30 Mar. 1972
Iceland	18 July 1969	In force: 16 Oct. 1974
Indonesia		
Iran	2 Feb. 1970	In force: 15 May 1974
Iraq	29 Oct. 1969	In force: 29 Feb. 1972
Ireland	1 July 1968	In force: 29 Feb. 1972

Non-Nuclear-Weapon States that have signed, ratified or acceded to NPT [a]	Date of ratification or accession [a]	Safeguards agreement with the Agency
Italy		Signed: 5 April 1973
Ivory Coast	6 Mar. 1973	
Jamaica	5 Mar. 1970	Under negotiation
Japan		
Jordan	11 Feb. 1970	Signed: 5 Dec. 1974
Kenya	11 July 1970	Under negotiation
Khmer Republic	2 June 1972	
Korea, Republic of		
Kuwait		
Laos	20 Feb. 1970	Under negotiation
Lebanon	15 July 1970	In force: 5 Mar. 1973
Lesotho	20 May 1970	In force: 12 June 1973
Liberia	5 Mar 1970	
Libyan Arab Republic		
Luxembourg		Signed: 5 April 1973
Madagascar	8 Oct. 1970	In force: 14 June 1973
Malaysia	5 Mar. 1970	In force: 29 Feb. 1972
Maldives	7 Apr. 1970	Under negotiation
Mali	5 Mar. 1970	Under negotiation
Malta	6 Feb. 1970	Under negotiation
Mauritius	28 Apr. 1969	In force: 31 Jan. 1973
Mexico	21 Jan. 1969	In force: 14 Sept. 1973
Mongolia	14 May 1969	In force: 5 Sep. 1972
Morocco	20 Nov. 1970	Signed: 30 Jan. 1973
Nepal	5 Jan. 1970	In force: 22 June 1972
Netherlands [b]		Signed: 5 April 1973
New Zealand	10 Sep. 1969	In force: 29 Feb. 1972
Nicaragua	6 Mar. 1973	Approved by the Board
Nigeria	27 Sep. 1968	Under negotiation
Norway	5 Feb. 1969	In force: 1 Mar. 1972
Panama		
Paraguay	4 Feb. 1970	
Peru	3 Mar. 1970	Under negotiation
Philippines	5 Oct. 1972	In force: 16 Oct. 1974
Poland	12 June 1969	In force: 11 Oct. 1972
Romania	4 Feb. 1970	In force: 27 Oct. 1972
San Marino	10 Aug. 1970	Under negotiation
Senegal	17 Dec. 1970	Under negotiation
Sierra Leone [c]		Under negotiation
Singapore		
Somalia	5 Mar. 1970	Under negotiation
Southern Yemen		
Sri Lanka		
Sudan	31 Oct. 1973	
Swaziland	11 Dec. 1969	Approved by the Board
Sweden	9 Jan. 1970	Under negotiation
Switzerland		Under negotiation
Syrian Arab Republic	24 Sep. 1969	
Thailand	7 Dec. 1972	In force: 16 May 1974
Togo	26 Feb. 1970	

Non-Nuclear-Weapon States that have signed, ratified or acceded to NPT [a]	Date of ratification or accession [a]	Safeguards agreement with the Agency
Tonga	7 July 1971	Under negotiation
Trinidad and Tobago		
Tunisia	26 Feb. 1970	Under negotiation
Turkey		
Upper Volta	3 Mar. 1970	
United Republic of Cameroon	8 Jan. 1969	
Uruguay	31 Aug. 1970	Signed: 24 Sep. 1971
Venezuela		
Viet-Nam	10 Sep. 1971	In force: 9 Jan. 1974
Yemen, Arab Republic of		
Yugoslavia	3 Mar. 1970	In force: 28 Dec. 1973
Zaire	4 Aug. 1970	In force: 9 Nov. 1972

[a] The information reproduced in columns 1 and 2, with the exception of that relating to Sierra Leone, was provided to the Agency by the depositary Governments of NPT, and an entry in column 1 does not imply the expression of any opinion on the part of the Secretariat concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

[b] The Netherlands have also signed, on 5 April 1973, agreements in respect of the Netherlands Antilles and Surinam, under NPT and the Treaty for the Prohibition of Nuclear Weapons in Latin America.

[c] Has not yet acceded to NPT.

ANNEX C

PARTIES TO THE TREATY FOR THE PROHIBITION OF NUCLEAR WEAPONS IN LATIN AMERICA

State	Date of ratifiaction
Mexico	23 September 1967 [a]
Brazil [b]	29 January 1968
El Salvador	22 April 1968 [a]
Dominican Republic	14 June 1968 [a]
Uruguay	20 August 1968 [a]
Honduras	23 September 1968 [a]
Nicaragua	24 October 1968 [a]
Ecuador	11 February 1969 [a]
Bolivia	18 February 1969 [a]
Peru	4 March 1969 [a]
Paraguay	19 March 1969 [a]
Barbados	25 April 1969 [a]
Haiti	23 May 1969 [a]
Jamaica	26 June 1969 [a]
Costa Rica	25 August 1969 [a]
Guatemala	6 February 1970 [a]
Venezuela	23 March 1970 [c]
Trinidad and Tobago [b]	3 December 1970 [c]
Panama	11 June 1971 [c]

[a] Ratified or acceded to NPT.

[b] Is not a Party to the Treaty because it did not waive the conditions for the entry into force contained in Article 28(2).

[c] Signed NPT.

THE TREATY FOR THE PROHIBITION OF NUCLEAR WEAPONS IN LATIN AMERICA (TREATY OF TLATELOLCO)

A. GONZÁLEZ-DE-LEÓN
OPANAL,
Mexico 6, D.F.

Abstract

THE TREATY FOR THE PROHIBITION OF NUCLEAR WEAPONS IN LATIN AMERICA (TREATY OF TLATELOLCO).
The Tlatelolco Treaty established the first area inhabited by man in which nuclear weapons are prohibited. Eighteen Latin American States party thereto undertake to use all nuclear material and facilities exclusively for peaceful purposes. Special features of the Treaty are outlined; attention is called to obligations resulting therefrom that may require the adoption of appropriate legislation by the countries concerned in relation to the establishment of a national system of material control, the prohibition of transit of nuclear weapons and the status of foreign facilities over which effective jurisdiction is not exercised by a State party to the Treaty.

The Treaty for the Prohibition of Nuclear Weapons in Latin America, known as the "Treaty of Tlatelolco" after the site in Mexico City in which it was opened for signature on 14 February 1967, is actually a multilateral instrument consisting of three parts: the Treaty itself and two Additional Protocols.

Through the Treaty 18 Latin American States[1] have already undertaken to use all nuclear material and facilities under their jurisdiction exclusively for peaceful purposes and, to that effect, they have prohibited and shall prevent in their respective territories the testing, use, manufacture, production or acquisition by any means whatsoever of any nuclear weapons and, therefore, the receipt, storage, installation, deployment and any form of possession of this kind of armament. In other words, through the Treaty these countries have renounced their right to engage in, encourage or authorize, directly or indirectly, the testing, use, manufacture, production, possession or control of any nuclear weapon and to participate in anyway in such activities (Article 1).

Additional Protocol I is the means by which non-Latin American States who have de jure or de facto responsibility over territories in the area of application of the Treaty (as defined in Article 4) assume the same obligations as the States Parties to the Treaty, as far as those territories are concerned. Protocol I has already been signed and ratified by two States[2].

---

[1] At present the States Parties to the Treaty are: Barbados, Bolivia, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. Brazil and Trinidad and Tobago have signed and ratified the Treaty but have not waived the pre-requisites for its entry into force (Art.28). Argentina and Chile have signed but not yet ratified. Cuba and Guyana have not signed (since 1969 Guyana announced her intention to do so, but it has not been possible on account of para.2 of Art.25 of the Treaty, which was invoked by Venezuela in this case).

[2] The Netherlands and the United Kingdom.

Finally, Additional Protocol II is the instrument by which Nuclear-Weapon States gurantee the States Parties to the Treaty that they will respect the status established in the same Treaty, and commit themselves not to contribute in any way to the execution of acts that could imply a violation of its terms, as well as not to use or threaten to use nuclear weapons against any of the Parties to the Treaty. At the time of writing Protocol II has been ratified by two nuclear powers[3].

The conclusion of the Treaty of Tlatelolco required rather complicated and difficult negotiations involving all States in the region and consultation with other States outside the area of application, both the nuclear powers and those internationally responsible for territories inside the same area. The conducive negotiations were channelled mainly through the Preparatory Commission for the Denuclearization of Latin America (COPREDAL), and lasted from the middle of 1963 until the date of opening for signature (14 February 1967). Consultations with States outside the area were carried essentially by the Negotiating Committee established to that effect by the Preparatory Commission. It can thus be said that the terms of the Treaty reflect – besides the needs of the project to preserve the nuclear security of the area – the points of view and fundamental criteria expressed by the Latin American States and the other powers consulted.

The Treaty includes several aspects that constitute a novelty and establishes some situations that are unique: in the first place – and this has been repeatedly said – it creates the first area inhabited by man in which there will be no nuclear weapons (the definition of nuclear weapon given in Article 5 is the most complete until now). The existence of the area is based on a formal Treaty of a multilateral character, with all the weight that this has in international law and with the compulsion and coercion that the system of the Treaty itself establishes (in Article 20 the Treaty provides sanctions for non-compliance, grading them according to the seriousness of the case, even foreseeing the intervention of the UN Security Council when non-compliance so deserves). The execution of the Treaty requires a Control System and this has been established in the Treaty itself (Articles 12, 14, 15, 16 and 18), involving the permanent Agency created to that effect – the Agency for the Prohibition of Nuclear Weapons in Latin America (OPANAL) – as well as the participation of the International Atomic Energy Agency (IAEA) through the application of its Safeguards System (Article 13). To survey its strict execution, as well as to widen its scope, in several ways the Treaty establishes the operation of three organs: the General Conference (Article 9), in which all States Parties to the Treaty are represented; the Council (Article 10), composed of Representatives of five Member States; and the Secretariat (Article 11) charged with the co-ordination of the two previous organs and acting as liaison and centre for disemination or exchange of information among Member States.

The General Conference met in 1969 (First Part of the First Session), 1970 (Second Part of the First Session) and 1971 (Second Session), and in 1972 for an Extraordinary Session[4]. The Council is organized so as to be

---

[3] The United Kingdom and the United States of America. China and France have announced that they will sign Protocol II in the near future, thus leaving the Soviet Union as the single nuclear power still reluctant to adhere.

[4] The Third ordinary Session was convened for 21 August 1973.

able to function continuously at the seat of the Agency (Mexico City) and meets regularly with intervals not exceeding 60 days. Two Working Groups are currently in existence: one for the purpose of examining the correlation or interaction between the Treaty of Tlatelolco and other international instruments, multilateral as well as bilateral, to which Member States are Parties (Treaty on the Non-Proliferation of Nuclear Weapons, Treaty of Moscow, Antarctic Treaty, etc.) and one in charge of studying the role that OPANAL may play in the promotion of the peaceful uses of nuclear energy in order to give the organs created by the Treaty of Tlatelolco a positive function — the negative one being supervision of the observance of the prohibition of nuclear weapons.

OPANAL's Secretariat is launching a Fellowship Programme for training in the field of safeguards government officials from Member States, financed by the Special Fund for Peaceful Uses of Nuclear Energy, which was created in 1970 on the basis of voluntary contributions. It is expected that all activities in which Member States are interested (meetings, seminars, training courses, etc.) can be launched in the near future.

One of the most interesting efforts at the moment is aimed at obtaining the adherence to the Treaty and Additional Protocols of States that have not yet signed. Both to that effect and to help solve controversies that may exist among States with respect to the Treaty of Tlatelolco[5], a Committee of Good Offices has been functioning since 1970, integrated with Representatives of three Member States. The Secretary-General, on his part, has been exploring several possibilities and has established contact with various Governments in order to assist or advise them in this respect. Among other things, he has visited Venezuela offering his help for the eventual solution of the controversy with Guyana.

The importance of the system established in the Treaty of Tlatelolco became more evident in the meeting of the UN Security Council in Panama in March 1973. In fact, the great majority of States Members of the Council, and Representatives of other States invited to the meeting, made reference to the scope of the Treaty and underlined the importance that its full implementation may have in the maintenance of international peace and security. From the conclusions reached there three aspects may be pointed out: a general consensus as far as the importance of the Treaty is concerned, the hope of the world organization that all States in the Latin American region adhere to it, and the need that all powers eligible to adhere to Additional Protocols I and II will do so in order to give the Treaty its full effect.

Among the obligations that States Parties to the Treaty and, consequently, Members of OPANAL should keep in mind in the future for the eventual adoption, if necessary, of domestic legislation, the following can be underlined:

(A) Those referring to the Control System, which in turn could be divided in two:

(a) Aspects concerning their obligations in the light of Article 13: application of the Safeguards System of the IAEA, as far as this is implemented

[5] The only controversy affecting at the moment the Treaty is the one between Guyana and Venezuela that has prevented the former from adhering to the Treaty and has provisionally left Trinidad and Tobago out.

and the characteristics and specific points of such implementation become clear. Although at the moment these aspects cannot be stated with precision, it is very likely that in the future, as States continue to develop the peaceful uses of atomic energy, there will be a need to establish certain domestic regulations in order to harmonize national legislation with requirements of an international character.

(b) Aspects concerning those parts of the Control System that OPANAL will exercise directly in the light of Article 12 of the Treaty: ordinary and special reports requested by the Secretary-General which Member States will have to submit (Articles 14 and 15); special inspections that may become necessary (Article 16), and observation of possible explosions for peaceful purposes (Article 18). Particularly with respect to the last point, Member States may be required in due time to adopt certain regulations to systematize compliance with the said obligations and facilitate the work of OPANAL[6].

(B) Aspects that may require express provisions on the prohibition of transit of nuclear weapons through their respective territories. In this connection it may be pointed out that the Treaty does not include any rule but the Preparatory Commission, in approving the final text of the Treaty and opening it for signature, established that transportation is implicitly prohibited, since "any form of possession of any nuclear weapon, directly or indirectly, by [the Parties] themselves, by anyone on their behalf or in any other way" is proscribed (Article 1, para. b). As far as transit itself is concerned, the Preparatory Commission pointed out that "it is to be understood that principles and rules of international law in the matter shall be applied, according to which the territorial State is entitled, in the free exercise of its sovereignty, to permit or deny transit in each particular case on the basis of the request of authorization by the State which is interested in carrying it out, unless otherwise agreed in a treaty among such States"[7]. It is quite probable, therefore, that some States may require or prefer to adopt specific legislation to establish this prohibition, in the light both of the Treaty of Tlatelolco and the Treaty on the Non-Proliferation of Nuclear Weapons, in order to allow these instruments their maximum efficacity from the point of view of nuclear security in the whole region by guaranteeing the total absence of nuclear weapons.

(C) With respect to States that do not exercise effective jurisdiction over a portion of their territory, in view of foreign facilities — military or of any other nature — situated there and consequently find it difficult to maintain in those portions efficient control as required in the light of their obligations from the Treaty, it is also likely that they may eventually require some adjustment, either in their domestic legislation or in the terms of the agreements or treaties by which the corresponding regime is established: not having ceded sovereignty over such portions of their territory, the obligations derived from the Treaty apply to them as well.

---

[6] As far as the nuclear explosions for peaceful purposes are concerned, it will be indispensable to keep in mind IAEA document INFCIRC/169, which contains some "guidelines" for their observation.

[7] Mexico and Panama have announced that they shall not permit in any case the transit of nuclear weapons through their respective territories.

It is most important, therefore, that the Governments of Member States should begin to think not only in terms of the external implications of the Treaty of Tlatelolco[8], but of the internal consequences it entails; in other words, which aspects of the obligations mentioned in the previous paragraph would require in their judgement revision of their own domestic legislation in order to give full implementation to the Treaty.

[8] See OPANAL publications, serie Estudios y Monografías, No.1.

II

STUDY GROUP MEETING ON REGULATIONS AND PROCEDURES FOR LICENSING NUCLEAR INSTALLATIONS

Athens, 16 to 20 December 1974

IAEA ACTIVITIES AND ASSISTANCE IN REGULATORY MATTERS CONNECTED WITH NUCLEAR POWER PROJECTS

HA-VINH PHUONG
Legal Division,
International Atomic Energy Agency,
Vienna

Abstract

IAEA ACTIVITIES AND ASSISTANCE IN REGULATORY MATTERS CONNECTED WITH NUCLEAR POWER PROJECTS.

The IAEA programme for 1975-80 includes accelerated work on the codes and guides to provide a standard frame for assessing the safety and reliability of nuclear power plants. The established procedure for such work and different types of documents to be produced are outlined. The Agency's advisory services in regulatory matters connected with nuclear power projects have been provided to several developing countries in recent years and are expected to be requested by an increasing number of countries going nuclear in conjunction with the changing energy situation.

1. INTRODUCTION

In fulfilling its statutory obligation to advise Member States on the safe use of atomic energy, the IAEA has over the years established quite a number of standards and guides ranging from the safe handling of radioisotopes to the safe handling of plutonium. Safety standards, issued under the authority of the Board of Governors, are recommendations to national authorities to serve as a basis for specific regulations, whereas guides, which are not subject to Board approval, are merely aimed at providing guidance on a variety of safety items or operating procedures. However, current increases in electric power demand through nuclear energy call for increased international efforts to formulate comprehensive safety and reliability criteria, internationally acceptable, especially for use by countries embarking for the first time on nuclear power projects and which are in the process of setting up adequate regulatory framework and of determining safety prescriptions therefor. Accordingly, under the Agency's programme for 1975-80, there is to be intensified work on the elaboration of recommendations deemed necessary on matters of nuclear plant safety and safety-related reliability that would serve as a standard frame of reference for analysing nuclear plant safety and quality assurance.

2. ACTION PLANS IN NUCLEAR SAFETY

The Agency's plans for establishing further safety codes and guides in connection with the general expansion of nuclear power projects were first discussed by an ad hoc committee of senior experts in April 1974 in Vienna. In examining the Agency's six-year programme in June 1974, the Board of Governors proceeded to a thorough exchange of views on the proposed plans, which were reviewed, in the light of the Board's discussions, by a working group of experts in July 1974. The revised plans were subsequently endorsed by the Board and incorporated in the programme approved by the General Conference in September 1974[1].

The approved scheme provides for the Agency to be assisted in this programme by a standing group of highly qualified international experts, called the Senior Advisory Group (SAG), and consisting of eminent experts from Member States in which the regulation of nuclear power plants has reached a level of relatively high development[2]. Under the supervision of the Senior Advisory Group, work on codes and guides is to be initiated by small working groups composed of experts and Agency staff members and reviewed by Technical Review Committees. In carrying out this work the Agency will as in the past ensure close co-ordination with appropriate international organizations, and maximum use will be made of relevant documentation and experience available in national legislation and practices. Three types of documents are contemplated under this programme:

> Codes of Practice establishing the objectives and minimum requirements for the safety of thermal neutron nuclear power plants, their systems and components, which are subject to approval by the Board of Governors
>
> Safety Guides recommending procedures for the implementation of Codes of Practice
>
> Users' Manuals directed primarily to nuclear power plant operators and providing methods and techniques for solving specific problems.

Within the time frame of about two years completion of work is being aimed at for a limited number of codes and guides. At its first meeting in October 1974 the Senior Advisory Group assigned priority to the preparation of five codes of practice and a dozen guides covering the following areas: governmental organization, siting, design, operation and quality assurance, and five corresponding Technical Review Committees were subsequently established by the Agency in consultation with the Senior Advisory Group.

3. ASSISTANCE IN REGULATORY MATTERS

To date quite a number of countries have received the Agency's advice and assistance in the framing of statutory or regulatory provisions relating to various areas in the peaceful applications of atomic energy, such as radiation protection, transport of radioactive materials, nuclear power licensing, nuclear liability, nuclear ships. In particular, in recent years such expert services were increasingly requested by developing countries

---

[1] See document GC(XVIII)/526/Mod.1, Annex VII.

[2] Twelve experts from the following Member States have been appointed by the Director General of the Agency as members of SAG for a three-year term: Canada, Czechoslovakia, France, Federal Republic of Germany, India, Japan, Mexico, Sweden, Switzerland, UK, USA and USSR.

to assist them in a comprehensive determination of the legislative or regulatory issues involving in a nuclear power programme and in the advance preparation of draft bills or regulations for licensing purposes with a view to timely consideration by the national authorities. This type of assistance, which is globally referred to as 'legislative assistance' and which the Agency has been providing to Member States for over a decade, is carried out either under the Agency's Technical Assistance Programme by assignments of experts or through advisory services performed by members of Agency staff and followed up from Headquarters in Vienna.

Experience has shown that such advice and assistance on regulatory matters were generally well taken by the national authorities concerned as reflecting impartial guidance and, also, as providing an incentive for speeding up the legislative or regulatory process involved. To cite a concrete case, the Philippine Atomic Energy Regulatory and Liability Act of 1968, for instance, was drafted by the Philippine Atomic Energy Commission with the help of a legal consultant provided by the Agency in 1966; more recently draft regulations drawn up under that Act by an ad hoc Committee of the Commission for the licensing of nuclear facilities were reviewed with the Agency's assistance and made effective in 1974 prior to the implementation of the country's first nuclear power project.

In recent years, advisory services in this field were also provided to Greece (1970), Pakistan (1970), Thailand (1971), Mexico (1972), Yugoslavia (1972), Iran (1973), Singapore (1973, 1974), Malaysia (1974) and Yugoslavia (1975).

With regard to training on regulatory matters, the Agency has to date accepted for in-service training at Headquarters a number of officials from various developing countries either under the Agency's Fellowships Programme or at the expense of nominating Governments. Some of such training schemes have also been arranged through the United Nations Institute for Training and Research (UNITAR) and other international bodies such as WHO.

4. CONCLUSION

The changing energy situation is accelerating the demand for nuclear power in many more countries and, if nuclear power is to fulfil these new expectations, a great effort must be devoted at the international level to the elaboration of widely acceptable criteria for the safety and reliability of nuclear power plants. The Agency is already taking steps in this direction, with particular regard for the needs of developing nations. In this conjunction, the Agency is expanding its advisory services in nuclear power planning, regulatory matters, project implementation and training schemes for specialized personnel with a view to being of timely help to nations going or about to go nuclear.

THE WORK OF THE OECD NUCLEAR ENERGY AGENCY ON SAFETY AND LICENSING OF NUCLEAR INSTALLATIONS

P. STROHL
OECD Nuclear Energy Agency,
Paris

Abstract

THE WORK OF THE OECD NUCLEAR ENERGY AGENCY ON SAFETY AND LICENSING OF NUCLEAR INSTALLATIONS.

The acceleration of nuclear power programmes in OECD Member countries is reflected in the emphasis given by OECD/NEA to its activities in nuclear safety and regulatory matters. Particular effort is devoted to work on radiation protection and radioactive waste management, safety of nuclear installations and nuclear law development. A Committee on the Safety of Nuclear Installations reviews the state of the art and identifies areas for research and co-ordination of national programmes. A Sub-Committee on Licensing collates information and data on licensing standards and practices of different countries with a view to considering problems of common interest. Comparative studies of various licensing systems and discussions between licensing authorities should help to improve regulatory control of nuclear installations for which there appears to be a need for internationally accepted standards in the long run.

INTRODUCTION

With the considerable development of nuclear energy on the industrial scale, in particular in relation to the construction of nuclear power plants, the activities related to nuclear safety, regulation and control have acquired greater emphasis in government programmes. This trend is bound to gain increasing importance with the prospective acceleration of nuclear power programmes in OECD Member countries to meet their future energy needs; and this is reflected naturally enough in the programme of the OECD Nuclear Energy Agency where about two-thirds of the Agency's effort is currently devoted to safety and regulatory aspects of nuclear activities.

NEA's work in this field covers three distinct but interrelated sectors, i.e. radiation protection and radioactive waste management, safety of nuclear installations and nuclear law. The traditional pragmatic approach of the Agency means that this programme is a selective reflection of subjects lending themselves to intergovernmental co-operation rather than any attempt to cover comprehensively the whole field.

As far as the safety of nuclear installations is concerned, the Agency's work had been related, until recently, almost exclusively to the survey of development of reactor safety research and its application to reactor design through its Committee on Reactor Safety Technology (CREST). The development of nuclear energy made it apparent that there was now a need for a greater emphasis to be put on licensing problems and on the interactions of nuclear safety research and licensing practice. To encourage and co-ordinate co-operation in this field CREST has been converted into the Committee on the Safety of Nuclear Installations (CSNI), which is responsible for the activities of the Agency concerning the technical aspects of the design, licensing, construction and operation of nuclear installations insofar as they affect the safety of such installations. This Committee also constitutes a forum for a free exchange of information between licensing authorities and research groups to contribute from their particular background to the definition of research objectives and to provide a feedback of research experience to licensing authorities.

NUCLEAR SAFETY TECHNOLOGY

It is quite clear that nuclear safety technology is an integral and essential part of nuclear power development and in turn the increased knowledge and experience in the design and operation of nuclear power plants has a beneficial impact on safety design. In this context, the role of the NEA Committee on the Safety of Nuclear Installations is to review the existing state of knowledge on selected topics of nuclear safety technology, identifying discrepancies and gaps in knowledge, and to promote the initiation and co-ordination of programmes of research, concentrating on nuclear installations of types currently operated, being built or under design. This work is channelled through a number of working groups and ad hoc specialist meetings and currently embraces a fairly wide variety of topics.

It is not the purpose here to give a full description of the work in this field but rather to illustrate it by a few examples. General studies include protection of nuclear plants against external impacts (principally aircraft crash and chemical or fuel explosions in the proximity of a nuclear installation), antiseismic design and siting of nuclear plants. In the field of light water reactors current topics include emergency core cooling, mechanical and material problems relating to the safety aspects of steel components in nuclear power plants (in collaboration with CEC) including consideration of the problem of in-service inspection. In the field of fast reactors special attention is given to reactor fuel/sodium interactions. A separate group of experts known as the Liquid Metal Boiling Working Party has been concerned for some time with thermo-hydraulics in sodium-cooled cores. Work is also being done on gas-cooled reactors, with particular emphasis on high temperature gas-cooled reactors, and heavy water reactors. The CSNI will continue the Nuclear Safety Research Index as an information channel on all major theoretical and experimental work under way throughout the OECD area. Recently the Committee has also undertaken a study of the options available to licensing authorities regarding safety provisions for nuclear ships. This study will attempt to define the essential active and passive safety provisions required to ensure a sufficiently high level of safety, with the subsequent aim of facilitating international discussion on a wider scale for the development of generally accepted criteria and harmonized regulations.

REGULATORY MACHINERY

Countries embarking on a programme of nuclear power require to establish effective regulatory machinery to govern the siting, design, construction, commissioning and operation of nuclear reactors and other installations, and associated activities. Equally they need either competent professional staff or access to disinterested advice to make the machinery work properly. These needs have presented and are presenting several OECD Member countries with practical problems. Countries already operating licensing machinery have adopted a diversity of practice that is not only explained by differences in legal tradition but also by differences in technical requirements.

It should be recognised that the scope for harmonization in this field is limited by varying local conditions, but there is an evident risk that unjustified differences in national licensing conditions could undermine public confidence. Moreover, unnecessary differences merely create obstacles to international trade, particularly in nuclear fuel and equipment. In addition, achievement of a unified regime for nuclear third party liability requires a common outlook on the licensing of nuclear installations covered by this regime. Thus, it is as much in the interests of vendor countries as their customers to exchange experience on licensing practices and to reduce unnecessary regulatory obstacles to nuclear development.

Although regulatory and administrative procedures in OECD countries vary greatly from country to country, there are certain denominators common to all national systems. Practically all regulatory controls provide for authorization in two stages: the first for construction of the installation, the second for its operation. These stages, however, are often subdivided: for example, a siting licence for the installation may be required before the construction licence proper is granted; also full industrial operation may only be authorized after operational testing of the installation has been carried out. The regulatory and control systems specify in great detail information to be provided to the authorities concerning the characteristics of the site, the technical specifications and safety assessment of the installation, the personality and competence of the operator, technical qualifications of the staff, radiation monitoring, releases of radioactive effluents, storage and disposal of radioactive waste, safety devices during normal operation, measures planned in case of accident, etc. The licensing files are submitted for study by one or more technical expert committees, which include representation from all the disciplines involved and which advise the competent authorities in the matter of granting the licence. In practice, when issuing a construction licence the authorities lay down a series of technical requirements for each specific installation. Following delivery of the operating licence the installation is inspected periodically for the purpose of controlling whether the safety requirements continue to be observed. These controls are frequently carried out by a body of specialized inspectors with wide powers. The legislation empowers the competent authorities to suspend or withdraw a licence in cases where the safety requirements are not being observed. Most laws provide that the authorities may supplement or amend the licensing requirements, even after a licence has been issued, and this provision may have great practical consequences in a field such as that of nuclear energy where the technology is in continuous progress.

As a first step towards greater harmonization in power reactor licensing, the CSNI has formed a Sub-Committee on Licensing whose first task is to compile and analyse data on standards, criteria and codes of practice adopted in different countries by the authorities responsible for licensing and inspection. The structure and operating methods of the authorities will also be studied. A special task might be to consider how siting policies are determined for nuclear installations near international borders. The programme of the Sub-Committee on Licensing also includes a participation in the IAEA Project on safety codes and guides; its contribution will mainly concentrate on the codes and guides on reactor design. Other activities include discussion of the question of backfitting and information exchanges in the case of nuclear incidents and accidents. The Sub-Committee will also have an interest in a recent recommendation of the OECD Council on principles concerning transfrontier pollution, which are designed to facilitate the development of harmonized environmental policies with a view to solving transfrontier pollution problems. The implementation of these principles, which should be based on a fair balance of rights and obligations among countries concerned by transfrontier pollution, include in particular equal right of hearing for those who may be affected outside the country where pollution originates as for those of that country. According to this principle, the individuals involved should have the same rights of standing in judicial or administrative proceedings and they should be extended procedural rights equivalent to the rights extended to those of the country where such pollution originates. This recommendation has obvious implications for licensing practices in the nuclear energy field, which often provide for prior public enquiries.

SAFETY AND LICENSING

It is obvious that the acceleration of nuclear power programmes in OECD Member countries poses a number of problems in the field of safety and licensing of nuclear installations, and specific measures will have to be taken to ensure a smooth expansion, while maintaining the high safety standards achieved by the nuclear industry. The main consideration applies evidently to the changeover from a period dominated by research and the construction of experimental and demonstration reactors to a phase of fast industrial expansion. There is also the rapid increase in unit size, which requires more complex safety systems and sometimes different solutions to safety problems. Furthermore, the possible introduction of new types of reactors in the relatively near future is another factor to be taken into consideration. At the same time, safety systems are becoming more and more sophisticated; also regulations are being strengthened for reasons often unconnected with nuclear power as such (general concern for environment protection), which may lead to the introduction of changes in existing installations. In addition, the construction of an increased number of installations and the selection of new sites will lead to an increased workload for national authorities responsible for the licensing and control of nuclear installations.

In fact, significant measures are already being taken or planned in many countries for strengthening reactor safety research and promoting co-operation between scientists engaged in safety technology and the licensing authorities. Similarly, measures are being taken or planned to provide the administrations competent for licensing and inspection with an organization and means that should enable them to meet their increased workload. The main objectives are the development of streamlined administrative procedures, the standardization in the design and components of installations, the pre-selection of sites, the recruitment and training of qualified operating and administrative staff.

It may be wondered what future role may be attributed in the field of safety and licensing of nuclear installations to international co-operation, which has already exerted a considerable influence in the field of radiation protection. It is quite clear that the licensing of nuclear installations depends very closely on local circumstances and conditions as well as on the administrative organization in each particular country. This easily explains why international co-operation has had a more limited scope in this field. However, it cannot be denied that the policies followed by the more advanced countries in the field of reactor safety have, and will continue to have, an impact beyond frontiers. The standardization system, given its very nature, should have repercussions at the international level. One cannot doubt the usefulness of international consultations on technological safety research, which have led to remarkable progress. It is more difficult to say whether it is desirable and/or indeed possible to achieve in the near future a certain harmonization of the technical criteria used for reactor safety and to what extent such a harmonization could encourage the development of nuclear power. Moreover, what are the advantages to be gained by exchanges of experience on licensing regimes both from the viewpoint of procedures and of practical operation? Certain countries have already emphasized the importance of the benefit they would gain from such exchanges and, generally speaking, discussions and comparisons between licensing authorities should help to improve regulatory and control methods (while observing individual national characteristics).

The safety of large nuclear installations undoubtedly raises far too many complex and new problems to make it possible to answer these various questions in general terms. Doubts have been expressed on actions for harmonization in this area. For OECD Countries the Committee on the Safety of Nuclear Installations provides a natural forum for the consultations and exchanges just mentioned, to the extent that national authorities may wish to make use of it and find some common interest in it. Safety technology and practices are now in an evolutive state but is it likely that in the longer term they will have to be subjected to some system of codes of practice and standards prepared and accepted at international level; an increasingly greater importance is therefore being attached to this Committee's work in the perspective of an expansion of nuclear electricity programmes.

ESSENTIAL COMPONENTS OF SAFETY ANALYSIS REPORTS FOR NUCLEAR POWER PLANTS

M. ROSEN
Division of Nuclear Safety and Environmental Protection,
International Atomic Energy Agency,
Vienna

Abstract

ESSENTIAL COMPONENTS OF SAFETY ANALYSIS REPORTS FOR NUCLEAR POWER PLANTS.

The Safety Analysis Report represents the principal communication between the applicant for a licence and the regulatory body. In many countries a Preliminary Safety Analysis Report is required at the pre-construction stage and a Final Safety Analysis Report at the pre-operation stage. Outlines of the general objectives and essential components of such reports are provided, and review by the regulatory body is described.

1. INTRODUCTION

The applicant's principal purpose in preparing and submitting a Safety Analysis Report (SAR) is to inform the appropriate authorities of the detailed nature of the nuclear power plant and plans for its use. The submittal of the SAR is usually required by governmental atomic energy laws and it represents the principal communication between the applicant and the regulatory body. The information provided must be sufficient to permit an independent review of whether the plant can be built and operated with due consideration to the health and safety of the general public and the operating personnel.

To accomplish this it must contain a systematic presentation and analysis of the nuclear safety aspects of:

(a) Siting
(b) Design
(c) Construction
(d) Operation.

In many countries the safety reports are usually issued as a Preliminary Safety Analysis Report (PSAR) at the pre-construction stage and as a Final Safety Analysis Report (FSAR) at the pre-operation stage. The PSAR supports the application for authorization to construct and the FSAR supports the application to operate. This paper will briefly summarize the general objectives and essential components of SARs. More detailed information can be found in the literature mentioned.

2. OBJECTIVES

The SAR is a compilation of various types of information presented by the applicant to the competent authority. The prime objectives of the document are to present:

(a) A sufficiently detailed description of the site characteristics and nuclear power plant structures, systems and components
(b) A clear identification of the safety-related design bases and criteria
(c) A demonstration of compliance of the design of the plant at the particular site with the stated design bases and criteria
(d) A safety analysis in which individual system and component designs are evaluated for effects of anticipated disturbances, malfunctions, or failures
(e) A plan for the applicant's organization, including a description of the manner in which the plant will be operated.

The document must contain sufficient information to enable the competent authority to perform its own independent safety assessment and to decide upon any specific conditions for operation of the plant (see discussion in section 5). The information should be presented in a concise manner and the various items treated in accordance with their relative importance to nuclear safety. The design information provided in the SAR should reflect the most advanced state of the facility design available at the time of submission (which may vary depending on specific national requirements). If certain information is not available, the criteria and basis to be used to develop the required information, the concepts and/or alternatives under consideration, and the schedule for completion and submission of the information in the form of amendments to the SAR should be included.

The main difference between the preliminary and final safety reports is that the former will be more a statement of intent, while the latter will be statements of design conclusions and therefore require to be supported by final design calculations, drawings, circuit and wiring diagrams, etc.

3. ORGANIZATION

To ensure that submitted SARs are as complete as possible, various documents have been prepared that specify in detail the organization and information requirements. In recognition of the need for this specific guidance the International Atomic Energy Agency issued in 1969 Safety Series No. 31, "Safe Operation of Nuclear Power Plants", and in 1970 Safety Series No. 34, "Guidelines for the Layout and Contents of Safety Reports for Stationary Nuclear Power Plants". The US Atomic Energy Commission has more recently published in 1972 a "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants". Even more recently the NORDIC working group on reactor safety prepared in 1973 a draft of their proposed "Guidelines for the Preparation of Safety Assessment Documents for Stationary Water Cooled Nuclear Power Plants".

The IAEA Safety Series No. 34 and the USAEC Standard Format represent two examples of guidelines that are currently available. The IAEA document recommends four distinct subject sections, with subsections and further subdivisons (e.g. Site, Meteorology, and Wind). In the USAEC document the SAR is divided into seventeen chapters, with sections, subsections and further divisions (e.g. Site Characteristics, Meteorology, Regional Climatology, and Data Sources).

The four major subject titles contained in the IAEA document along with a listing of the subsections are presented below. Following this, for comparison, the various chapters of the USAEC Standard Format are shown. The general information requirements of the various sections and chapters are then presented in the next part of this report.

3.1. Table of Contents from IAEA Safety Series No. 34

(Chapter I – Introduction)

Chapter II – Site

1. Site description
2. Meteorology
3. Hydrology
4. Geology and seismology
5. Ecology
6. Summary

Chapter III – Components and Systems

1. Summary description of plant
2. Reactor
3. Reactor cooling system
4. Containment system
5. Control and instrumentation
6. Electrical systems
7. Power conversion systems
8. Fuel handling and storage
9. Plant auxiliaries and miscellaneous services
10. Radiation protection
11. Radioactive wave systems

Chapter IV – Safety Analyses

1. Initiating event
2. Analyses

Chapter V – Operational Aspects

1. Operating organization
2. Operation during commissioning
3. Normal operations
4. Operation during abnormal and accident conditions

3.2. Table of Contents from USAEC Standard Format Document

4. CONTENTS

As can be seen from these listings, essentially similar topics appear in both formats, although the specific order of presentation varies somewhat. Using the four major subject areas of the IAEA outline as a guide, some general information requirements of the SAR are described below. This information should be presented in the most appropriate form; that is, drawings (such as for piping and instrumentation), maps, diagrams, sketches, and charts where necessary. The technical basis and methods used to arrive at design decisions must be presented (e.g. calculational models and codes) and all reports, standards, or other documents that are referenced in the text of the SAR should be clearly identified.

4.1. Site

Provides information on the geological, seismological, hydrological, meteorological, and ecological characteristics of the site and vicinity, in conjunction with population distribution, land use, and site activities and controls. The purpose is to indicate how these site characteristics have influenced plant design and operating criteria and to show the adequacy of the site characteristics from a safety viewpoint.

Information should clearly present the typical environmental conditions and the anticipated extreme environmental conditions. A tabulated summary should be given of the specific values or range of values for environmental variables such as wind velocity, minimum and maximum air temperatures, seismic accelerations, and maximum discharge temperature of liquid effluents.

4.2. Structures, components, and systems

An introduction containing a summary description of the plant should be provided. This enables the reader to obtain a basic understanding of the overall facility and allows review of the detailed information that follows with better perspective and with recognition of the relative safety importance of each individual item to the overall plant design.

The detailed description of the plant identifies, describes and discusses the principal architectural and engineering designs of those structures, components, equipment and systems important to safety. It discusses conformance with design criteria, seismic design and dynamic analyses. A full evaluation of the plant together with supporting information is provided to establish the capability of the plant to perform throughout its lifetime under all normal and operational modes including both transient and steady state.

4.3. Safety analysis

The evaluation of the safety of a nuclear power plant is accomplished, in part, by analyses made of the response of the plant to postulated disturbances in process variables and to postulated malfunctions or failures of equipment. Such safety analyses provide a significant contribution in the selection of the design specifications for components and systems from the standpoint of public health and safety.

Situations that must be analysed range from anticipated operational occurrences (such as a loss of electrical load resulting from a line fault) to postulated accidents of low probability (such as the sudden loss of integrity of a major component). They include the Design Basis Accidents, whose consequences are not expected to be exceeded by any other accidents considered credible. This section should present information on all the engineered safety features (such as emergency core-cooling systems) provided in the plant in sufficient detail to permit an adequate evaluation of their performance.

4.4. Operational aspects

This provides information describing the way operation of the plant will be conducted. The operation of the plant entails a myriad of instructions and procedures of varying detail for the operating staff. The details of such procedures are not included in the SAR, but information is provided to indicate generally how the applicant intends to conduct operations, and to ensure that he will maintain a technically competent and safety-oriented staff.

This also provides information relating to the period of initial operation, with particular emphasis on tests planned to demonstrate the degree to which the plant does, in fact, meet the design criteria. Explanations for any special limits, conditions, surveillance requirements, and procedures to be in force during the initial period of operation are included.

Finally, it provides the technical operating limits (e.g. power, temperature, pressure), conditions, and requirements imposed upon the plant and the bases or reasons for these qualifications.

Additionally, to provide confidence that the components, structures, and systems of a facility are designed and constructed to a quality and in a manner appropriate to safe and reliable operation, a quality assurance programme must be established. The programme covers all activities affecting the safety-related features of the facility including engineering, purchasing, fabrication, handling, shipping, storing, cleaning, erecting, installing, maintaining, repairing, refuelling, and modifying. A description of this programme should appear separately or be included in the section on structures, components, and systems.

5. REVIEW

The regulatory organization that has the responsibility and authority to issue the licence to construct and operate usually has the important role of performing the technical safety review of the nuclear project. It is the task of the regulatory body to:

(a) Acquire a sufficient understanding of the safety bases of the plant design
(b) Perform a sufficient review of the technical submission to determine whether the design complies with the specified safety bases and criteria for construction and operation
(c) Accept or ask for modifications or additions to the design bases, after consideration of the relevant national criteria and standards.

To review the SAR, which contains the detailed safety bases and analyses, a staff with knowledge of the major technical specialities involved in nuclear power plant technology should be available. IAEA Technical Reports Series No. 153, "Organization of Regulatory Activities for Nuclear Reactors" discusses the staff requirements and organization necessary to perform the safety review.

Since a highly trained staff may not be available in the early stages of a national nuclear programme, some of the more technical aspects of the safety review normally performed by a safety review staff can be accomplished outside the specific regulatory group; perhaps at a research centre or university, which would have easier access to the required experts. During these early years, in consideration of the possible staff limitations, it may not be necessary for the regulatory agency to emphasize many areas usually associated with safety analyses. For example, the routine accident analyses and reactor transient behaviour will be similar for the plant being reviewed and for other plants designed by the NSSS vendor for its own domestic market and for the international market. The agency can concentrate only on features that differ between the plant being constructed and other similar plants, and the reasons for these differences. Considering the probable limitations of the small staff that may be initially available, many of the safety aspects can most easily be reviewed by this method. The comparison must be in sufficient detail and include all of the important structures, systems, and components. The information that can be obtained by this process will cover any differences in:

(1) Codes and standards
(2) Systems and components
(3) Equipment design, capacity and redundancy
(4) Test requirements.

This approach has several distinct advantages. First, becoming familiar with the complex systems can serve as an essential means of training for both utility and regulatory staff. Second, when the comparison is done not only to the reference plant usually specified in the project contract, but also to a more recent plant, it can serve as a means of following new developments.

THE ROLE OF ADVISORY COMMITTEES IN THE LICENSING OF NUCLEAR FACILITIES IN CANADA

J. H. F. JENNEKENS
Nuclear Plant Licensing Directorate,
Atomic Energy Control Board,
Ottawa, Canada

Abstract

THE ROLE OF ADVISORY COMMITTEES IN THE LICENSING OF NUCLEAR FACILITIES IN CANADA.

The Reactor Safety Advisory Committee was established in 1956 to advise the Atomic Energy Control Board on all aspects of the safety of nuclear reactors. Subsequently, other advisory bodies have been set up for various purposes in the licensing process but their structure and working procedures are quite similar. As illustration, a study is made of the composition and functioning of the Reactor Safety Advisory Committee. A general schematic chart of the licensing process is provided in the annexes.

1. INTRODUCTION

The Atomic Energy Control Act, which came into force in 1946, constituted the Atomic Energy Control Board and authorized it to control atomic energy materials and equipment in the national interest and to participate in measures for international control of atomic energy as might thereafter be agreed. The basic role of the Board is to control atomic energy materials and equipment in the interests of health, safety and physical security; to control atomic energy materials, equipment and information in the interests of national and international security; to award grants in aid of atomic energy research; and finally, to administer certain aspects of the Nuclear Liability Act, which is expected to be proclaimed shortly.

In passing the Atomic Energy Control Act of 1946, the Parliament of Canada declared atomic energy to be a matter of national interest and therefore subject to federal jurisdiction. It was realized, however, that co-operation with provincial authorities would be of major importance in ensuring that relevant provincial regulatory requirements that did not conflict with requirements arising out of the Atomic Energy Control Act and Regulations would be complied with in the development and application of atomic energy. It was further realized that experts employed by both provincial and federal departments charged with responsibilities in such fields as public health, industrial safety, pressure vessel certification and inspection and environmental controls possessed both individually and collectively a wealth of experience and expertise which would be of invaluable assistance to the Atomic Energy Control Board in the licensing of nuclear facilities pursuant to the provisions of the Atomic Energy Control Act and Regulations.

Thus, in 1956 when the first application to construct a nuclear reactor outside the research establishments operated by Atomic Energy of Canada Limited was submitted to the Board a decision was made to establish the

Reactor Safety Advisory Committee. Since that date a number of advisory committees have been established including:

(1) The Reactor Operators Examination Committee
(2) The Accelerator Safety Advisory Committee
(3) The Heavy Water Plant Safety Advisory Committee
(4) The Uranium Hexafluoride Plant Safety Advisory Committee
(5) The Advisory Committee on Radiological Health Safety for Fissionable Material Processing Plants
(6) The Radioactive Waste Safety Advisory Committee
(7) The Advisory Committee on Nuclear (Radioisotopic) Devices.

As their names imply, the role of the Board's advisory committees is varied; however, their structure and method of operation are quite similar. For illustration purposes and in keeping with the theme of this Study Group Meeting, the remainder of this paper will deal with the Reactor Safety Advisory Committee.

2. THE REACTOR SAFETY ADVISORY COMMITTEE

2.1. Purpose

In establishing the Reactor Safety Advisory Committee, the Board charged it "to advise on all aspects of the safety of nuclear reactors". The very brevity of this term of reference has enabled the Committee to examine comprehensively and to recommend to the Board the fundamental safety criteria upon which the design, construction, commissioning and operation of Canadian nuclear reactors are based as well as to review in detail particular aspects of such reactors.

2.2. Membership

The Chairman and Secretary of the Committee as well as all of the members are appointed by the President acting on behalf of the Board. The membership includes representatives of federal and provincial government agencies as appropriate to the province in which a particular reactor is to be located. Local Medical Officers of Health are also invited to join the Committee in the review of reactors to be constructed in their area of jurisdiction.

Listed below are the names of those departments and agencies currently represented on one of the three branches of the Committee:

(a) Projects located in the province of Ontario

Ontario Ministry of Health
Federal Department of Health and Welfare
Local Medical Officer of Health
Ontario Ministry of Labour
Ontario Ministry of Consumer and Commercial Relations
Federal Department of Energy, Mines and Resources
Ontario Ministry of the Environment
Chalk River Nuclear Laboratories.

(b) Projects located in the province of Quebec

Quebec Department of Natural Resources
Quebec Department of Municipal Affairs
Quebec Ministry of Social Affairs
Federal Department of Health and Welfare
Quebec Department of Labour
Federal Department of Energy, Mines and Resources
Chalk River Nuclear Laboratories.

(c) Projects located in the province of New Brunswick

New Brunswick Department of Health
Federal Department of Health and Welfare
New Brunswick Department of Fisheries and the Environment
New Brunswick Department of Labour
Federal Department of Energy, Mines and Resources
Chalk River Nuclear Laboratories.

Not included in the above listings are the names of organizations such as universities from which individual experts have been drawn to serve on the Committee. Typically, the total number of members on each of the three branches of the Committee is about fifteen. It should be noted that representatives of federal government agencies and members appointed because of individual expertise and competence serve on all three branches of the Committee. Thus, Committee membership includes engineers, scientists in a number of disciplines and medical doctors.

2.3. *Operation*

2.3.1. Background information

The method of operation of the Reactor Safety Advisory Committee has evolved as a result of experience gained over the eighteen years of its existence. Initially, the Committee reviewed in considerable detail the various documents submitted in support of construction and operating licence applications. This close scrutiny continued after a reactor had been declared 'in-service' and throughout the ensuing years of operation.

As the nuclear power programme expanded the number of reactor units about which the Committee's advice was sought grew to such an extent that the workload imposed upon its members amounted to a significant fraction of their total working time. Not only did the number of reactors increase significantly (from one in 1956 to twenty-three in 1974) but also their size and complexity. Thus, one of the first changes in the Committee's method of operation was the creation of sub-committees. At present, two such sub-committees exist: the Health Physics Sub-Committee and the Sub-Committee on Reactor Control. As their names suggest, these sub-committees consist of specialists in two areas of primary importance to the licensing of nuclear reactors.

At the present time the activities of the Reactor Safety Advisory Committee are divided into two categories: activities associated with the initial licensing of reactors and, secondly, post-licensing activities.

Further details on these two categories are given below. Since the Canadian licensing process has already been described in a companion paper,[1] the description of the Reactor Safety Advisory Committee's operation that follows will be restricted to the two formal licensing stages (construction licence and operating licence). Details regarding the Committee's activities in relation to 'site approval' are given in the companion paper.

2.3.2. Activities associated with initial licensing of reactors

Upon receipt of an application for a construction licence, the staff of the Board advise the relevant branch of the Reactor Safety Advisory Committee and forward to each member copies of documentation submitted in support of the application. In reviewing this documentation, the Committee takes into account assessments prepared by the Board staff in the months that follow receipt of the application. During this review meetings are held with the applicants and their nuclear and conventional engineering consultants to obtain additional information required for an in-depth assessment of the proposed nuclear plant. If the Committee is satisfied with the proposed design, it recommends to the Board that a Construction Licence be granted. In this connection it is worth noting that no licence for a nuclear plant has been granted without a favourable recommendation from the Reactor Safety Advisory Committee

The Committee meets several times during the construction of a nuclear plant, normally at least once a year and one or more of these meetings is held at the plant site. One of the primary documents reviewed at such meetings is an annual revision (up-dating) of the Preliminary Safety Report. Other documents reviewed include periodic reports by the staff of the Board and special reports prepared by the applicants on particular subjects including the results of experimental tests performed to support the analysis of postulated accidents.

As a result of its continuing review, the Committee prepares periodic reports to the Board in which it recommends the imposition of such safety requirements as it seems advisable and actions that should be taken by the staff of the Board to ensure that such requirements are complied with.

When construction of a nuclear plant in Canada is completed, the various process and safety systems are commissioned and tested to ensure that they will function as intended. Everything is tested except the actual operation of the reactor, which cannot be started up until an Operating Licence is granted. Assurance of adequate testing is obtained through surveillance by members of the Board staff at the reactor site during the construction and commissioning phases of the plant. The Committee is provided with reports by the Board staff on the progress of commissioning operations and its analysis of test results.

Upon completion of 'pre-criticality' commissioning operations the Committee reviews the final design, results of tests and plans for operation of the plant. Only when it determines that the plant has been designed, constructed, commissioned and staffed adequately, and that it can be operated safely, does it recommend to the Board that an Operating Licence be granted.

---

[1] JENNEKENS, J. H. F., Safety aspects of nuclear plant licensing in Canada, this publication.

2.3.3. Post-licensing activities

During the initial years of operation of a nuclear plant the Reactor Safety Advisory Committee is requested by the Board to maintain a close scrutiny of the plant's operating performance. Basically, this scrutiny includes a review of quarterly and annual operating reports prepared by the licensee on all aspects of plant operation including process and safety system performance, overall plant reliability, events of special significance to safety, radiological protection generally and radioactive effluents in particular, staff training and emergency preparedness. The Committee also reviews periodic reports prepared by Board staff stationed at the plant site as well as special reports on any subject relevant to the assurance of a high standard of overall safety.

The Committee meets with representatives of the licensee at least annually and normally a few months following the submission of the annual operating report. A report of the Committee's findings is submitted to the Board and it may include recommendations concerning the conditions under which the Operating Licence should be renewed. These recommendations normally result from the Committee's detailed consideration of subjects brought to its attention by the Board staff during private meetings of the Committee which precede and follow the general meetings with representatives of the licensee.

Once a plant has reached 'maturity operation' (normally three or more years after the 'in-service' date), the primary responsibility for continuing detailed assessment of the plant's performance shifts to the staff of the Board. However, the Committee continues to receive copies of all of the reports cited above and utilizes part of the time of some of its many meetings throughout the year to review the actions taken by the Board staff. Should any member of the Committee wish to call attention to any matter concerning the operation of a 'mature' plant, he may do so by making arrangements with the Chairman. Normally, the Committee declares its endorsement of the compliance activities of the Board staff, although it retains both the obligation and the right to submit recommendations to the Board regarding extension or modification of such activities. Recommendations regarding licence renewal and conditions of operation are a continuing responsibility of the Committee.

ANNEX A

GENERAL SCHEMATIC OF THE NUCLEAR POWER PLANT LICENSING PROCESS IN CANADA

This Annex can be found in the form of a chart, consisting of two fold-out sheets attached to the back cover of this publication.

ANNEX B

ADDENDUM TO GENERAL SCHEMATIC OF THE NUCLEAR POWER PLANT LICENSING PROCESS IN CANADA

The purpose of this addendum is to provide information for the better understanding of the Schematic. This information is presented under the following topics:

(1) Purpose of the Schematic
(2) Considerations in the use of the Schematic
(3) Use of the Schematic
(4) Schematic legend
(5) Additional information on items shown on the Schematic

1. PURPOSE OF THE SCHEMATIC

The purpose of the Schematic is:

(a) to provide the AECB staff and applicant with a tentative schedule for the preparation, submission and review of documentation in support of applications for a site approval, a construction licence, and an operating licence for a nuclear power station.

(b) To aid in the estimate of manpower requirements for the various stages of licensing a nuclear power station.

(c) To provide a consistent approach to the scheduling of licensing actions for nuclear power stations.

2. CONSIDERATIONS IN THE USE OF THE SCHEMATIC

(1) The General Schematic is prepared for a utility planning its first nuclear power station. Consequently, several of the items on the Schematic may not apply to a utility which already owns and operates one or more nuclear stations.

(2) Generally, the timing of items at the beginning of the Schematic is related to the receipt of the 'letter of intent', whereas the timing of those at the end of the schedule is related to the issuance of the operating licence. Items in the middle are generally related to the issuance of the operating licence as well, but their timing is more dependent on the length of the project and therefore such items will be scheduled to suit each project.

3. USE OF THE SCHEMATIC

A copy of the Schematic with addendum will be included in the package of information that will be sent to the applicant together with a reply to the letter of intent.

As soon as possible thereafter AECB staff and the applicant should meet to discuss the mutual use of the Schematic and to determine what changes will be required for the station. It is intended that agreement on the format of the Schematic and the method of use will be reached at approximately the time site approval is given.

The Schematic will then be used by both the AECB staff and the applicant with meetings between them held as frequently as required (nominally once per year) to update it.

4. LEGEND

Solid line with an arrowhead

This indicates the estimated time for an event to take place (start to finish) with action taking place on a regular basis over the full length of time.

Dashed line running into a solid line with an arrowhead

The dashed line indicates the event would be expected to start anywhere along its length. The solid line provides the same indication as given above.

Dashed line with an arrowhead

This indicates an event which requires only a short period of time (a few days) to take place (such as the actual issue of the Construction Licence by the Board).

Dashed line with no arrowhead

This indicates dependence of one event on another with the time being variable.

Filled circles

Activities preceding filled circles are mandatory for the applicant from an AECB standpoint.

5. ADDITIONAL INFORMATION ON ITEMS SHOWN ON THE SCHEMATIC

(Note: Only those items which appear to require additional explanation are mentioned below.)

5.1. Letter of intent

The letter of intent should be addressed to the President of the AECB and should briefly outline the intention of the utility to build a nuclear power station at a particular site. The type and size of the reactor proposed as well as a very basic schedule for the design, construction, and operation of the plant should also be included.

It should be noted that during the period of acquisition of a particular site by a utility (Site Acquisition Phase) informal discussions take place between representatives of the utility and AECB staff regarding siting requirements.

5.2. Package of information

This will basically consist of the following:

A guide for the preparation of safety reports;
A copy of paper 72-CNA-102 entitled "Reactor Licensing and Safety Requirements";
A copy of the Atomic Energy Control Act, Regulation and various Board Orders;
A copy of the General Schematic of Nuclear Power Plant Licensing Process and addendum;
A copy of a document outlining the required qualifications for control room operators and shift supervisors.

Other information available at the time which may further aid the applicant in preparing the required documentation will be included with the above documents.

5.3. Public announcement of the project

This statement is to be interpreted as an announcement by the utility to the public of its intention to build and operate a nuclear power station at a particular site. Included in the announcement should be a brief description of the proposed station including the type and size of the reactor proposed and the location of the site.

5.4. Public participation

This may take place in the form of town-hall type information and discussion meetings or by other means primarily for members of the public who are living in the vicinity of the proposed nuclear power station and for other members of the public whose interests may be affected. It would be the utility's responsibility to justify the need for such a station. However, AECB representatives would be prepared to answer questions regarding the licensing of the station.

5.5. Basic utility organizational chart

This should provide a basic outline of the utility's organization and should include the names of individuals where appropriate. Particular attention should be given to that part of the organization which is responsible for the nuclear power program. The names of individuals with whom the AECB staff would be communicating in the initial phase of the project should be included.

5.6. Project organization chart — channels of communication

The project chart, as its name implies, should be more comprehensive than the basic utility chart. It should contain a finer breakdown of the organization to indicate which people are responsible for the various aspects of the project such as design, construction, commissioning, training, health physics, and others as appropriate. It should also show the channels of communication between the various groups involved in the nuclear power program within the utility as well as the channels of communication with outside organizations (consultants) doing contractual work for the utility. Organization charts of the outside organizations should also be included but need only include that portion which is relevant to the contractual work. Those individuals with whom the AECB would be communicating should also be indicated.

In addition, a brief description of the responsibilities associated with each position should be given.

5.7. Safety Report

The Safety Report in its initial form is called the Preliminary Safety Report. The Preliminary Safety Report is revised annually in order to keep it as up to date as practicable with the actual design and accident analysis of the station. The final revision is made a year prior to the submission of the application for an operating licence. This revision then becomes the Safety Report and normally is not subject to further revisions except for the updating of some of the calculated values with actual values determined from commissioning.

5.8. Site preparation and excavation

This is defined as preparatory site work but does not include the pouring of concrete for the reactor building.

5.9. Start of construction

This is defined as the pouring of the concrete for the reactor building.

5.10. Design information

Please see Attachment 1.

5.11. Applicant internal review of station design

To aid in achieving a better overall design it is visualized that an internal review will be done by appropriate staff members of the utility who will feed-back information to the designers with regard to adequacy of the design from their standpoint.

5.12. Identification of key permanent staff positions and plans for staffing these positions

The positions referred to are the senior staff responsible for the overall operation of the station. These should cover the following areas: station management, maintenance, technical support, training and health physics. The plans for staffing these positions should include the following:

An outlined of the qualifications required for the positions

A schedule for the appointment of personnel to fill the positions

Training requirements (if any).

5.13. Station staffing and training plans

This should include the following:

Predicted staffing requirements from the start of construction to commercial operation of the station
Schedule for the appointment of personnel
An outline of the training program which should include theoretical and practical courses in nuclear and conventional subjects as well as in radiation protection and which should indicate the approximate number of hours planned for each course
A preliminary training schedule.

5.14. Commissioning information

This item is intended to cover commissioning reports for the various systems and equipment and any special reports of concern which may be prepared and issued as a result of commissioning activities.

5.15. Prescribed materials and equipment

This item includes all nuclear materials with the exception of heavy water and fuel (i.e. includes boosters, radioactive isotopes, etc.).

5.16. Application to acquire and load heavy water

Such an application should be in two parts:

(a) Part I – Application to acquire heavy water
Part I should include sufficient information with regard to the acquisition, transportation, etc. of heavy water (see appropriate AECB Regulations) as well as its storage at the site to allow a Permit to Acquire to be issued.
(b) Part II – Application to load heavy water
This application should include a schedule for the addition of heavy water to the reactor systems and any special precautions to be taken in conjunction with the loading of the water.

5.17. Application to acquire and load fuel

This application should also be in two parts:

(a) Part I – Application to acquire fuel
The application should include sufficient information with regard to the design, acquisition, on-site storage, etc. of the fuel to allow a fuel acquisition permit to be issued.
(b) Part II – Application to load fuel
The application should include a schedule for the loading of fuel into the reactor and any special precautions to be taken in conjunction with or subsequent to the loading operation.

5.18. Outline for station radiation protection

An outline should be presented of the following:

Radiation protection regulations (which specify the policies to be followed with respect to radiation protection at the station)
Radiation protection organization (the responsibilities, with respect to radiation protection, of health physicists, radiation protection technicians, and other personnel should be outlined)
On-site and off-site emergency plans (the latter being the responsibility of public authorities)
On-site and off-site environmental programs
Station liquid and gaseous effluent monitoring programs and associated laboratory facilities
Plans for internal and external dosimetry of station personnel
Radiological protection equipment (types, quantities and general plans for monitoring instruments, protective clothing, respiratory devices, etc.)
Decontamination facilities
Radioactive waste management plans.

Although the plans for the above items may be only preliminary, sufficient details should be presented to permit the AECB to assess their adequacy. Also, a schedule for the items should be included.

5.19. Specific examinations

All shift supervisors and control room operators for the station are required to write the AECB "specific" examinations within one year preceding their being authorized for their respective positions.

5.20. General examinations

All shifts supervisors and control room operators for the station are required to write the AECB "general" examinations prior to being authorized. However, if they have written these examinations while employed at another nuclear station, they may be exempted from rewriting them.

5.21. Application for an operating licence

The application for an operating licence should contain sufficient information to provide assurance that the station has been constructed in accordance with the Design Description given in the Safety Report and in accordance with all required codes and standards.

In addition, sufficient information should be given to provide assurance that all commissioning will be completed as per the commissioning program and that all AECB licensing reprequisites will be completed as per the schedule laid down for them.

5.22. Prerequisites for loading fuel and an operating licence

Attached (Attachment 2) is a copy of the general prerequisites for loading fuel and for the operating license. It is anticipated that a specific document will be prepared for each station appropriately revised to accommodate changes from one station to another.

5.23. Station certifications

These are in the form of brief letters from the station to the AECB certifying that all the requirements essential to the granting of a particular authorization have been met. The requirements would normally have been detailed in the various applications previously received from the station and in the documentation specifying the various prerequisites.

ATTACHMENT 1. LICENSING PREREQUISITES – DESIGN INFORMATION

1. GENERAL

The PRELIMINARY SAFETY REPORT submitted in support of an application for a licence to construct a nuclear power station contains a considerable volume of design information and the results of analyses of postulated accidents. However, as its title implies, the information contained in the report is subject to subsequent updating as the detailed design of the station proceeds. The updating takes place formally by the submission, on an annual basis, of a revision to the PRELIMINARY SAFETY REPORT in accordance with the conditions of the CONSTRUCTION LICENCE.

To minimize any delays in the licensing process, the timely provision of design information of an accident analyses is required.

The purpose of this document is to outline the scope and nature of information to be provided to the AECB during the intervals between submission of the PRELIMINARY SAFETY REPORT and the annual revisions thereof.

2. LICENSING REVIEW OF DESIGN INFORMATION

The primary purpose of the review of design information by the AECB staff is to confirm that the systems important in terms of overall plant safety conform with basic principles and requirements specified by the Board on the advice of the Reactor Safety Advisory Committee. Sufficient information must therefore be submitted in order that this purpose can be achieved.

In terms of timing, it is evident that the submission of information must be scheduled in such a way that confirmation of compliance with safety principles and criteria is obtained prior to the "freezing" of design. If this scheduling is not maintained, costly design changes may result.

INFORMATION REQUIREMENTS

3.1. Scope

3.1.1. Preliminary analyses and scoping studies;
3.1.2. Associated research, development and testing programs;
3.1.3. Design descriptions and flowsheets;
3.1.4. Project milestone schedules;
3.1.5. Safety system reviews;
3.1.6. Man-rem audits.

3.2. Format

No special format for presentation of information on an interim basis is necessary. In fact, designers, constructors and operators have developed a number of formats to serve operational purposes and these have been found to be very appropriate for the purpose of licensing reviews. Examples of such documents are:

(1) Technical reports on equipment and design features
(2) Interim progress reports on the analysis of postulated accidents
(3) Design manuals
(4) Operating manuals
(5) Design and operational flowsheets
(6) Project scheduling milestone diagrams
(7) Control and safety system design guides
(8) Station data sheets.

ATTACHMENT 2. PREREQUISITES FOR FUEL LOADING AND STATION OPERATION

1. PREREQUISITES FOR PERMIT TO LOAD FUEL AND HEAVY WATER [2]

1.1. Completion assurances

1.1.1. Design assurance

The "assurance" should certify that the design has been completed in conformance with relevant codes and regulations or to a higher standard. The "as-built" design is to be in accordance with the description given in the "Safety Report".

1.1.2. Construction assurance

The "assurance" should certify that construction has been in conformance with relevant codes and regulations or to a higher standard. The construction shall be in accordance with the design described in section 1.1.1 above (any exceptions to be noted pending revision of the Design Description). The assurance should give reference to inspection, test or other construction reports. Also, the assurance should state that any outstanding construction work will be completed in accordance with this paragraph.

1.1.3. Commissioning assurance

The "assurance" should certify that the commissioning of the Station is being carried out and will be completed in accordance with the document entitled "Commissioning Program" (which is to be submitted as a primary licensing document in support of the application for an operating licence).

---

[2] It is assumed that fuel will be loaded after the heavy water has been added to systems. This need not be the case.

1.2. Documentation required

1.2.1. Licensing documents

1.2.1.1. "Safety Report"

1.2.1.1.1. Design description to be complete for the "as-built" station.

1.2.1.1.2. Accident analysis to be complete.

1.2.1.2. "Commissioning program"

This document should clearly tabulate the commissioning operations and other requirements that are to be fulfilled prior to fuel loading (e.g. list of essential Phase "A" commissioning procedures).

1.2.1.3. "Operating policies and principles"

This document should be complete insofar as it applies to Phase "A" commissioning operations. NOTE: It is to be recognized that this document will be subject to revision in the light of subsequent commissioning and operating experience in the same manner as other operational documents. In order to ensure that this document fulfils its purpose, close liaison must be maintained between Operations and AECB staffs.

1.2.1.4. "Radiation protection regulations"

Such a document should be available.

1.2.2. Supporting documents

NOTE: Two copies of these documents are to be filed with the Board.

1.2.2.1. Design flowsheets & manuals

Sufficient design information is to be available to permit a judgement to be made regarding the adequacy and completeness of the following systems:

(a) Regulation, including digital computer controllers
(b) Protection (shutdown system)
(c) Heat transport
(d) Moderator and helium
(e) Fuel
(f) Steam and feedwater
(g) Auxiliary cooling
(h) Process water
(i) Station service power
(j) Process air
(k) Fuel channel
(l) Building ventilation
(m) Reactor building and penetrations
(n) Radiological protection provisions

(o) H_2O dousing
(p) Emergency cooling
(q) Pressure equalization
(r) Standby and fire water.

1.2.2.2. Commissioning procedures

Essential Phase "A" commissioning procedures.

1.2.2.3. Operating flowsheets & manuals

Operating manuals for all systems listed in section 1.2.2.1. In particular, "Radiation Incidents and Emergencies" is to have received the approval of the AECB Staff.

1.2.3. Reference documents

NOTE: These documents are to be available upon request. Examples are:

1.2.3.1. Inspection and test register

1.2.3.2. Equipment development test reports, stress analysis reports, etc.

1.2.3.3. Field test and commissioning reports

1.2.3.4. Training documents

<u>1.3. Additional prerequisites</u>

1.3.1. Prior to loading of fuel and heavy water, each system is to be maintained in a fully operable state as required to satisfy the design intent. If essential systems are not in a fully operable state, fuel may be loaded only if there is no possibility of moderator being introduced into the calandria.

1.3.2. Establishment of a test and maintenance program.

1.3.3. Provision of physical security measures.

1.3.4. Acquisition of necessary AECB authorizations for prescribed substances (fuel, special fissionable substance, heavy water, radioactive isotopes).

1.3.5. Development of accountability procedures for prescribed substances in accordance with AECB regulations and the conditions of licence.

1.3.6. Provision of radiological protection equipment and emergency supplies in accordance with "Radiation Incidents and Emergencies".

1.3.7. Completion of the technical training program for operations personnel occupying "Basic Staff" positions.

1.3.8. Key station staff positions such as shift supervisors and control room operators or equivalent to be approved by the AECB.

1.3.9. Successful completion of all essential Phase "A" commissioning operations.

1.3.10. AECB staff acceptance of station certification that all necessary prerequisites have been satisfactorily fulfilled.

2. PREREQUISITES FOR PROVISIONAL OPERATING LICENCE (Phase "B", "C" and "D" Commissioning)

2.1. Completion assurance

2.1.1. Commissioning assurance

Assurance should certify that each commissioning operation will be completed essentially in accordance with published commissioning procedures.

(NOTE: Progression to Phase "C" and "D" commissioning will be contingent upon satisfactory completion of the predetermined prerequisites and the concurrence of the AECB staff representative. "Satisfactory" completion of a commissioning operation is achieved when the design intent of the system has been fulfilled or exceptions justified).

2.2. Documentation required

2.2.1. Licensing documents

2.2.1.1. "Commissioning program"

This document should be complete but subject to revision in the light of commissioning test results.

2.2.1.2. "Operating policies and principles"

This document should be complete but subject to qualification noted in 1.2.1.3 above.

2.2.2. Supporting documents

Note: Two copies of these documents are to be filed with the Board.

2.2.2.1. Design flowsheets & manuals

Sufficient design information is to be available to permit an engineering judgement to be made regarding the adequacy and completeness of the following systems:

(a) Radioactive waste management
(b) Fuel storage bay

(c) Fuel handling
(d) Turbine, condenser and auxiliaries
(e) Generator
(f) Main power output
(g) Common water supply
(h) Communications
(i) Meteorological instrumentation.

2.2.2.2. Commissioning procedures

Phase "B", "C" and "D" commissioning procedures should be submitted.

2.2.2.3. Operating flowsheets & manuals

All essential operating manuals for the systems listed in sections 1.2.2.1 and 2.2.2.1 are to be complete.

2.2.3. Reference documents

2.2.3.1. Tabulated summary of the organizational division of duties and responsibilities of the station staff. This summary will include the following staff positions or equivalents:

Superintendent
Assistant Superintendent
Senior Commissioning Engineer
Commissioning Engineer
Shift Supervisor
Control Room Operator
Maintenance Engineer
Senior Technical Engineer
Mechanical Engineer
Control Engineer
Chemist
Physicist
Radiation Protection Officer
Health Physicist

Depending on the organizational arrangements, the Board may require the inclusion of other positions in addition to those mentioned above.

2.2.3.2. Statement of minimal educational and experience qualifications for staff positions noted in 2.2.3.1.

2.3. Additional prerequisites

2.3.1. Radiation protection qualifications to be completed for essential operating personnel.

2.3.2. Operating staff to be approved by the AECB.

2.3.3. Provision for systematic review of station operation and performance.

2.3.4. A review of the results of commissioning operations in each phase of the program will be performed prior to commencing successive phases. This review is to be carried out in conjunction with the AECB staff as approval to proceed to each successive phase will be contingent upon AECB staff concurrence. Particular note is to be made of significant faults encountered, faults currently outstanding, modifications required and any revision to the previously published program.

3. PREREQUISITES FOR FULL OPERATING LICENCE

3.1. Completion assurances

3.1.1. Commissioning assurance

Assurance should certify that the commissioning program has been successfully completed and that there is no outstanding work which would adversely affect or compromise the safe operation of the station.

3.1.2. Operation assurance

Assurance should certify that the Station will be operated in accordance with the Operating Policies and Principles. Detailed operating procedures shall conform to published operating manuals which are to be kept up to date.

3.2. Documentation required

3.2.1. Licensing documents

3.2.1.1. "Commissioning program"

This document is to be revised to reflect the actual commissioning operations performed on the station.

3.2.1.2. "Operating policies and principles"

This document is to be revised to incorporate any changes resulting from experience gained during the commissioning program.

3.2.2. Supporting documents

3.2.2.1. Operating manuals

Operating manuals should reflect the development of a comprehensive program for routine operational testing of systems and equipment essential to the safe, reliable operation of the station. The nature and frequency of functional testing are to be such that the degree of system reliability assumed in the accident analysis shall be maintained or exceeded.

3.2.2.2. Commissioning reports

Written reports on these commissioning operations deemed essential by the AECB staff are to be satisfactory completed.

(24 October 1973)

THE INSTITUTE FOR REACTOR SAFETY (IRS) OF THE TECHNISCHE ÜBERWACHUNGS-VEREINE EV

Its historical development and present status

H.-P. BUTZ
Institute for Reactor Safety,
Cologne,
Federal Republic of Germany

Abstract

THE INSTITUTE FOR REACTOR SAFETY (IRS) OF THE TECHNISCHE ÜBERWACHUNGS-VEREINE EV:
Its historical development and present status.

The Institute for Reactor Safety, which was established in 1965 by agreement between 11 Technical Inspection Associations in the Federal Republic of Germany in order to provide expertise on reactor safety, plays a key role in safety assessments of nuclear installations at both the Federal and State levels. A detailed account is given of the Institute's development, organization, functions and activities vis-à-vis the Federal and State authorities and at the international level. The safety criteria for nuclear power plants, as approved by the Länder Committee for Nuclear Energy, have been included as an Annex.

1. THE DEVELOPMENT OF THE INSTITUTE FOR REACTOR SAFETY

1.1. Forerunners of the Institute for Reactor Safety

In the second half of the last century the Technical Inspection Associations (TÜV) were founded by interested industrial circles with the purpose of studying the hazards of steam boiler installations and developing appropriate preventive measures. Since then they have also been invested by government institutions with the responsibility for checking and supervising other hazardous technical installations. They have always laid great value on a comprehensive advisory service for their members and those plants being supervised under government order. Because of this, they have developed a remarkable degree of activity in sectors such as heating and power service, feedwater technology, air purification and metallurgy and welding techniques. Moreover, those tasks concerned with the development of nuclear energy in the Federal Republic of Germany were taken up at an early stage.

As early as 1953 the general assembly of the Consolidated TÜV decided to concern itself seriously with questions of nuclear technology. In 1955 the TÜV were requested to place appropriately qualified personnel at the disposal of a central working group set up by the Consolidated TÜV. However, only the TÜV-Essen followed this call. Some Technical Inspection Associations began to set up their own working groups while others waited. So this first attempt to assemble those experts for nuclear engineering already available to the TÜV came to an early halt.

In 1958 the Advisory Committee on Reactor Safeguards (RSK) was formed by the then Federal Ministry for Nuclear Energy and Economic Water Affairs, as a consulting committee for the purpose of advising the Ministry on the exercise of its legal and functional control. The need for technical assistance for this committee, which only functioned on a part-time basis, soon became apparent. Because only the TÜV were in a position to guarantee the desired degree of qualified support by means of detailed testing, an agreement was made with the Consolidated TÜV for setting up a "Working Group for Reactor Safety". Appropriate resolutions were adopted by the general assembly of the Consolidation on 27 October 1960 at Mannheim. This Working Group for Reactor Safety paid particular attention to:

Performing preliminary examinations of safety reports
Checking nuclear and conventional processes as far as they are connected with safety problems
Supervising controls for the enforcement of safety measures for operational nuclear power plants
Performing systematic analysis of national and international findings for developing uniform technical rules.

The Working Group for Reactor Safety took up its duties on 1 January 1961. During the four years of its existence it produced 18 major evaluations.

Because of co-ordination difficulties, questions of responsibility and the geographical distances between members, it became only a temporary solution. It could not develop into a sufficiently integrated organization because of the method adopted of choosing varying expert groups from the TÜV to produce safety evaluations. On the other hand, the diversity of disciplines involved implied a permanent concentration of expertise, which could only be achieved in a self-supporting organization. With this the Working Group for Reactor Safety had outlived its usefulness, and the starting point for a new beginning, the beginning of the Institute for Reactor Safety (IRS), had been reached.

1.2. Ten years of activity for reactor safety

1965. The IRS was founded in December 1964, following a written decision taken by the 11 Technical Inspection Associations in the Federal Republic of Germany and Berlin. The IRS was registered as an official association in the District Court at Essen on 18 January 1965. On 10 March 1965 a contract was signed between the members and the managing committee of the IRS on the one hand and the then Federal Ministry for Science and Research on the other. By this contract the Federal Republic guaranteed to subsidize the operating costs of the IRS for a preliminary period of ten years, as a means of supporting the professional activities of the Institute. The first regular general assembly took place on 5 May 1965 at Cologne.

The activities were taken up on 1 January 1965, with 3 physicists, 3 engineers, an administrative manager and a typist. Despite personnel difficulties, the participation in safety evaluations within the licensing procedures took up a larger portion of the Institute's activities than had been initially intended. The scope of the German nuclear programme at that time made the assistance of experts from the Institute necessary. They took part in the safety evaluations for eight nuclear installations. The close co-operation with the Advisory Committee on Reactor Safeguards began.

1966. The tasks put to the IRS were actuated. This could only be made possible by a personnel increase, intensification of training and a greater familiarization by the experts with the work involved. The exchange of information and experience was put on an international basis. In particular, the exchange with the United States of America began to show favourable results. Contrary to expectations, the work on safety evaluation remained constant, while tasks serving the interests of the Federal Government increased in number. This was inevitable because of the very close ties on a technical level between the IRS and the Federal Ministry for Science and Research, resulting from the closely co-ordinated working programme of the IRS. The tasks of major importance among those of interest to the Federal Government included:

The setting up of a specialized library on reactor safety and radiation protection
The issuance of informative reports on congresses
Participation in safety experiments.

Experts of the IRS could now join special committees, a prerequisite for adequate participation in the development of regulations and guidelines on the national and international levels.

1967. After three years the staff of the IRS had increased to 11 experts and 5 administrative employees. It was slowly becoming clear, however, that this would not permit an adequate solution of the existing and expected problems. Thus, for the first time the personnel problem occupied the foreground.

Regulations and guidelines for the nuclear energy sector were practically non-existent. This was particularly true for the Federal Republic of Germany. This resulted in the adoption of foreign proposals along with an attempt to adapt these proposals to the German situation. In this work the IRS represented simultaneously all of the TÜV. The proposals themselves were discussed and harmonized with industry and the authorities.

Comparison with the United States of America showed how much expenditure is necessary to develop rules and regulations in parallel with technological developments. The co-ordination of this work was the main concern and centre of activity for the Institute during this year. The major items related to safety criteria, safe operation and in-service inspections in nuclear power plants and reactor pressure vessels. Safety evaluations were made for a total of 27 nuclear installations, showing a renewed increase in this respect.

1968. New aims, the existing organization and insufficient personnel made it necessary to strive for reforms that would put the IRS in a position to meet the growing demands of the Federal Government and the States, as well as to exercise a stronger influence on the nuclear energy groups of the TÜV. Both the IRS founders and the authorities were in agreement that this could only be achieved by a substantial increase in personnel.

The growing demands of the Federal Government were already being indicated by a more comprehensive consultant activity on research projects. From the very beginning it had been a constant task of the IRS to stimulate, observe, and evaluate research projects in the field of reactor safety, which were sponsored by the then Federal Ministry for Science and Research. The many proposals that came from industry, the TÜV and the IRS itself were registered, collected, scrutinized and then put before the Ministry. Since the beginning of 1968 a special series of reports recording the developments and results of research projects has been issued by the IRS.

1969. For the first time the work of the Institute was confronted with the reservations of the general public about the use of nuclear energy. A critical attitude towards all forms of technical development began to be noticeable. In particular, the problems caused by the environmental impact of our modern civilization found growing attention. The initial emotional protests were increasingly being replaced by rational arguments. This situation altered the climate under which the licensing procedures were carried through. Partly because of this pressure, considerations were intensified as to how the interplay between the Federal Government, the States, the Advisory Committee on Reactor Safeguards, the TÜV and the IRS could be formed more effectively with respect to the licensing procedures.

Special efforts – apart from safety evaluations of nuclear installations – were devoted to the development of reliability techniques. The safety assessment of nuclear power plants had been constantly improving through the growing experience in construction and operation, the results of applied safety research, as well as improvements in assessment procedures and assessment standards.

1970. The Federal Minister for Science and Education made certain decisions in connection with the BASF project and the proposed site for the fast sodium cooled reactor, SNR-300, that overthrew the generally accepted theory of site independence of nuclear power plants and set new trends for the coming years on the question of reactor safety. These decisions had a major influence on the development of the Institute. The Minister had combined these decisions with two measures:

The setting-up of a reactor safety research programme, aimed at achieving experimental confirmation of the effectiveness of additional safety measures

Reorganization and strengthening of the Government advisory and expert groups.

The IRS was requested, in connection with the latter measure, to provide the Ministry with a considerably greater capacity for safety evaluations than had been the case. The chairman, therefore, called an extraordinary general assembly to discuss questions arising from this unexpected strengthening of the IRS, and to pass the necessary resolutions for a new personnel plan and budget. On 2 November 1970, at Bonn, the assembly voted for a considerable increase in personnel for the Institute in 1971.

At the same time, with a view to harmonizing the co-operation between the various expert groups and in full consideration of the vested interests of the Federal Government, the assembly instructed the managing committee of IRS to revise the statutes and articles of the Institute as well as the terms of the contract with the Federal Minister for Science and Education.

1971. In 1971 three nuclear power plants were in operation in Germany, two were approaching completion, three were under construction and a further six on order. Work on a prototype gas-cooled high-temperature reactor was proceeding according to plan. At the same time preparations were in hand for a prototype fast sodium-cooled reactor. No alterations took place in the legal standing of the licensing procedure.

The IRS had to undertake an almost explosive growth in personnel in order to meet the rapid growing demands of the Federal Minstry for Science and Education for extra consultancy and support. By the end of 1971 66 technical and 33 other employees were already on the staff.

The division of the IRS into working groups had been developed to the extent that the two main divisions, "Fundamentals" and "Installations", could be formed. The principle adopted here was to concentrate all work not connected with actual projects into the first group, and in the second to concentrate the work on safety evaluations for licensing procedures.

In the course of the reorganization of the Advisory Committee on Reactor Safeguards it was decided at its constitutional meeting in October 1971 to transfer managerial responsibilities to the IRS. To ensure efficient continuation of business, the office of the Advisory Committee on Reactor Safeguards was formed into an independent organizational unit in the IRS, directly responsible to the directorate.

As previously, the major share of the activities was taken up by research interests and safety evaluations.

1972. The year 1972 was one of practical experience in nuclear engineering. In particular, this experience was gained through the commissioning of the first purely commercial large power stations Stade and Würgassen, the erection and operation of other nuclear power plants, and through the work of the Institute. In the eight years of its existence much thought was given in the IRS to the forms of co-operation with members and authorities. In particular, it was necessary to consider new ways of intensifying co-operation with the responsible Federal Authorities. Apart from this, the members of the IRS discussed the possibility of setting up a unified association with the Federal Government, by means of a merger between the IRS and the Laboratory for Reactor Control and Installation Safety at the Technical University of Munich. Besides the existing members, the Federal Government and possibly the State Authorities should be represented in the various bodies of the association.

In 1972 the IRS was registered as an official association in Cologne and the new statutes and articles adopted in 1970, together with revisions adopted by the general assemblies of 12 July 1967 and 7 June 1972, came into force.

A special project group was set up in the middle of 1972 to deal with those projects and special requests put to the IRS by the Federal Government. The most important task of the IRS, however, continued to be its contribution to a foreseeable and punctual progressing of current licensing procedures.

1973. The members of the IRS were deeply involved with actual proposals for a closer co-operation with the public authorities. All members were unanimous that a "Company for Reactor Safety Ltd." should be founded and that the original capital and voting rights in the partner assembly and the supervisory board should be divided equally between the former IRS members and the public authorities. A commission, set up by the general assembly, had negotiated with representatives of the Federal Government and the State Governments of Bavaria and North Rhine Westphalia to produce drafts for a limited company agreement, a syndicate agreement and an annulment agreement. These were considered by the members to be a useful basis for a successful co-operation with the new company. The guiding principle for the limited company, as foreseen in the draft, should be professional independence.

The scale of activities in all technical areas increased correspondingly with the growth in personnel.

2. THE INSTITUTE FOR REACTOR SAFETY

2.1. General

2.1.1. Members

According to the statutes and articles of the Institute, the Technical Inspection Associations in the Federal Republic, in Berlin, and the Germanic Lloyd with special duties on nuclear energy ships can be members of the IRS. The IRS has at present the following members:

Arbeitsgemeinschaft der TÜV Hessen e.V., Pfalz e.V. and Saarland e.V.
Germanischer Lloyd
Rheinisch-Westfälischer TÜV e.V.
TÜV Baden e.V.
TÜV Bayern e.V.
TÜV Berlin e.V.
TÜV Hannover e.V.
TÜV Norddeutschland e.V.
TÜV Rheinland e.V.
TÜV Stuttgart e.V.

2.1.2. Bodies

The association bodies are the general assembly, the managing committee and the director.

In the general assembly, which is the highest association body, all members have one vote. The managing committee consists of five members: two managing committee members from member TÜV as chairman and vice-chairman, two directors from member TÜV, together with the current director of the Consolidated Technical Inspection Associations.

The director is responsible for the technical and organizational leadership of the Institute, in name and by order of the managing committee.

2.1.3. Organization

The Institute consists of two main divisions, "Fundamentals" and "Installations", which have various divisions, together with the administrative section. The various divisions are subdivided into groups. The secretariat of the Advisory Committee on Reactor Safeguards (RSK) and the

Nuclear Safety Standards Committee (KTA) are within the Institute. The KTA secretariat is operated as an independent branch and utilizes IRS administrative and technical facilities.

2.1.4. Personnel growth

The Institute began its activities in 1965 with a very small staff, which grew only slowly until 1969. The increasing significance of nuclear energy in the following years led to extensive growth, which has continued up to the present time. Further increases in personnel strength are also to be expected in the future.

2.1.5. Work-time expenditure

Since its inception the IRS had been called on for a large amount of safety evaluations and consultancy work. Co-operation with the Technical Inspection Associations was very useful for both parties; it gave to the Institute's experts the experience and practical foundation necessary for their work. Co-operation with the Federal Ministries, particularly in the more recent years, had increased in significance and scope. Contacts with German and foreign research institutes in the fields of reactor safety and radiation protection have been strengthened continually. Safety evaluation analyses and work within the framework of the programme agreed to with the Government have determined the activities of the IRS.

2.2. Main Division Fundamentals

2.2.1. General Service Division

2.2.1.1. Information and Documentation Group

The work of this group concerns internal communication, documentation and external information. The group is responsible for supplying the IRS experts with information to meet their rapidly changing needs. The Institute's specialized library plays an important role in this respect. The group takes over the manuscripts prepared in the technical groups and deals with the editing.

The information services IRS-Kurzinformationen (IRS-Information briefs) and Aktuelle Meldungen (Current events) are regularly distributed outside the institute. In Stellungnahmen zu Kernenergiefragen (Opinions on nuclear energy questions) an attempt is made to help keep the public discussion on the advantages and disadvantages of nuclear energy on a factual level. Finally, the exchange of information should also be mentioned. This includes the organization of the annual IRS specialists meeting, various technical conferences of IRS and TÜV, and the Institute's internal seminars. These functions are also the responsibility of this group. It supports, in general, the technical work of the Institute by means of an appropriate presentation of the whole IRS literature.

2.2.1.2. Regulations and Guidelines Group

The solution of basic problems, co-operation in the compilation of safety related regulations and the standardization of safety assessments for nuclear engineering belong to the work of this group. This work is carried out in close contact with the appropriate Federal Ministries, State Authorities, the TÜV, national and international regulation bodies and other organizations. Noteworthy in this connection, in addition to the participation in the setting up of safety criteria and safety performance commentaries, is the effort to achieve a rationalization, standardization and classification of the atomic licensing procedure. Other tasks, e.g. in connection with the standard safety report and standard safety assessments, will be given to this group.

2.2.1.3. Electronic Data Processing Group

For quite a number of years now the IRS's activities have necessitated an ever-increasing utilization of electronic data processing (EDP). This is why the IRS entered into agreements with the Nuclear Research Center Jülich GmbH at Jülich and the Association for Mathematics and Data Processing mbH at St. Augustin-Birlinghoven for the use of their EDP equipment. Both institutions own IBM/370-168 systems. To avoid time-absorbing travelling to the sites of these large-size computers, the IRS rented a remote job entry terminal. It is thus possible to transmit the normal EDP jobs by means of card readers or tapes from the IRS's offices direct to these two computers via post office user-to-user lines. List and results can also be printed out or registered on tape at the institute.

2.2.1.4. Registration of Abnormal Occurrences Group

An important factor in any attempt to increase the safety of nuclear power plants is the systematic reliance on operation experience, which has to be registered and evaluated. The Federal Government, in agreement with the States, ordered the IRS to establish a central registration office. The registered operational experience, i.e. disturbances, damage, improvements on components and systems, together with the results of in-service inspections, should be made available in a well-prepared and evaluated form to all those responsible for the licensing and supervision procedures. The registration and evaluation system guarantees quick access to the information registered and is based on:

Reporting criteria, which are sorted according to their safety significance and the time delay involved between the onset of an abnormal occurrence and the reporting of the disturbance;

Forms that enable a definite sectionalization and classification of the disturbance (origin, detection, removal, effects, etc.).

2.2.2. Radiation Protection Division

The Radiation Protection Division concentrates its activities on the following problems:

The production, emission and transportation of radioactive material in nuclear installations

The effects of the dispersion of radioactive material in the environment during normal operation, including radiological and radioecological problems

The emission of fission products as a result of accidents and their radiological effects

The processing, storage, transportation and reprocessing of nuclear fuel and the hazards involved

The disposal of gaseous, liquid and solid radioactive wastes.

In recent years the problems connected with the dispersion of radioactive material in the exhaust air of nuclear power plants have been investigated in detail. The significance of these problems has increased as more and more nuclear power plants have been erected and planned on large rivers. Back in 1971 the first results of investigations of the possible synergistic effects of subsequent releases from nuclear power plants were disclosed on the occasion of the 7th IRS specialists' meeting. These results were used for the preparation of radiation exposure maps with a view towards the possible concentration of large nuclear power plants in certain limited areas. It could be proved that restrictions on the erection of nuclear power plants as a result of external radiation exposure by radioactive noble gases and aerosols need not be expected if realistic emission rates are aimed at. The values that are now normally stated and that comprise great safety factors would, however, necessarily lead to restrictions in the selection of sites. According to the results so far at hand, additional requirements, e.g. for minimum distances between individual nuclear power plants, are only to be expected with regard to the ^{131}I release. Such restrictions can only be avoided if it can be proved that the data used to calculate the radiation exposure via the pasture-cow-milk pathway are too conservative.

These results intensified the efforts to gain detailed knowledge of the essential ecological processes that lead to a concentration of radionuclides via the foodchain. The ecological factors involved with the transport of ^{131}I to the thyroid gland of the critical group were ascertained in theoretical investigations relating to conditions prevailing in the Federal Republic of Germany.

2.3. Main Division Installations

2.3.1. Design Division

2.3.1.1. Reactor Statics Group

The activities of this group concentrate on reactor-physics investigations and checks. Computing programs are indispensable tools to solve the tasks involved. Of these programs, GAMTERANEX has been increasingly used for the safety analysis of light-water reactors. To rationalize work the ANIGAM program was developed on this basis in co-operation with the Rheinisch-Westfälische Technische Hochschule, Aachen. This program automatically computes the group constants for fuel elements of light-water reactors, taking existing poison rods or control-rod fingers into consideration.

These values are then used in diffusion and burn-up calculations to compute the following safety data for the reactor core:

Efficiency of control rods and rod banks

Stuck-rod values, excess reactivities and reactivity balances

Distribution of output and/or output form factors (hot spot factors)

Temperature coefficients of reactivity as well as kinetic parameters.

The IRS is thus in a position to check the physical design of a reactor in a completely independent way by means of a program system that is different from the manufacturer's.

2.3.1.2. Dynamics Group

The most important task of this group is the analysis of the dynamic parameters in the reactor core and the plant for operational transients and accidents. A general accident analysis is carried out. These investigations result in requirements for the reactor protection system and safety installations, and in the specification of marginal conditions for the core design, maximum pressures, and temperature transients that have to be taken into consideration in the design of components. The main fields of activity are:

Core dynamics
Plant dynamics
Thermohydraulic core design
Stability analysis.

Apart from the evaluation of systems within the scope of a specific step of the licensing procedure, the necessary quantitative processes have to be developed as well. Both the systems analysis and the computed results of the accident analysis are essential to arrive at an efficient evaluation of the whole reactor plant. Essential accidents in all types of reactors can be checked independently by the manufacturer.

2.3.1.3. Reliability Techniques Group

In the licensing procedures reliability analyses are increasingly used as an aid for decisions. The close connection with applied technology makes it possible to further develop computation methods and applications in a user-oriented way. The FESIVAR Monte Carlo simulation program has been particularly efficient and capable of further development. Experience showed that reliability analysis has been most useful for:

The quantitative evaluation of the reliability and availability of the systems that are of importance for the safety and operation of a plant

The detection of weak points of a system, the comparison of various modifications of a system and the establishment of requirements for sub-systems

The evaluation of different operation, repair and maintenance strategies and the establishment of admissible repair and inspection times

The evaluation of systems with regard to various accidents.

2.3.2. Systems Division

The main task of this division is the calculation of the thermodynamic and hydrodynamic effects of loss of coolant accidents in the primary circuit and the containment. To an ever-increasing extent other heat and flow problems are also dealt with insofar as they are safety-related. Unprogrammed analytical models and a great variety of computing programs are available to solve these problems; they are also used within the licensing procedure. The system evaluation of safety installations such as containments, pressure suppressing systems, emergency core-cooling systems and residual heat removal systems has recently become more important.

2.3.2.1. Heat and Flow Technology Group

The calculation methods of the group can, above all, be used to establish and check:

The leakage rates
The input rates of the emergency core-cooling systems
The time-dependent and local pressure and mass flow transients in the primary circuit

The coolant states in the primary circuit

The time-dependent and local temperature transients in fuel rods

The pressure difference loads, forces and momenta acting on primary-circuit sub-assemblies

The reaction forces and momentum loads in the case of longitudinal pipe ruptures and total circular pipe ruptures.

2.3.2.2. Safety Inclusions Group

The group deals with the following problems:

The time-dependent pressure and temperature transients in containments

The differential pressure loads of the building structures

The dynamic loads on pressure suppression and pressure relief systems

The loads on structures as a result of separated assemblies.

The computer programs, especially those for the pressure and temperature transients in the containment and in subdivided building structures, have been under continuous development with regard to economic design and precise safety analyses ever since the IRS was founded. They have become part of the manufacturers' and experts' basic equipment for the evaluation of thermodynamic processes in the containment and in the relevant buildings for water, gas and sodium-cooled reactors. A variety of current test programs, which are continually being evaluated, serve the long-term aim of establishing realistic parameters and models, which are reflected in the licensing procedure as well as in safety-related regulations.

In recent years an increasing number of problems have come up with regard to dynamic processes in the containment, especially in the pressure-suppressing systems. With newly developed models the IRS plays an important role in the recognition of problems, the determination of essential parameters, and the transposition of test results on operation and accidental states in nuclear power plants.

2.3.3. Components Division

2.3.3.1. Construction Group

The group deals with the field of constructional design and quality assurance. The work on constructional design concentrates on questions of material erosion, the choice and design of connecting elements, and of their testability. The accessibility of assembled components for the various non-destructive test methods has recently become an important factor.

As far as quality assurance is concerned, the steady development of non-destructive test methods is most important. A close review of ultrasonic processes, acoustic emission, and holography, especially in the field of mechanized testing, is made in order to be able to increase the preciseness of the test requirements.

Construction and quality assurance of reactor pressure vessels are decisive factors when it comes to evaluate reactor components on terms of safety; a steady revision and modification of the knowledge available is indispensable.

2.3.3.2. Stability Group

This group concentrates above all on:

The examination of the design of nuclear power plant components

The examination and further development of evaluation criteria such as admissible stresses and operating cycles

The preparation and application of advanced methods of computation in practical safety analyses.

The activities of this group have recently turned to novel problems, which include the safety analysis of components under extreme loads such as may be produced in loss of coolant accidents in nuclear power plants with light-water reactors or in the case of power excursions in fast reactors. These loads are characterized by short-term extreme peak loads. The resulting stresses are dealt with in view of the admissible tension and elongation limit values.

Evaluation criteria are being developed for gas or sodium-cooled high-temperature reactors. For light-water reactors the evaluation criteria within the scope of the KTA Primary Circuit Rules have to be reworded and amended.

2.3.3.3. Materials Group

When evaluating large-size reactor components, special attention has to be paid to the choice and long-term behaviour of materials.

In the case of light-water reactors the effects of the manufacturing processes (deformation, welding, heat treatment) and of the neutron dose accumulated during operation are most important. As a result of the big wall thickness of these components, deviations in the mechanical and technological characteristics of the material will occur. These have to be limited by precise specifications. For high-temperature reactors the material changes are even more important because of the long-term operational temperature stresses. Here, the influence of neutron radiation is difficult to evaluate since, on the one hand, increased temperatures permit the material to recover and, on the other, a material swelling in specific areas has to be expected as a result of the very high neutron fluxes.

2.3.4. Operational Technology Division

2.3.4.1. Plant Protection Group

The group deals with special tasks, which are mainly related to the protection of nuclear power plants and other nuclear installations such as reprocessing plants, fuel element plants and stores of radioactive material against external events. These activities, in the development of which the institute has played an important role in recent years, comprise:

Natural events such as floods, storm tides, earthquakes, landslides, lightning and biological organisms

Civil events such as chemical explosions, pressure waves, aircraft crashes, toxic gases, fire, mining damage and sabotage.

These activities concentrate on quantifiable models of load assumptions to be applied in practical work as well as hazard evaluations concerning the dangers to the environment resulting from such occurrences. For this purpose, computer programs have been developed to the stage of application to compute

The penetration of structures by crashing aircraft components

The effects of such components on the structures

The effects of pressure waves

The vibration of structures as a result of earthquakes

The load involved in such vibrations.

2.3.4.2. Measured-Data Processing Group

This group deals with safety problems in the field of reactor instrumentation, e.g.

Data gathering of nuclear and conventional values

Data processing of derived values

Installations for the communication between the plant and its operators.

This work concentrates on the system and reliability analysis of reactor protection systems and their specific relationship to accident analysis. The activities comprise the evaluation of technical, physical electric and electronic methods and the examination of the technological suitability and reliability of equipment.

2.3.4.3. Power Supply Group

This group is responsible for questions relating to the generation and supply of electric power required for components important for safety; these components and electric units comprise above all:

Emergency power generators and control units

Cable networks within the plant

Auxiliary equipment to operate these electric units.

2.3.5. Research Promotion Division

2.3.5.1. The problem

The growing utilization of nuclear energy to cover ever-increasing demands for energy means more stringent requirements for the safety of nuclear installations. The Federal Government generously subsidizes a broad research programme in order to:

Improve the knowledge of the behaviour of those systems and components that are an important safety factor in nuclear installations, in both normal and abnormal operation

Guarantee a continuous development of safety technology in order to meet the requirements of the general progress in nuclear engineering and the increasing utilization of nuclear energy.

In the interest of the general public the Federal Government is anxious to have all competent bodies participate in this programme and wishes that all interested parties continuously receive the information they may require. International co-operation on a well-balanced basis of give and take should help towards an optimum utilization of all available means.

2.3.5.2. The task

The task consists of:

Technological and organizational planning of a rapid and purposeful execution of a given basic programme under the aspect of an optimum participation of all competent bodies

Technical and financial supervision of the execution of research projects, while keeping to an ultimate target for all projects and plans; supervision of the individual targets and of the scheduled dates and costs

Systematic documentation of information and quick transmission of individual items of information to interested bodies at home and abroad

Co-ordination of international understandings on the planning and execution of research projects and plans with a centralized control of the flow of information.

2.3.5.3. The solution

Both on a national and international level the IRS has acquired a central position with regard to the solution of safety problems in nuclear plants. Due to its present activities with regard to actual safety analyses work in the licensing procedure and its numerous international contacts, the IRS fulfils all requirements for a central position in safety research as well. This was a decisive factor for the establishment of the Research Promotion Division of the IRS. This department works on the above-mentioned tasks under the order of and in close co-operation with the relevant Federal Ministries; it thus makes an important contribution to the execution of the reactor safety research programme.

The results produced so far can be grouped as follows:

Within the scope of reactor safety research 10 research projects with a total of 68 research plans and an overall financial volume of about DM 100 million are under way; they are promoted in accordance with the relevant task. Seven research plans with a financial volume of about DM 8.5 million have already been completed.

Numerous research plans, whose scheduled expenses considerably exceed the financial volume so far employed, are in the planning stage and some of them will be initiated in the very near future.

Management work is done for 8 expert groups whom the Federal Ministry for Research and Technology invited to submit advice on individual projects and for a greater number of working groups in charge.

The IRS-F Reports (Forschungsberichte), of which 21 have so far been issued, are a steady source of information on all research plans.

With the aid of electronic data processing, a system for the rapid transmission of research results is being developed.

The systematic control and following-up the flow of information in co-operation with the United States Atomic Energy Commission (USAEC) has been initiated.

2.4. The Advisory Committee on Reactor Safeguards (RSK)

Since its foundation the IRS has provided substantial assistance to the Advisory Committee on Reactor Safeguards. While this activity had previously been in the hands of the individual experts – due to the restricted number of personnel – it was later transferred to the Projects Group which was assisted by the technical divisions. Within the scope of the reorganization of the advisory boards of the former Federal Ministry for Education and Science in 1971 the tasks of the Committee were reviewed and a few aspects changed. The committee at that time was dissolved in the summer of 1971 after its 65th meeting and founded again shortly afterwards. In December 1972 the organizational decree of the Federal Chancellor provided for a transfer of the responsibility for reactor safety – with the exception of reactor safety research – from the Federal Ministry of Education and Science to the Federal Ministry of the Interior. The committee advises only the Federal Ministry of the Interior on all questions relating to the safety of nuclear installations. This advice is to concentrate on novel questions and problems of fundamental importance.

2.4.1. The Office

When the Advisory Committee on Reactor Safeguards was reorganized, management was transferred to the IRS on the occasion of constituting the committee assembly in October 1971. To enable the Office to fulfil its task it was established as an independent organizational unit within the IRS with direct responsibility to the IRS management. There is an agreement between the Federal Ministry of the Interior and the IRS management to the effect that the committee's chairman is entitled to determine the type, scope and priorities of the tasks to be worked on by the Office. The advisory documentation and alternative resolutions submitted to the committee are compiled by the office independently, under its own technical responsibility.

2.4.2. Tasks

The general task of the Office is to assist the committee by all means in its advisory activities to the Federal Ministry. In detail, its task can be outlined as follows:

The preparation and organization of all meetings of the committee and its sub-committees

The early compilation in a condensed form of all information required for the advisory activities of the committee

Informing the committee by way of regular survey lists on the state of work on central problems, the progress of building activities, the scheduled time when licences are required, the state of the licensing procedure, and on particular events during building activities and acceptance tests with regard to all current licensing procedures

Promotion and direction of information on the preparation of detailed analyses relating to specific questions at the request of individual committee members

The submission of well-founded decision proposals to the committee under consideration of the opinions of the TÜV and the IRS as well as of its own investigators; the compilation of all important decision problems with a condensed description of the decision bases, and possible alternatives

The evaluation of the discussions and the preparation of minutes of the results as well as a compilation of all decisions and their relevant motives in a manner that is fit for publication.

2.4.3. The results

The committee meets once a month with the exception of July and August. Sub-committees with an average of 6 to 7 members have been formed to deal with technical problems in detail and to prepare the committee meetings. Furthermore, experts who are not members were invited to co-operate in these sub-committees. On the one hand, they specialize in certain cross-sectional tasks. This division was made after the re-appointment of the committee in the summer of 1974. In accordance with the announcement of the establishment of an advisory committee on reactor safeguards, the recommendations are published in the Bundesanzeiger (Federal Gazette).

In principle, the procedure for advising the committee, which is incorporated in the committee rules, has proved its worth. These rules have substantially contributed to a prompt co-ordination and a smooth and timely settlement of comprehensive problems by means of intensified contacts to all bodies participating in the procedure. The committee's guidelines for pressurized-water reactors, which were completely revised and published within a few months' time, are an outstanding example. Similar guidelines for boiling-water reactors will be completed in the near future. These guidelines are an essential contribution to the standardization of safety requirements.

2.5. The Nuclear Safety Standards Committee (KTA)

The Nuclear Safety Standards Committee was established in accordance with the announcement of the establishment of a nuclear safety standards committee of 1 September 1972; in December 1972 it was transferred from the original responsibility of the then Federal Ministry for Education and Science to that of the Federal Ministry of the Interior. According to this announcement, the committee is responsible for the establishment and promotion of safety regulations in those fields of nuclear technology where, on the basis of experience, a uniform attitude of the experts of manufacturers, builders and users of nuclear installations, of other independent experts, and of the authorities can be foreseen.

The foundation of the committee was preceded by several years of negotiations between the parties concerned, in particular on its form of organization and its composition. The final decision provided for the institution under public law, which is similar to the technical committees in accordance with Section 24 of the Trade Regulations.

2.5.1. The Office

Of particular importance was the discussion on the establishment of the Office, which should be independent from the groups represented on the committee. The most suitable solution seemed to be incorporation in the IRS. Thus, the Office was finally established as an independent management division within the IRS. The relevant contractual basis is the Agreement on the Establishment of the KTA Office of 26 February 1972, between the Federal Republic of Germany and the Institute for Reactor Safety. When the managing committee of the IRS decided on 25 April 1973 to execute the above agreement, the Office was established.

According to the agreement, the Federal Government, the Association of German Power Plants and the National Association of the Electric Industry each bear 28% of the costs of the KTA Office, the remaining 16% being borne by the Consolidated TÜV.

2.5.2. Tasks

The Office has the following responsibilities:

Management of all committee's business and the related general administration, in particular the preparation of the individual committee meetings

Care of the now 16 sub-committees; in this connection, the assistance to the programme sub-committee, to which the Office suggests necessary regulation subjects, is of particular importance

Follow-up of the technical examination of the results with regard to the preliminary report and regulation orders given by the committee as well as technical co-operation in this respect

Creation and promotion of contacts with regulation-issuing organizations at home and abroad

Systematic stock-taking of the regulations applied in the German licensing procedure for nuclear installations

Compilation of relevant laws, regulations, guidelines and standards at home and abroad

Comprehensive documentation of basic information and correspondence relating to regulatory work.

2.5.3. Results

At present, 26 rules are being worked on, three of them in ad hoc sub-committees. Two of these rules – The design of nuclear power plants against seismic effects; principles, and Hoisting equipment in nuclear installations – have already been completed. For those tasks that relate to documentation a specialized library is being compiled, which will be likely to comprise about 20 000 necessary documents.

2.6. The role of the Institute for Reactor Safety in the atomic licensing procedure

The German atomic licensing procedure reflects the federal structure of the Federal Republic. Licensing is a responsibility of the eleven States, including West Berlin. Their supreme authorities, i.e. the Ministry for Labour and Social Affairs, Economy and Traffic, the Interior, and most recently, the Environment, enter into close co-operation to solve the problems involved. In this connection the States are subject to a control function of the Federal Government, which, in agreement with the Federal Council, has the right to issue statutory ordinances and general administrative regulations, and to give directives regarding the lawfulness and expediency with which the States carry out their duties.

The basic law, i.e. the Atomic Energy Act with the Nuclear Installations Ordinance, Financial Security Ordinance and Radiation Protection Ordinance, applies to the whole of the Federal Republic. The Federal Government and the States have experts to advise them in these fields. These experts are mostly members of the Advisory Committee on Reactor Safeguards, TÜV and the IRS.

2.6.1. Course of procedure

Here the mediating position of the IRS between the level of the Federal Government and the States becomes obvious; this position is by no means the result of a mere accident, but was deliberately aimed at by the founders of the IRS. This becomes even more obvious when one looks at the licensing procedure. The applicant, e.g. a public utility company in the case of a nuclear power plant, will file its application, checked by a group of experts on the basis of the accompanying technical documentation to find out whether the requirements for a licence have been fulfilled. This group of experts is normally composed of members of the local TÜV and the IRS. The resulting safety analysis will be the basis for licensing. This will also include the directions of the Federal Ministry of the Interior, which, in turn, will consider the recommendations of the Advisory Committee on Reactor Safeguards.

2.6.2. IRS tasks

As a result of IRS position in any licensing procedure, all safety information is centrally compiled and analysed. This, in turn, enables the necessary assistance to the Advisory Committee on Reactor Safeguards (RSK). The RSK office is thus freed from time-absorbing details and can efficiently deal with essential problems. The main customer of the IRS is the Federal Ministry of the Interior. The preliminary technical work efficiently enters directives given by the Federal Government. The IRS activities lead to suggestions for closing information gaps. These suggestions are often converted into research programmes. Thus, our special division's assistance to the reactor safety research programme of the Federal Ministry for Research and Technology seems to be only a logical consequence. Finally, standardization efforts for the acceleration and rationalization of the licensing procedure receive valuable stimulus from the Nuclear Safety Standards office.

The IRS, with its manifold tasks, is the link between all those involved in the licensing procedure. It is anxious to provide a quick and comprehensive flow of information. This explains the central position of the institute in the atomic licensing procedure.

2.7. Projects

The IRS has developed many and various activities in the safety assessment of nuclear power plants. Since its inception IRS has been concerned with safety evaluations for the following nuclear power plants in the Federal Republic of Germany.

Nuclear power plants with pressurized-water reactors:
Obrigheim (KWO), Stade (KKS), Biblis A, Biblis B, Neckarwestheim (GKN), Unterweser (KKU), Mülheim-Kärlich, Wyhl (KWS), Grohnde (KWG), WENESE concept, Grafenrheinfeld, Brokdorf

Nuclear power plants with boiling-water reactors:
Gundremmingen (KRB), Lingen (KWL), Würgassen (KWW), Brunsbüttel (KKB), Philippsburg (KKP), Isar (KKI), Krümmel (KKK), KWU concept building line 72

General Electric concepts

Nuclear power plants with high temperature reactor:
Uentrop (THTR), Uentrop (HTR)

Nuclear power stations with fast breeding reactors:
Kalkar (SNR).

The main weight of the safety evaluations fell on those subjects that reflected the efforts to help formulate and solve the basic safety-related demands on nuclear power plants:

An analysis of possible accidents in the nuclear installations and their effects

An analysis of weak points in components and systems, together with proposals for the removal of these weak points through reliability techniques

An analysis of environmental impacts caused by the nuclear power plant during specified operation and under accident conditions

An analysis of possible impacts from external sources, and the assessment of design requirements.

Individual activities have been integrated into these objectives.

The assessment of the effects of loss of coolant accidents and the related necessary control measures represents an important area of the IRS. Here an exact analysis is required, resulting in special demands on containments and pressure suppression systems, the maximum stresses on reactor pressure vessel internals and erosion effects, and maximum fuel element temperatures.

For this purpose all available computer programs are systematically collected, and with inclusion of the latest research results, adapted to the distinctive characteristics of the installation. With the use of these programs it has been possible to obtain a great many parameter studies to support the evidence of the safety evaluations. The parameter studies are particularly concerned with the following: radiation protection; core design; reliability analysis; containment; efficiency of the emergency core-cooling system; forces caused by outflowing media, reaction forces and missiles; impacts from external sources.

The systematic investigation of possible circuit transients, such as a loss of heat sinks, allows the restriction of operation and accident-stipulated design basis values for the primary circuit. For this major item it is necessary to link up various computer programs in order to achieve integral treatment of the nuclear-physical, dynamic and hydraulic processes.

Parallel to this, the IRS has been concerned for a long time with supporting theoretical calculations by means of experimental results.

In another item, the release values of radioactive materials under normal operation and accident conditions, together with the resulting radiological impact on the general and local population, are evaluated for various projects. Particular attention is paid here to broader areas, i.e. by the analysis of possible superposition of releases from nuclear power plants in a regional area under development such as the areas of the Upper-Rhine and the Lower-Elbe.

The formulation of requirements for nuclear power plants related to possible impacts from external sources has been strongly promoted in recent years. Extensive preliminary studies were necessary to establish quantitative design basis requirements for nuclear power plants for protection against an aircraft crash or gas explosion. In the meantime some of these requirements have been determined and have already been taken into consideration in nuclear power plant designs.

In the field of protection of the installation against sabotage the analyses for the formulation of design basis requirements, together with the application of these requirements in certain installations, are of a comprehensive nature and are treated confidentially. In the determination of protective measures operational interests are normally balanced against the demands of sabotage protection and the optimal solution determined.

The multiplicity of special project management tasks led a very early stage to the central control of work co-ordination, planning and general organization of the specific duties of each division. The commissioned projects group, which does not take part in the actual decision making concerning safety evaluations and consultancy processes in the individual technical groups, serves as an additional control point for a continuous and harmonized processing of the safety evaluations in the IRS.

2.8. Tasks for the Federal Government

According to the IRS statutes and articles, the following tasks are performed for the Federal Government:

Consultancy and safety evaluations for Federal and State authorities

Treatment of fundamental safety questions

Elaboration of regulations and guidelines for technical safeguards

Collection, evaluation and distribution of relevant national and international findings

Planning, assisting, observation and evaluation of research projects

Documentation of data needed for licensing.

The contract between the IRS and the Federal Government requires that the economic and working programme of the IRS be pre-approved by the Federal Government on an annual basis. It had been agreed that at least 50% of the available IRS working capacity should be reserved for Government tasks.

The co-ordination and processing of work to be performed on behalf of the Federal Government is carried out by a project group specially set up for this purpose. Apart from the mutual establishment of priorities for individual projects with the respective authorities involved, proposals are given for an effective processing of orders within the framework of the complete IRS working programme. These include a precise specification of orders for adaption into existing order planning and processing, together with following up the technical and timely completion of the project. The control of completion dates and time expenditure for each individual project is carried out in accordance with a special computer program based on IRS project statistics.

The order programme can be roughly divided into continuous long-term tasks and ad hoc projects. The long-term tasks include, for example, the complete report and documentation area, consulting and professional advice for the RSK, preparatory work for projects in the field of reactor safety research, the establishment of regulations and guidelines. They can be planned on the basis of experience as a constant part of the working programme. This is of course impossible with special projects, where neither the total amount of work involved, nor the time necessary for its completion, can be accurately estimated beforehand. On the other hand, these are usually projects of current concern and requiring a quick solution. A percentage of the staff must be able to cover all disciplines and always be available at short notice to meet these demands. This is achieved by a continuous survey and evaluation of all running projects, together with a forecast plan based on the experience and results of previous years.

The main tasks in this area are:

Proposals for the establishment of safety specifications for nuclear power plants, and their introduction into the licensing procedures

Comparison between foreign nuclear power plant conceptions and German construction types of nuclear power plants, taking German safety criteria and RSK guidelines into consideration

Safety requirements for plutonium storage

Assembly of all necessary information for licensing procedures requiring investigation

Survey of all perceivable backfitting problems for nuclear power plants in operation

Preliminary site investigation for nuclear power plants (site evaluation information and site evaluation model)

Reliability analysis for assessment of the emergency core-cooling system of a foreign reactor against a comparable German construction.

2.9. International contacts

The growth in importance of the IRS has been matched by the increase in international co-operation that has taken place during the last ten years. During this time many contacts have been made and strengthened abroad. A great change has taken place compared to the early years of the IRS, when it was mainly concerned with learning and gathering information. The advanced degree of specialization of the IRS experts has led to a large number of requests for technical information and advice. Requests have even come from countries that have had more experience with nuclear energy than the Federal Republic of Germany. Today the IRS has contacts throughout the world. The time given for information exchange, co-operation and consulting has in the meantime taken on major proportions.

2.10. Reports and publications

The results of the work of the IRS find their reflection in the safety evaluations and in the qualified opinions and recommendations that are given to the Federal Ministry of the Interior and the Advisory Committee on Reactor Safeguards. A percentage of these have either a confidential or a preliminary nature. Other work, in the form of IRS reports or articles in trade publications or lectures by members, is made available to the respective Federal or local Government authority, interested industrial circles and, to a certain extent, to the general public.

At present the following reports and information services are issued:

Reports generally available: Activity reports, IRS announcements, general reports, research reports, guidelines and recommendations, conference reports, scientific reports, commentaries on nuclear energy questions, situation reports, brochures;

Information services: Information in brief, reactor safety — current reports, translations — nuclear technology regulations, index of new publications in trade journals, reactor safety meetings;

Reports not generally available: Safety evaluations, business reports, internal reports, working reports.

The number of reports and publications has increased simultaneously with the increase in the number of experts employed by the IRS. In the past ten years approximately 125 generally available reports, as well as 150 publications, have been issued. A further increase above this average can be expected in the future.

ANNEX

FEDERAL REPUBLIC OF GERMANY
NUCLEAR POWER PLANT SAFETY CRITERIA

These nuclear power plant safety criteria have been prepared as the technical part of General Administrative Regulations still to be enacted by the Federal Minister of the Interior. The criteria were approved by the Länder Committee for Nuclear Energy on 25 June 1974 after the groups of experts participating in the licensing procedure, including the manufacturing and constructing industries, utilities and expert consultants, had had the opportunity to express their opinions.

These safety criteria have been developed especially for application to nuclear power plants with light water reactors; for all other types of nuclear power plants, however, they are strictly applicable for non-facility specific requirements and in principle for facility specific requirements.

DEFINITIONS

1. Operation in compliance with the instructions

(1) Operating processes for which, according to the applicant, the plant, assuming the function of all systems (fault free condition), is intended and suitable (specified normal operation);

(2) Operating processes which occur in the event of component malfunction (fault condition), insofar as safety-related reasons do not oppose continued operation (abnormal operation);

(3) Inspections, tests, maintenance and repair procedures.

2. Incident

As used in these criteria, incidents are events which interfere with the operation of the plant in such a way that continued operation is impossible for reasons of safety, although the plant has been designed for these events.

3. Discharge of radioactive substances

The intentional ejection of radioactive substances in exhaust air or waste water from the plant during specified normal operation.

4. Release of radioactive substances

The unintentional escape of radioactive substances from their designated place of storage.

5. Single failure

A single failure is a failure which is caused by a single event including consequential failures caused by this failure.

6. Redundancy

Existence of more serviceable technical means than are necessary for the fulfilment of the function envisaged.

7. Limiting value

As used in these criteria, limiting values are values specified for process variables of plant components, plant systems or media contained therein, which, upon adherence, include a reasonable safety margin to exclude a failure of important safety-related equipment.

SECTION 1

Criterion 1.1: open

SECTION 2

Criterion 2.1.: Quality assurance

The quality of all the components[1] of a nuclear power plant shall be in accordance with its safety-related function. To this end, such principles and procedures which, in accordance with the present state of science and technology are appropriate for the special safety requirements of nuclear technology, shall be applied in the design, manufacture, construction and inspection as well as the operation, maintenance, and repair of those plant components which are important from the aspect of safety. In this respect, approved standards of technology are to be examined in individual cases. The safety-related functions of all plant components shall be clearly defined and documented. In compliance with their safety-related functions, regulations governing the design, material, construction, inspection, operation, maintenance and repair of all plant components shall be established and applied. Details of previous examination material, construction, acceptance, functional and routine tests must be described in the test regulations. A quality assurance programme must be carried out to ensure compliance with these regulations. The results of the quality assurance programme shall be documented together with the results of the tests. Documents required as a proof of quality with respect to the design, manufacture, construction, testing, operation, maintenance, and repair of plant components which are important from the aspect of safety must be available during the entire life of the plant.

Criterion 2.2: Testability

All plant components shall be so constructed and arranged that they can be adequately tested and maintained prior to their commissioning and thereafter at regular intervals in accordance with their safety-related importance or function. In cases where, in accordance with the latest state

[1] Here and in the following, "plant components" refer also to buildings.

of technology, periodical inspections of plant components cannot be realized to the extent necessary to detect possible faults, safety measures shall be taken to cope with these possible consequences of faults so that even if the incidents which have to be taken into consideration under these circumstances actually occur, the reactor can be shut down and maintained in a safe condition, the residual heat can be removed, and the discharge or possible release of radioactive material can, according to the scientific and technological regulations in force, be kept as low as practicable, even when they are below permissible limits.

<u>Criterion 2.3:</u> Radiation exposure of the environment

To protect the environment against impacts from the nuclear power plant, it shall be ensured that all plant components of safety-related importance are so designed and shall be maintained in such a condition that, both the radiation dose to the environment by the direct radiation from the station and the discharge and possible release of radioactive substances are kept as low as practicable, even when they are below permissible limits[2], according to the scientific and technological regulations in force.

Furthermore, these plant components shall be so designed and protected against external impacts that they will be able to perform their safety functions both during specified normal operation and during incidents.

<u>Criterion 2.4:</u> Radiation exposure in the plant

All components of a nuclear power plant which contain or may contain radioactive substances shall be so designed, arranged and shielded that the radiation dose to which the staff is exposed during all the activities necessary during specified normal operation of the plant is kept as low as practicable, even below the permissible limits, according to the scientific and technical regulations. In order to meet this requirement, the plant components shall be designed and arranged to ensure ease of maintenance and repairs.

<u>Criterion 2.5:</u> Arrangement of the working area, working cycle, working environment

The working areas and working cycles in the nuclear power plant shall be ergonomically planned so that they ensure optimum safety consciousness within the staff during the execution of their duties.

---

[2] The present permissible dose limits for a site during specified normal operation of the facility are as follows: The radiation exposure, as a result of internal and external irradiation relative to the whole body (with respect to all emitters of radioactive material relevant to the environment) at the most unfavourable point of each respective exposure pathway in the environment, is not permitted to exceed 300 microjoules per kilogram [μJ/kg] (30 mrem) per annum by discharge of radioactive material in waste water and 300 μJ/kg (30 mrem) per annum by release of radioactive material in exhaust air. The radiation dose to the thyroid gland of infants from radioactive iodine transported through food chains is allowed at most to amount to 900 μJ/kg (90 mrem); this limiting value (with respect to all emitters of radioactive material relevant to the environment) is effective for the most unfavourable place in the vicinity of the nuclear power plant independent of the possibility of persons or grazing animals being permanently present at this location.

Criterion 2.6: External impacts

All plant components necessary to ensure safe shutdown of the reactor and maintain it in that condition, to remove residual heat or to prevent possible release of radioactive substances, shall be designed and maintained in such a condition that they can fulfil their safety functions even in the event of the occurrence of natural phenomena which have to be taken into consideration, such as earthquakes, landslides, storms, floods and tides as well as the eventual influence of biological organisms (e.g. bird flights, coolant system grown over with mussels) or other external impacts such as obstruction by third persons, aircraft crash, action of dangerous substances, especially explosives, and surface damages. The design of these plant components shall be based on:

1. the most serious natural phenomena or other external impacts which according to the state of knowledge and technology must be taken into consideration at the site in question,
2. combinations of several natural phenomena or other external impacts, as well as the combination of these impacts with fault conditions, in so far as their simultaneous occurrence as based on probability and degree of damage must be considered.

The discernible future development of the characteristics of the site shall be taken into consideration.

Criterion 2.7: Protection against fire and explosion

The necessary precautions shall be taken for the prevention of fires and explosions in the plant. The important safety-related plant components shall be so designed and arranged that they are not prevented from fulfilling their function by fires and explosions.

Suitable equipment for the early detection and fighting of fires and hazards of explosions shall be available. It shall be so designed and protected that, even in the event of failures, damage or misoperation, plant components which are important from the safety standpoint (in that case with regard to their redundancies) shall continue to be serviceable.

Criterion 2.8: Access control, areas to be sealed

The total area of the nuclear power plant and additional plant regions inside and outside the total area which require particular protection shall be protected against the access of unauthorized personnel. The means of access to these areas shall be so arranged that a complete control of personnel and freight traffic is ensured.

Criterion 2.9: Escape routes and means of communication

The nuclear power plant shall have simple, clearly and durably marked escape routes with fail-safe lighting.

Suitable alarm systems and means of communication shall be provided so that the entire staff present in the plant can be instructed accordingly in an emergency from at least one central position.

The communication inside and outside the nuclear power station, which is necessary for the safety during specified normal operation, the control of incidents, and also during unforeseen events, shall be warranted at every time.

Criterion 2.10: Decommissioning of nuclear power plants

Nuclear power plants shall be so designed that they can be decommissioned in compliance with the Radiological Protection Regulations. After the final decommissioning a conception of the removal according to the Radiological Protection Regulations shall be available.

SECTION 3

Criterion 3.1: Reactor design

The reactor core, the associated coolant systems, the corresponding components of the measuring, control and regulating systems as well as the reactor protection system and one of the shutdown systems shall be so designed and constructed that the adherence to limits specified for specified normal operation and for incidents is warranted for the stress of fuel assemblies and other important safety-related components throughout their entire service life.

Criterion 3.2: Inherent safety

The reactor core shall be so designed that rapid reactivity increases resulting from prompt feedback characteristics will be stopped so far as to avoid safety-related important damages in the reactor core and coolant circuit system in co-operation with the remaining inherent qualities of the plant and the shutdown arrangements.

Criterion 3.3: Reactor pressure vessel internals

The reactor pressure vessel internals shall be so constructed and arranged that the permissible stress limits may not be exceeded during specified normal operation. In addition, the pressure vessel internals shall be so constructed that, in the event of their being subjected to stresses set up by fault conditions, the reactor can be safely shut down along with the removal of residual heat, and dangerous consequences such as inadmissible reactivity increases can be excluded.

SECTION 4

Criterion 4.1: Pressure-containing enclosure of the primary coolant

Systems which contain the primary coolant and which are subject to a higher pressure than atmospheric pressure shall be so constructed and arranged that the occurrence of dangerous leaks and quickly growing cracks and brittle fractures can be avoided according to the state of science and technology. Therefore, in the design, an appropriate addition to the stress limits shall be provided. Equipment shall be provided for the purpose of monitoring any leaks occurring during operation. The components of the pressure-containing enclosures shall be designed and anchored so that incidents occurring in those components will not produce potential dangerous damage in other safety-related components. It shall be possible to operate the nuclear power plant so that the in each case specified limiting values laid down for the pressure-containing enclosure of the primary coolant are not exceeded during specified normal operation and during incidents.

Criterion 4.2: Residual heat removal during specified normal operation

A reliable, redundant system for residual heat removal during specified normal operation shall be provided and be designed so that after interruption of the heat removal from the reactor to the heat sink the specified limiting values for the fuel assemblies, the pressure-containing enclosure of the primary coolant, and the containment are not exceeded, even in the residual heat removal system.

Criterion 4.3: Residual heat removal after losses of coolant

A reliable, redundant system for emergency core cooling (emergency core cooling system) during losses of coolant shall be available and constructed in such a manner that for the sizes of break, break locations, operating conditions and transients in the primary coolant system:

1. the coolant system is able to fulfil its safety-related function, even during tests, repairs, or a simultaneous occurrence of a simple failure in the system,
2. the limiting values specified in each case as permissible for the fuel assemblies, core internals, and containment, are not exceeded, and
3. chemical reactions are limited to an extent which are harmless from the safety-related point of view.

SECTION 5

Criterion 5.1: Process monitoring and alarm systems

Nuclear power plants shall be provided with equipment which make it possible to obtain a sufficient general view of the plant and its specified normal operation and to record all safety-related process variables at any time.

Danger-alarm systems shall be available to provide an early indication of changes in operation which could impair safety.

Criterion 5.2: Incident instrumentation

Nuclear power plants shall be provided with measuring and recording equipment which, during and after an incident or accident,

1. supplies sufficient information about the condition of the plant in order to be able to take the necessary protective measures for the staff and the plant,
2. gives indications regarding the development of the event and makes possible its documentation,
3. enables prediction to be made of the effects on the environment.

Criterion 5.3: Equipment for the control and shutdown of nuclear reactors[3]

The equipment for controlling and shutting down nuclear reactors shall master all reactivity changes which may arise during specified normal operation and during incidents so that the limiting values of the reactor system specified in each case as permissible are not exceeded at the transients likely to be considered[4]. The effectiveness and rate of motion of the control rods, operating either singly or collectively shall be limited so that in the event of an incorrect command the permissible limits for the reactor system are adhered to.

The reactor core and the control equipment shall be co-ordinated so that neutron flux fluctuations which could result in permissible limits specified for the fuel elements being exceeded either cannot arise or can be safely and quickly detected and suppressed.

The shutdown reactivity resulting from the reactivity balance shall also have an adequate shutdown reserve for the case where there is a complete failure of control rods or at least a failure of the control rod with the greatest reactivity effect.

In addition to the shutdown system required for operation, which may be completely or partially identical to the control equipment, a second shutdown system, independent and diversified of the first, shall be provided for shutting down the reactor.

One of the two shutdown systems shall be capable on its own of rendering the nuclear reactor subcritical so quickly from any operating condition or faulty situation even in the event of failure of the control rod with the greatest reactivity effect, and maintaining it in this condition so long as the permissible limiting values of the reactor system are not exceeded. Failure of the control rod with the greatest reactivity effect need not be taken into consideration if both shutdown systems, including excitation by the protective system, especially regarding shutdown characteristics, effectiveness and time behaviour are equivalent.

The other shutdown installation shall be capable on its own of rendering the reactor subcritical from any operating condition involved and keeping it subcritical for as long as desired, even at the temperature most adverse to reactivity balance.

---

[3] A definition of this criterion is provided with regard to the possible loss of the scram system in operational transients.

[4] These transients are dependent on the plant, e.g. change of coolant temperature and pressure due to faults in the power control, rod drop, failure of the main heat sink, steam line break.

Criterion 5.4: Control room and auxiliary control equipment

A control room shall be provided from which the nuclear reactor can be safely operated during specified normal operation and from which, in the event of the occurrence of incidents, measures can be taken to maintain the plant in a safe condition or to bring it into such a condition.

Apart from the control room, auxiliary control equipment shall be provided so that in case of failure of the control room — including the maintenance rooms of importance, e.g. distribution room (cable spreading area) and electronics room — the reactor can be shut down and maintained in a subcritical state, the residual heat removed and the essential plant variables monitored.

The control room and the auxiliary control equipment shall be segregated physically from each other, shall have separate power supplies and shall be protected against external effects so that they cannot fail simultaneously.

SECTION 6

Criterion 6.1: Reactor protection system

The nuclear power plant shall be equipped with a reliable[5] reactor protection system which initiates protective actions when specified response values are reached. It shall be so designed as to fulfil its safety-related function even during tests or repairs with the simultaneous occurrence of a single system failure. Protective actions shall not be affected or presented by hand-given orders. On principle, two criteria (for initiation of protective actions) shall be available for any event to be controlled by the reactor protection system. Various physical parameters shall be used as far as possible. Parameters which are derived from other parameters or which produce the criteria for initiation of protective actions through interaction with further process parameters (e.g. AND-configuration) shall be deemed as a single parameter. If the requirement for two fundamental criteria (for initiation of protective actions) cannot be fulfilled, because e.g. only one physical parameter is available, then the data gathering for the one parameter shall be based on a correspondingly higher value in relation to the data gathering of the remaining parameters.

The mechanical and electrical equipment of the measuring channels (detectors up to and including limiting value transmitters) of the reactor protection system shall, as a general principle, not be used for functions in connection with the control of the reactor. Exceptions shall be permissible only, if they are necessary because of the technical characteristic of the reactor protection system or the measuring, open-loop and closed-loop control systems, and if the reactor protection system is not adversely

---

[5] As means for the reliable design of the reactor protection system, the following shall be applied by preference:

- redundant design of components, structural assemblies and subsystems, physically separated installation corresponding to the effective range of possible events initiating a failure,
- use of different types of equipment (diversity principle),
- largely automatic monitoring in respect of a failure,
- adjustment of components to possible environmental conditions.

affected in its safety-related functions. Redundant reactor protection system components shall, as a general principle, have interdependent equipment for data gathering and signal processing; interfaces shall not impair the redundancy and tripping safety of the system.

The reactor protection system shall be designed so that it does not initiate any actions even during incidents in the reactor protection system, which may cause the reactor plant to reach a dangerous condition. Redundant components of the reactor protection system shall be physically segregated so that incidents inside one of the partial systems cannot simultaneously affect the function of the remaining system.

SECTION 7

Criterion 7.1: Emergency power supply

In addition to the electrical energy supply by the mains feed and the main generator, reliable emergency power supply systems shall be provided for the important safety-related plant components, which guarantee the electrical energy supply of these plant components in the event of a failure in the mains supply and the main generator. Interdependent redundant emergency power generators and distribution systems shall be provided for the emergency power supply, so that, even during tests and repairs with the simultaneous occurrence of a single failure, a sufficient safety-related emergency power supply is ensured. The redundancy of the emergency power generating and distribution systems (electrical systems[6]) shall be in accordance with the redundancy of the mechanical systems. Under outside influences, not all emergency power supply systems shall be simultaneously put out of operation. It shall be ensured that prior to the expiration of the permissible time for the interrupted sustained operation of the emergency power generators, the emergency power supply can be covered by other sources.

SECTION 8

Criterion 8.1: Nuclear reactor containment[7]

The nuclear power plant shall have a containment which can meet its safety-related operations especially during incident conditions. Plant components containing radioactive substances shall be accommodated in a containment, if an inadmissible release of radioactive substances to the environment cannot be avoided in a sufficiently reliable manner by any other method. Particularly, reactor plant systems carrying primary coolant at high pressure shall, as a general principle, be installed in a containment. Exempted from this can be sections of the main steam and

---

[6] Interpreter comment

[7] The containment system includes the containment itself, the surrounding structures and the auxiliary systems for holding back and filtering the possible leakages of the containment.

feedwater lines and other lines, if this is required from an engineering point of view, and if it is ensured that a rupture of these lines does not result in an inadmissible radiation exposure of the environment. A reliable and sufficiently quick closure of the containment penetrations shall be ensured.

Criterion 8.2: Design bases of the containment[7]

The containment, its interior rooms, airlocks, and penetrations as well as the auxiliary systems of the containment such as the systems, which are necessary for the adherence to the containment design values, shall be designed with a sufficient reserve in such a manner that they withstand the highest pressure and temperature loads which may occur during incidents without exceeding the leakage rate upon which the design is based, or without destroying important safety-related systems. The containment shall be protected against consequential damage by outflowing media, reaction forces and missiles in such a manner that its function is maintained.

Criterion:8.3: Leakage tests of the containment

The containment, airlocks and penetrations shall be so designed and constructed that, upon the occasion of the initial testing, the leakage rate can be tested at the design pressure, and the pressure and strength test can be conducted at the design pressure with a safety margin including a margin necessary for taking into account the design temperature. It shall be possible to carry out periodical tests at such pressures at which a sufficient conclusion in respect to the leakage rate at the design pressure is possible.

Criterion 8.4: Containment penetrations

Pipes which are connected with the reactor coolant or the inside atmosphere of the containment and penetrate the containment shall, as a general principle, have two shutoff valves, one of which is to be fitted outside and the other inside the containment. Exceptions thereof shall be permissible, if the technical peculiarity or the mode of operation of the respective pipe deems this to be necessary, and if the safety-related function of the containment is not impaired.

Pipes which penetrate the containment, but are not connected to the reactor coolant or the inside atmosphere shall have at least one shutoff valve on the outside of the containment. The design of the shutoff valves and the respecting pipe up to the outer shutoff valve shall at least be in accordance with the design of the containment. The setting of the shutoff valves shall be supervised from the control room.

The containment penetrations by pipes shall meet the same design requirements as are valid for the containment itself. This requirement also applies to cable penetrations. The shutoff valves, pipe- and cable-penetrations shall be protected against consequential damage due to escaping fluids, reaction forces and missiles. The function of the safety-related pipe- and cable-penetrations must be ensured also under fault conditions.

Criterion 8.5: Heat removal from the containment

A reliable, redundant system for the containment heat removal shall be provided. It shall be designed and constructed so that even in the occurrence of a single system failure during incidents, the temperature and pressure in the containment can be lowered.

SECTION 9

Criterion 9.1: Ventilation systems

The nuclear power plant shall be equipped with reliable ventilation systems for the following rooms:

1. rooms in which, during specified normal operation and during incidents, radioactive substances can occur in the ambient air in higher concentrations than one tenth of the values stipulated in Appendix II of the First Radiation Protection Regulations (Erste Strahlenschutzverordnung). Exceptions shall be permissible, if the provisions of Section 34, subsections 1 and 21(4) of the First Radiation Protection Regulations are adhered to;
2. rooms in which, during specified normal operation, values specified as permissible for ambient air conditions cannot be adhered to in any other way, or in which safety-related components must employ air cooling, even during incidents;
3. rooms in which the air is substituted by an inert gas or in which, for work protection reasons, specific ambient air conditions must be fulfilled.

The ventilation systems shall be so designed and constructed and adjusted to the characteristics of the remaining plant components so that during specified normal operation and incidents, the values specified in each case as permissible for ambient air conditions and the discharge or release of radioactive substances will not be exceeded. Recirculating air systems shall be combined with exhaust air systems in a suitable manner, so that the radiation exposure of persons inside or outside the plant is kept as low as practicable, even below permissible values, taking into consideration the rules of science and technology.

So far as the concentration of radioactive substances in the air of specific rooms can become so large that values specified in each case as permissible are exceeded, the associated ventilation systems shall be equipped with air filter systems. A connection of the ventilation system where the exhaust air is passed through the filter systems only when required, shall be permissible. The air filter systems shall be sufficiently reliable and shall be so constructed that they have the necessary extraction efficiency under the respective conditions of use. The necessary devices to test their conditions shall be provided.

SECTION 10

Criterion 10.1: Radiation protection monitoring

In the nuclear power plant, the personnel, organizational, spatial, and mechanical requirements shall be fulfilled to ensure that during specified normal operation, incidents, accidents and during unforeseen events a sufficiently accurate and reliable radiation protection monitoring is guaranteed. In particular, the plant shall be equipped with:

1. stationary equipment for the measurement of local dose rates,
2. stationary equipment for the measurement of the concentration of radioactive substances in the ambient air of groups of rooms or rooms in which a suitable monitoring for the protection of people or for an early detection of any radioactive substances released is necessary,
3. stationary equipment for measuring the concentration of radioactive substances in circuits in which appropriate monitoring is necessary for the early detection of eventual releases of radioactive substances,
4. apparatus for determining local dose rates as well as the concentration and type of radioactive substances in air and water,
5. equipment for measuring personnel dose rates as well as contamination of people and objects,
6. laboratory facilities suitable for interpreting and analysing radioactive tests.

Criterion 10.2: Activity monitoring of gaseous and liquid wastes

In the nuclear power plant, the personnel, organizational and mechanical requirements shall be fulfilled in order to carry out, to the extent necessary, sufficiently accurate and reliable measurements and recordings of the type, quantity and concentration of radioactive substances occurring and discharged with the gaseous and liquid wastes, and to limit the discharge, if necessary.

Criterion 10.3: Environmental monitoring

In the nuclear power plant, the personnel, organizational and mechanical requirements shall be fulfilled to ensure a sufficiently accurate and reliable radiation protection monitoring of the environment to the extent necessary during the specified normal operation and during incidents and accidents. In particular, the plant shall be provided with:

1. equipment and instruments for determining dose, dose rate, concentration of activity, surface contamination, and nuclides during specified normal operation,
2. equipment and instruments for obtaining the necessary information on local doses, concentrations of activity, surface contaminations and nuclides in the case of eventual releases of radioactive substances,
3. equipment for the measurement of wind direction and wind speed.

SECTION 11

Criterion 11.1: Handling and storage of nuclear fuels and other radioactive substances

Nuclear power plants shall be provided with equipment for the safe handling, containment and storage of nuclear fuels and other radioactive materials. This equipment shall be so designed, arranged and shielded as to exclude an inadmissible stress of the staff and the environment[8] by radiation, the release of radioactive substances to the environment or incidents by criticality.

The equipment used to store irradiated nuclear fuels shall be provided with adequate capacity for storage and appropriate and sufficiently reliable systems for the removal of residual heat during specified normal operation and during incidents.

[8] Compare with footnote 2.

LICENSING AND REGULATORY CONTROL OF THERMAL POWER REACTORS IN THE UNITED KINGDOM

W.S. GRONOW, R. GAUSDEN
Nuclear Installations Inspectorate,
Health and Safety Executive,
London, United Kingdom

Abstract

LICENSING AND REGULATORY CONTROL OF THERMAL POWER REACTORS IN THE UNITED KINGDOM.

The regulation of nuclear safety and liability in the United Kingdom is governed by the Nuclear Installations Acts 1965 and 1969. A site licence is required for the construction or operation of a nuclear reactor or other prescribed installation. The responsible Minister is vested with broad regulatory powers for licensing purposes. The Nuclear Installations Inspectorate, set up in 1959, is responsible for safety assessments of proposed facilities and for inspection during construction, commissioning and operation. The power to impose and enforce conditions attached to a licence gives the Nuclear Inspectorate adequate control over the design and construction of a nuclear plant and its operation. Whilst there have been changes in the form and content of various licence conditions over the past decade, the practice is still to keep the licences as free from technical detail as far as practicable, consistent with the need to define the extent of control. The licence conditions and the procedural and technical documents drawn up thereunder provide a framework for safety control. The extent to which provisions can be made for emergency countermeasures is an essential feature of the United Kingdom siting policy.

INTRODUCTION

The regulation of nuclear safety in the United Kingdom is governed by the Nuclear Installations Acts 1965 and 1969. The Acts are administered in England and Wales by the Secretary of State for Trade and Industry and in Scotland by the Secretary of State for Scotland. These Ministers have very wide discretion in the use of their regulatory powers and no body other than the Atomic Energy Authority or a Government Department may construct or operate a nuclear reactor or other prescribed installation without the site being licensed by the responsible Minister. The Ministers are also empowered to attach to a nuclear site licence any conditions considered necessary for safety and these conditions can then be legally enforced under statutory penalties. The flexibility of these powers makes it possible to frame conditions appropriate for the protection of operators and the public from ionizing radiations for any of the licensed sites. The Ministers are assisted in the detailed execution of the Act and in framing the conditions attached to site licences by the Nuclear Installations Inspectorate. This paper summarizes the experience gained in applying safety controls to nuclear power plants in the United Kingdom and an outline is given of some of the changes made to meet the problem of regulating a developing and expanding industry.

FIG. 1. Nuclear power station sites in the United Kingdom, 1973.

LEGISLATION

Papers presented at earlier conferences [1, 2] described the way in which the safety provisions of the Nuclear Installations Act 1959 were administered and the philosophy behind the conditions attached to the licences issued under that Act. This Act was amended in 1965 to bring United Kingdom law into conformity with certain International Conventions on the legal liability for nuclear damage. These are the Paris Convention of 1960 and the Convention supplementary to it signed in Brussels in 1963, both under OECD, and the Vienna Convention of 1963 under the IAEA. Some technical difficulties in the implementation of control under the 1965 Act and the influence of the International Conventions have been described by Charlesworth and Fryer [3]. Since 1965 the Nuclear Installations Act has been amended by a further Act in 1969 to maintain conformity with the financial limits on nuclear liability in the International Conventions and to make changes to certain liability rules. A further amendment permitting particular processes for enrichment of uranium and extraction of plutonium to be carried on by commercial concerns as well as the United Kingdom Atomic Energy Authority has been made by the Atomic Energy Authority Act 1971.

ORGANIZATION OF THE NUCLEAR INSPECTORATE

The Nuclear Inspectorate was set up in 1959 when the first four commercial nuclear power stations of the 'Magnox' type were in various stages of construction. Since that time nine of these stations have come into operation and a further five stations of the advanced gas-cooled reactor type are under construction. The location of all power reactors in the United Kingdom is shown in Fig.1. Several other installations have also been licensed under the Act, including seven low-power research reactors, two of which were subsequently dismantled and the sites abandoned. In April 1971 the main fuel processing plants and isotope preparation units were detached from the UKAEA to form private companies and thereby became subject to the licensing and inspection regime of the Nuclear Installations Acts.

The safety regulation of power reactors is primarily concerned with the safety assessment of designs, commissioning and operating procedures and inspection during construction, commissioning and operation, as well as the evaluation of proposed sites. However, for any installations licensed under the Acts the Inspectorate must judge the adequacy of the safeguards provided to prevent an escape of radioactivity or emission of ionizing radiations that might cause harm to operators or the public. This judgement involves an assessment of the risks of accidents and their consequences and requires a thorough understanding of the processes involved and of the engineering and control of nuclear plants.

The organization of the Inspectorate has been changed from time to time to make the best use of the available effort in regulating a developing and expanding nuclear industry and there has been a steady increase in its strength. Nevertheless, the additional effort entailed in the safety regulation of the installations detached from the UKAEA led to a substantial increase in the size of the Inspectorate and considerable re-organization was undertaken at that time. Under the Chief Inspector and his Deputy, the work of

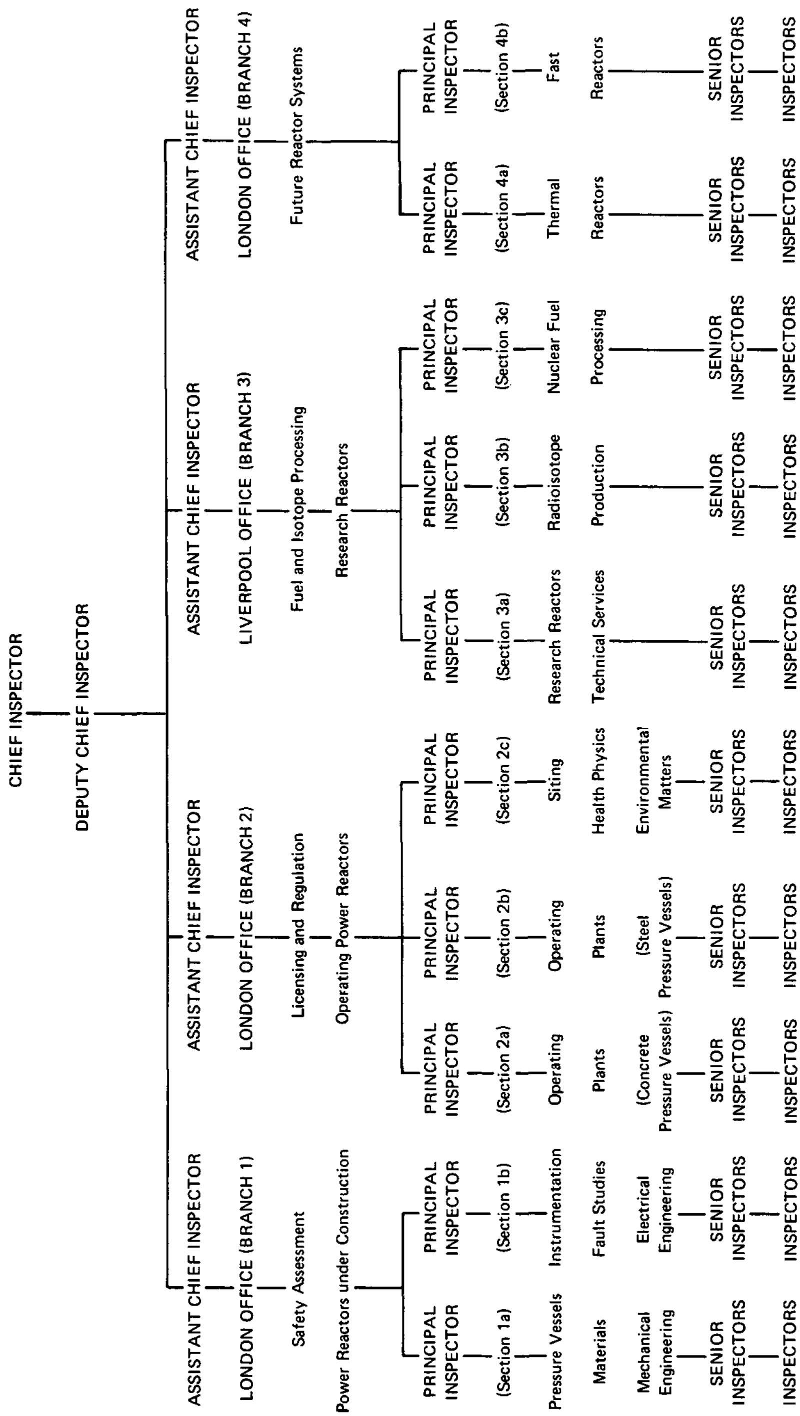

FIG. 2. Organization of the nuclear installations inspectorate.

the Inspectorate is now divided between four branches led by Assistant Chief Inspectors — three, in London, to deal mainly with power reactor systems and the other, in Liverpool, to deal with fuel and isotope processing facilities and research reactors. An organization chart showing the lines of responsibility and division of work is given in Fig.2.

The work on power reactors is arranged so that one branch deals with the safety assessment of all power reactor systems and the inspection of stations under construction, and provides a pool of specialist experience, which can be utilized on safety problems that arise in the operation of nuclear power plants. The second branch deals with reactors in the experimental or prototype stage, and it is at present considering LWRs, HTRs and fast reactors. The other London branch is responsible for the licensing and regulation of all nuclear power stations belonging to electricity supply undertakings in the United Kingdom and deals with siting, operational safety and environmental problems.

The Liverpool branch is concerned with all aspects of assessment, licensing and operational safety of research reactors and fuel and isotope processing installations. It provides consultative services to the Inspectorate in respect of radiological protection and criticality problems.

NUCLEAR SITE LICENCES (Fig.3)

Applicants for nuclear site licences usually consult the Inspectorate on the information required in a submission for a licence and on the detailed procedures to be followed. These will vary with the type and size of the proposed installation. However, sufficient information must be provided to enable the Inspectorate to satisfy itself as to the safety of the proposed plant and the suitability of the site. For power reactors applicants are required to submit details of the basic safety principles on which the design is based and indicate how these principles are to be incorporated in the plant. Information must be given on the main pressure-containment system and cooling arrangements both in normal and accident conditions, the layout of the site, the expected radiation contours and arrangements for dealing with radioactive effluents, waste storage and the handling of irradiated fuel elements. The submission has to include an outline of the fault studies and other investigations and tests planned to support the design assumptions. The proposed location of the installation must meet the siting criteria set down for the type of plant proposed and all relevant details must be provided — siting policy is discussed in a later section of this paper. If the assessment of the proposed site and installation proves to be satisfactory, the applicant is advised that there are no safety objections to the granting of a licence to construct the installation and he may then make a formal application to the Minister.

On receiving an application for a nuclear site licence, the Minister may direct the applicant to publicize the proposal and give notice to specified public and local authorities including river boards who have the right to make representations regarding the proposal within 3 months of the notice being served on them. In the case of nuclear power stations these matters are dealt with under the Electricity Acts, which make similar provision for publication and notification to interested parties of any proposed power station. The procedure to be followed is laid down by Section 2 of the

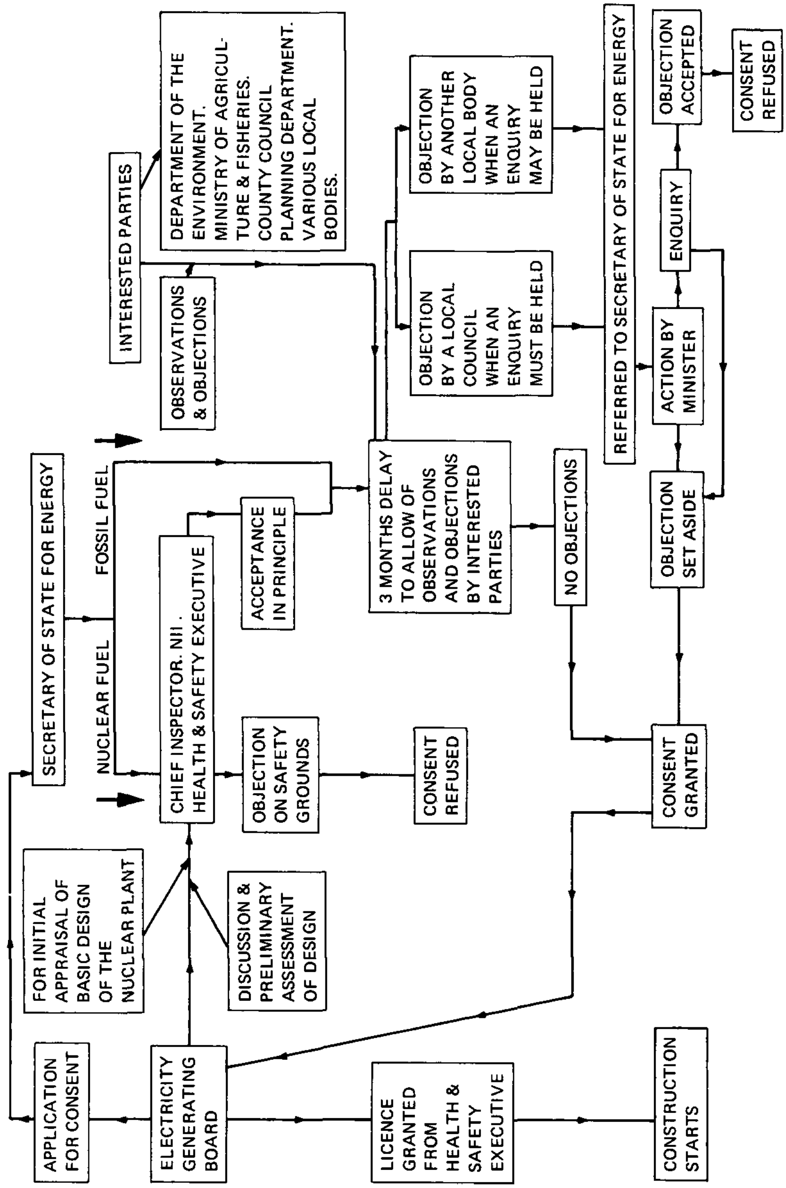

FIG.3. Consent procedure (electricity power station construction) in the United Kingdom.

Electric Lighting Act 1909, which is also administered by the Secretary of State for Trade and Industry and the Secretary of State for Scotland. Under this section the Minister's consent is required before any power station can be built or extended. An application for a nuclear site licence will not be granted until the Minister gives his consent to build a nuclear station under the Electric Lighting Acts.

When all interested parties have been given an opportunity to comment or object to the proposed station, the Minister decides whether or not the proposals affect their interests to an extent that makes it desirable to hold a public enquiry. If, however, the local Planning Authority objects, the Minister is obliged to hold such an enquiry.

Under these arrangements public enquiries have been held on seven of the applications for consent to build a nuclear power station. In only one of these cases was the Minister obliged to order an enquiry because of objections by the local Planning Authority. This was the proposal to build a nuclear power station at Connah's Quay in North Wales where the planning authority felt that the consequential restrictions on residential development, an integral part of UK siting policy, would inhibit the development potential of the region. One planning strategy for this region envisaged a town of 250 000 persons centred on the proposed location of the power station. The proposal was turned down on planning grounds largely because the presence of a nuclear power station might introduce a further constraint on possible development plans for the region. This was the first and only nuclear power station to be refused following a public enquiry and indicates the difficulties that might be encountered in siting nuclear power plants near urban developments where there is a conflict between the need to preserve a relatively thinly populated area near a nuclear power plant and the long-term development plans for that area.

LICENCE CONDITIONS

The power to impose and enforce conditions attached to the nuclear site licence gives the Nuclear Inspectorate adequate control over the design and construction of a nuclear plant and of its operation, but until a licence has been issued the Inspectorate has no formal powers over any proposed plant. In practice, as previously mentioned, a licence would not be granted until sufficient information has been made available to the Inspectorate to judge the safety of the plant. The licence may be varied at the Minister's discretion. which makes it possible to amend, add or revoke licence conditions at any time. Full use is made of the flexibility of the licensing system to attach only those conditions appropriate to the state of plant. For example, the installation of the plant is regulated by the attachment of conditions requiring the licensee to submit information on the design and any supporting development and testing programme, in advance of construction, and on the arrangements made to ensure the quality of materials and construction. At a later stage, when the construction is approaching completion, the licence is varied and new conditions attached that regulate the commissioning and operation of the plant. These conditions cover such matters as, radiological protection; plant operating limits; commissioning, operating and maintenance procedures; the storage and disposal of new and irradiated fuel;

the storage of radioactive waste and emergency arrangements. The licensee is also required to appoint a safety committee to consider any matter of relevance to safety in the operation of the plant.

Whilst there have been a number of changes in the form and content of conditions attached to site licences over the past decade, it is still the practice to keep these as free from technical detail as far as is practicable, consistent with the need to define the extent of control. The licensee is encouraged to prepare his own procedural and technical documents that meet the intent of the various licence conditions. These documents, subject to scrutiny by the Inspectorate, can then be formally approved under the conditions of the licence and form part of the regulatory requirements imposed on the operators. The advantages of this practice are that the operators are involved in setting the safety standards and controls with which they have to comply and the licence conditions need not be modified when it is considered desirable to change these standards or controls. The licensee is free to propose amendments to these documents at any time and, if approved by the Inspectorate, they can be implemented by the issue of a simple legal document called a consent/approval. In this way safety controls can be modified or introduced to meet problems as they arise with the minimum of delay and interference to the operations on a nuclear site.

DESIGN SAFETY ASSESSMENT

The commercial nuclear power plants in operation or under construction in the United Kingdom are all of the gas-cooled, graphite-moderated type. Nine of these stations were fuelled with natural uranium clad in Magnox and the last five, AGRs, are fuelled with enriched uranium oxide clad in stainless steel. The total capacity of these stations amounts to some 11 000 MW(e) and since the start of the first programme of nuclear power in 1956 designers, constructors, operators and safety assessors have all accumulated considerable experience and knowledge of this reactor type.

The safety philosophy adopted at the start of this programme was that no credible fault or failure of the reactor plant or credible combination of such faults or failures should lead to a release of radioactivity that could endanger members of the public living in the vicinity of a nuclear power station. The plants were sited at locations where it was feasible to take emergency action for persons who might be at greatest risk in the event of an escape of radioactivity. The licensee was also required to show that the standards of the design and the quality of the materials and of the construction for all items of plant, significant for safety, were in accordance with the best engineering practice.

For the Magnox reactors in steel pressure vessels the design base accident was that of fracture of one of the external gas ducts, in such a place and of such size that it caused the most severe fuel element temperature transient in this loss of coolant accident. This accident and safety features of the gas-cooled reactors have been described and discussed at previous conferences as well as the design developments that led to the introduction of the AGR. However, there have been a number of significant improvements in the safety characteristics of the gas-cooled reactor system which should be noted in any review of safety progress. For example, the introduction of the prestressed concrete pressure vessel eliminated the need for external gas ducts and allows in-service inspection of many of the pressure-retaining components. There have also been a number of improvements in the design of reactor components, fuel handling machinery, and control and shut-down systems. In addition, the original safety philosophy has been modified and refined to take advantage of the increased knowledge and experience of safety problems.

The design base accident is still used to define the range of faults for which automatic shut-down and emergency cooling must be provided but the fault analysis has been extended to cover a wider range of accidents. The object of this further analysis is to ensure that there is no step change in the consequences of accidents and, if necessary, to reduce the risk or consequences of such accidents by changes in the design. Where appropriate, use is also made of the techniques of probability analysis in the safety assessment of reactor components and systems and, for the later designs, this technique has been extended to include a range of possible accidents and their consequences. This exercise has proved to be of limited value not least because of the lack of reliable data on failure of components that make up a complete reactor system.

The Inspectorate has a small but expert group of safety assessors whose principal task is to examine those areas of reactor designs that have the greatest significance for safety and to recommend, if necessary, where improvements should be made. It has up to now not proved possible to design comprehensive safety standards or produce codes of practice that could be applied to the wide variety of reactor designs that have been built or are under consideration in the United Kingdom. Nevertheless, some standards have been formulated for reactor pressure vessels and reactor instrumentation and these are used by industry where they can be applied to the particular design. Progress in the field of standardization will depend on the number and range of reactor systems adopted for power production and the effort available from industry to codify approved practices. It is not the present intention, however, to introduce standards that may inhibit innovation and progress in safety design.

INSPECTION DURING CONSTRUCTION

The standards adopted by the nuclear industry in the manufacture and construction of nuclear plants have been closely monitored from the start of the first programme of nuclear power in the United Kingdom. The conditions attached to the licence, which permit construction of the plant, require the licensee to make arrangements for inspection and testing at the manufacturer's works and on the site. Much of this work falls on recognised independent inspecting authorities of high repute or on the licensee's own inspecting organization. The arrangements, which are subject to scrutiny by the Inspectorate and require approval of the Minister, must set down the details of the items to be inspected, the nature of the inspection and the agency to be employed. More recently greater emphasis has been given to quality control and the maintenance of adequate records of all materials and components used in reactor plants. The Inspectorate maintains close contact with inspecting agencies and allocates considerable effort to site inspection, especially for those items of plant of novel design and of major safety significance.

SAFETY IN OPERATION

Nuclear power plant operators have a duty under the law to build and operate their plants safely. The conditions attached to nuclear site licences granted for operating reactors cover all matters relevant to the safe operation of the plant and the protection of operating personnel and members of the public. The scope of these conditions has been briefly mentioned in an earlier section of the paper but it should be emphasized that wherever possible they are framed so as to ensure that all operations on the plant are properly thought out and set down in writing from the initial loading of the first fuel charge, during commissioning and throughout the operating life of the station. For example, the unusual and temporary safety problems that arise in working up a nuclear power plant to full power are dealt with by the Commissioning Committee. The members of this Committee are drawn from the organizations concerned with the design, construction and operation of the station who thus make up a body that has the widest experience and most comprehensive knowledge of the plant and its characteristics. Under the Chairmanship of the Station Manager this Committee has executive control over the commissioning and approves the tests and experiments carried out in the plant to demonstrate that it meets the design intent. These arrangements are formalized under the licence and the licensee has to submit a programme for the commissioning of the plant, specifying the tests and other operations to be carried out. The Inspectorate call for such information as may be considered appropriate to monitor the safety controls and judge the adequacy of the programme of testing and witness the more important tests as the commissioning proceeds.

The safety of operating reactors, however, is primarily controlled by operating rules that specify the safe operating limits of the plant and such matters as the availability and frequency of testing of essential safety equipment. A reactor may not be operated except in accordance with these rules, which are formally approved under the licence. It is not expected, however, that over the long life of a nuclear plant all these rules will continue to define appropriate safety criteria but it is desirable for any proposed changes to be carefully considered before they take place. For this purpose the licensee is required to set up a Safety Committee to advise on the safety of any proposed change to the operating rules or modification to the plant having significance for safety. Any alteration to the rules or modification to the plant defined above must be approved by the Minister before they may be implemented. The Nuclear Inspectorate, in making inspection visits to nuclear sites and by scrutinizing submissions made in support of safety proposals, provide an independent check on the effectiveness of the licensee's organization in applying safety controls.

The Magnox reactors have between them accumulated over 200 years of operating experience at high load factors. As may be expected, there have been a number of defects and failures of these plants, which have required careful consideration from the safety point of view. Perhaps the most significant of these was the discovery that mild steel oxidation in the carbon dioxide coolant was proceeding at an unexpectedly high rate in the hot temperature regions of the reactors and boilers. This problem and the steps taken to reduce the rate of oxidation were reported at the 1971 Geneva Conference [4]. However, in addition to a programme of inspection and monitoring of components exposed to the hot coolant gas, it led to a full review of the implications for safety of premature failure of any of these components. Though the rate of oxidation has been significantly reduced, it is now the practice to carry out a review of the effects of mild steel oxidation on each of the Magnox stations every year. Over the past few years the operators have developed equipment for inspection and monitoring of internal components of the reactors and undertaken major modifications and repairs, that were not considered feasible at the start of the Magnox programme. These developments and facilities have given increased confidence in the operators' ability to detect and perhaps correct incipient failures in these reactor systems.

The licence conditions and the procedural and technical documents drawn up under them provide a framework for safety control. This does not, however, relieve the licensee of his responsibility for safety, nor does it ensure safety. The safety of operating plants depends ultimately on the operators and the record of the industry shows that they have made safety a prime consideration in all their activities. There has never been an accidental release of radioactivity from a nuclear power station in the United Kingdom having significant effects outside the site boundary, and no member of the public has been exposed to radiation either from planned discharges of low-level radioactive waste or direct radiation from the plant which approach the permissible levels recommended by the ICRP. So far as persons employed on the site are concerned, the working practices adopted by the licensees have been very successful in limiting the total exposure of this group of people. Only a small proportion exceed the level regarded as acceptable for the general public and only a few per cent receive exposures that require them to be classified persons.

SITING POLICY

The main safeguard to the public from any risks arising from nuclear power plants has been and will continue to be the achievement of high standards of design construction and operation of those plants. Nevertheless, in the remote event of an escape of radioactivity the only effective means of controlling the exposure of the public is by the choice of site. It is prudent, therefore, to take advantage of the secondary contribution that can be derived from the siting of nuclear power plants. On the other hand, electricity supply undertakings require sites that have adequate supplies of cooling water and suitable foundations and, for economic reasons, are near to centres of electrical load. The Generating Boards in the United Kingdom are also required to take account of amenity interests in the siting of all power stations and the routing of transmission lines.

The additional restrictions imposed on the siting of nuclear plants in the interests of public safety make it more difficult for the electricity undertakings to select and acquire suitable sites, especially in densely populated countries that have embarked on a large programme of nuclear power. This problem has led to a demand for relaxation in siting restrictions, which would permit nuclear power plants to be located in or near urban populations. It is, however, for Governments to judge whether or not the risks and benefits from the use of nuclear power justify such a step. This issue was given careful consideration in the United Kingdom and as a result of a full review of the safety characteristics of the gas-cooled reactor in a prestressed concrete pressure vessel and of the range of available sites, it was accepted that some relaxation of existing siting restrictions was desirable and appropriate for this type of reactor.

The results of this review were reported at Vienna in 1969 [5] where details of the population characteristics of the sites at Heysham and Hartlepool were given as examples of acceptable sites under a new siting policy for AGRs. Though these sites could be considered as being near-urban in character, they represent a class of site that in terms of the risks to health of the public is of an order of magnitude less than that of sites in or near large metropolitan areas. The siting criteria developed to implement the new policy excludes the use of sites in or near large centres of population, not least because it would be difficult to carry out effective emergency countermeasures for people who may be at greatest risk in the unlikely event of an escape of radioactivity. Clearly, emergency countermeasures become less reliable in built-up areas not only because large numbers of people might be involved but also because it would be difficult to detect the level and extent of the hazard. Emergency action would almost always have to cover a larger area than that based on the normal dispersion characteristics of windborne materials. Where dense populations extend laterally round a site and allowance is made for modest shifts in wind direction, the numbers involved in evacuation or medication could be several times larger than those based on a consideration of a single 30° sector. It would also be difficult to determine a sensible boundary for emergency action that would be accepted by people just outside that boundary and it will always be desirable to evacuate whole communities rather than create public apprehension by stopping short at some arbitrary division.

The extent to which provisions can be made for emergency countermeasures is an essential feature of United Kingdom siting policy. The difficulties outlined above suggest that for confidence in the effectiveness of such measures the level of population in the vicinity of a nuclear site should be kept as low as is practicable. Sites are only accepted if it can be shown that effective emergency action could be taken for all persons within a radius of about 1 km of the station and that the level of population and the nature of the terrain within a radius of about 3 km would not preclude the extension of such action if it ever became necessary. These characteristics of nuclear sites have to be maintained over the life of the station and advantage has been taken of the system of statutory control of town and country planning that exists in the United Kingdom to require local planning authorities to consult the Nuclear Inspectorate before giving planning permission for certain categories of development within a radius of 3 km of the station. There are no restrictions on purely industrial development, however, provided it does not present a hazard to the safe operation of the nuclear plant and the work force can be readily incorporated in the emergency arrangements.

The experience gained in siting nuclear power stations in the United Kingdom has confirmed the need for numerical siting criteria that specify acceptable population distributions, both to guide prospective licensees in the examination of potential sites and to set standards against which applications may be judged, as well as to control development round sites. In those cases where proposals have been made to site nuclear stations in areas where there are competing interests in land use considerable public opposition may be expected and it has proved essential to provide clear guidance on the development restrictions associated with a nuclear plant. The limitations on population distribution at present in force round AGR sites are set out in the attached Appendix, but where a choice of sites exists full advantage should be taken of the contribution to public safety that may be derived by selecting sites in less populated areas.

REFERENCES

[1] CHARLESWORTH, F.R., GRIFFITHS, T., "Licensing and inspection of nuclear installations in the United Kingdom", Reactor Safety and Hazards Evaluation Techniques 2, IAEA, Vienna (1962) 15.

[2] GRIFFITHS, T., GAUSDEN, R., "Development of licensing and inspection of nuclear installations in the United Kingdom", Proc. Int. Conf. Peaceful Uses of Atomic Energy (Proc. Conf. Geneva, 1964) 13, UN, New York (1964) 334.

[3] CHARLESWORTH, F.R., FRYER, D.R.H., Some technical implications of recent international conventions on the nuclear industry, J. Br. Nucl. Energy Soc. (1966).

[4] RUTTER, R.L., "Some aspects of the performance of the Mk I gas-cooled reactors of the CEGB", Peaceful Uses of Atomic Energy (Proc. Conf. Geneva, 1971), 2, UN, New York, and IAEA, Vienna (1972) 233.

[5] GRONOW, W.S., "Application of safety and siting policy to nuclear plants in the United Kingdom", Environmental Contamination by Radioactive Materials (Proc. Symp. Vienna, 1969), IAEA, Vienna (1969) 549.

[6] CHARLESWORTH, F.R., GRONOW, W.S., "A summary of experience in the practical application of siting policy in the United Kingdom", Containment and Siting of Nuclear Power Plants (Proc. Symp. Vienna, 1967), IAEA, Vienna (1967) 143.

APPENDIX

SITING CRITERIA FOR ADVANCED GAS-COOLED REACTORS (AGRs)

The class of site now considered suitable for nuclear power stations of the AGR type is defined by criteria that specify the acceptable density and distribution of the surrounding population. These criteria which limit the proximity of urban populations to a nuclear site are called limiting 'site' and 'sector' characteristics and are shown in Fig.4. The suitability of any proposed site is first tested by comparing its characteristic curves, derived from an analysis of the density and distribution of the surrounding population including projected development, with the limiting characteristics. The derived characteristics of the proposed site should not exceed either the limiting site or sector characteristics. The method used to derive the characteristic curves for any site was described in a paper [6] presented in Vienna in 1967 and the factors leading to the selection of the limiting characteristics were described in a paper [5] also presented in Vienna in 1969.

TABLE I. SECTOR FACTORS

Zone number n	Zonal distances from the reactor site centre (miles)	Sector zonal weighting factors w_i	Sector zonal population p_i	Limiting sector factor $\times 10^{-6}$: $\sum_{i=1}^{i=n} = p_i w_i$	Limiting sector factor $\times 10^{-6}$: Point values
1	0 - 1	32.4 w_1	p_1	p_1w_1	0.063
2	1 - $1\frac{1}{2}$	17.6 w_2	p_2	$p_1w_1 + p_2w_2$	0.137
3	$1\frac{1}{2}$ - 2	10.5 w_3	p_3	$p_1w_1 + .. + p_3w_3$	0.198
4	2 - 3	6.4 w_4	p_4	$p_1w_1 + .. + p_4w_4$	0.305
5	3 - 5	3.3 w_5	p_5	$p_1w_1 + .. + p_5w_5$	0.482
6	5 - 10	1.31 w_6	p_6	$p_1w_1 + .. + p_6w_6$	0.812
7	10 - 20	0.46 w_7	p_7	$p_1w_1 + .. + p_7w_7$	1.274

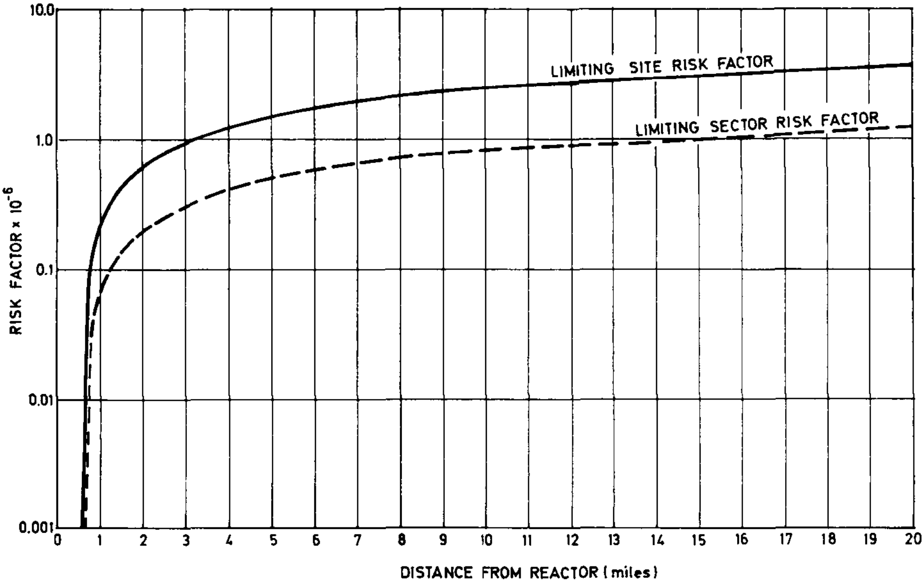

FIG. 4. Limiting site and sector risk factors for AGRs in concrete pressure vessels.

SECTOR CHARACTERISTICS

The sector characteristic of a proposed site is obtained from the summation of the products of population numbers in specified zones of the most densely populated 30° sector around the site and their respective weighting factors. The weighting factors that give greater relative importance to population close to the site are based on the well-known principles of diffusion of windborne materials.

The sector characteristic curve is derived by plotting

$$\sum_{i=1}^{i=n} p_i w_i$$

against outer radius of the n^{th} zone where

p_i is the population within a zone

w_i is the weighting factor for the same zone

i is the zone number

n is the number of zones from $i = 1$ to $i = n$.

Table I specifies the number and area of each zone, the weighting factors of these zones and the point values derived for the limiting sector characteristic.

TABLE II. SITE FACTORS

Zone number n	Zonal distances from the reactor site centre (miles)	Site zonal weighting factors W_i		Site zonal population P_i	Limiting site factor × 10^{-6}	
					$\sum_{i=1}^{i=n} = P_i W_i$	Point values
1	0 - 1	40	W_1	P_1	P_1W_1	0.190
2	1 - $1\frac{1}{2}$	22.5	W_2	P_2	$P_1W_1 + P_2W_2$	0.411
3	$1\frac{1}{2}$ - 2	13.75	W_3	P_3	$P_1W_1 + P_2W_2 + P_3W_3$	0.595
4	2 - 3	8.75	W_4	P_4	$P_1W_1 + .. + P_4W_4$	0.917
5	3 - 5	4.75	W_5	P_5	$P_1W_1 + .. + P_5W_5$	1.448
6	5 - 10	2.0	W_6	P_6	$P_1W_1 + .. + P_6W_6$	2.436
7	10 - 20	0.75	W_7	P_7	$P_1W_1 + .. + P_7W_7$	3.823

SITE CHARACTERISTIC

The site characteristic is obtained by a similar method to that used for the most densely populated 30° sector and takes account of distribution of the surrounding population. The site characteristic curve is derived by plotting

$$\sum_{i=1}^{i=n} P_i W_i$$

against the outer radius of the n^{th} zone where

P_i is the population within the zone

W_i is the weighting factor for that zone

i is the zone number

n is the number of zones from $i = 1$ to $i = n$.

Table II specifies the number and area of each zone, the weighting factors of those zones and point values derived for the limiting site characteristic.

RECENT EFFECTIVE AND PROPOSED IMPROVEMENTS IN THE NUCLEAR POWER PLANT LICENSING PROCESS IN THE UNITED STATES OF AMERICA

T. F. ENGELHARDT
Office of the General Counsel,
United States Atomic Energy Commission,
Washington, D.C.,
United States of America

Abstract

RECENT EFFECTIVE AND PROPOSED IMPROVEMENTS IN THE NUCLEAR POWER PLANT LICENSING PROCESS IN THE UNITED STATES OF AMERICA.

In his 18 April 1973 message to Congress on energy the US President noted that nuclear technology represented an indispensable source of energy for meeting current requirements and stated the need to avoid unreasonable delays in developing nuclear power by streamlining licensing procedures and by reducing overlapping jurisdictions. The Energy Reorganization Act of 1974 abolished the Atomic Energy Commission and transferred its licensing and regulatory functions to an independent regulatory commission, the Nuclear Regulatory Commission; a new Energy Research and Development Administration was concurrently established, vested with central responsibility for the planning, management and conduct of the Government's energy research and development.

The paper describes a number of administrative and legislative reforms that have been taken or are under way to improve and shorten the present nuclear facility licensing and regulatory process. It is estimated that full implementation of the 'standardization' and 'early site permit' concepts could reduce the overall time required to bring a nuclear power plant on line from the current ten years to six years or less. And this is being aimed at without compromising the thoroughness of the safety, environmental or antitrust licensing reviews, or sacrificing public participation in the licensing process.

INTRODUCTION

The basic framework for the licensing of nuclear facilities was established in the Atomic Energy Act of 1954 at a time when the nuclear power industry was in its relative infancy, when nuclear power plants were not generally competitive with fossil-fuelled power plants, when the licensing focus was almost exclusively directed at radiological health and safety, and when the public controversy surrounding the safety of nuclear plants was relatively subdued. Since its establishment this basic framework has been the subject of intensive and repetitive scrunity by the Congress, the Atomic Energy Commission (hereinafter "AEC" or "Commission"), and others; while a number of statutory and non-statutory changes have been made, the diagnosis up to now has never been that drastic surgery was warranted.

While there can be reasonable differences of opinion as to what legislative changes are needed to improve the present licensing system, the circumstances are now undeniably different from those that obtained when the 1954 statute was enacted. The factor of volume alone, in terms of the number of licence applications anticipated for the 1980s and beyond,

TABLE I. STATUS OF NUCLEAR POWER PLANTS, 1 NOVEMBER 1974

Number of units			Rated capacity (MW(e))
52 [a]	Licensed to operate		35 000
55 [b]	Construction permit granted		54 000
	26 under operating licence review	25 000	
	29 operating licence not yet applied for	29 000	
83	Under construction permit review		93 000
	17 site work authorized, safety review in process	18 000	
	66 other units under CP review	75 000	
28	Ordered		31 000
16	Publicly announced		20 000
234	Total		233 000

[a] In addition, there are two operable AEC-owned reactors with a combined capacity of 940 MW(e).
[b] Total of units under construction (construction permit granted plus site work authorized): 72 units, 72 000 MW(e).

should be inducement enough for a reexamination of the present statutory framework. Beyond this, the present 'energy picture', of which nuclear power is, of course, a part – whether it be described in terms of 'crisis' or other terminology – must be assayed when one begins to examine the kinds of legislative changes that will best serve the overall public interest. Stated in another manner, neither the short-range or long-term considerations can rightfully be slighted.

Nuclear power plants have played a prominent role in the President's various energy messages and addresses over the past year. In his 18 April 1973 message to the Congress on energy the President noted that nuclear technology represented an indispensable source of energy for meeting current needs, and stated that "we must seek to avoid unreasonable delays in developing nuclear power", and that "we need to streamline our governmental procedures for licensing and inspections, reduce overlapping jurisdictions and eliminate confusion generated by the government". Then, in his 29 June 1973 statement on energy, the President proposed a separation of the Atomic Energy Commission's licensing and regulatory functions from its other functions. In effect, the President proposed that the functions of the Atomic Energy Commission, except those pertaining to licensing and regulatory matters, be transferred to a new Energy Research and Development Administration, which would be vested with central responsibility for the planning, management and conduct of the Government's energy research and development. The Atomic Energy Commission with its remaining licensing and regulatory functions would then be renamed the Nuclear Regulatory Commission. This reorganization bill was enacted into law on 11 October 1974 as the Energy Reorganization Act of 1974 (Public Law 93-438). Finally, in his 8 November 1973 and 23 January 1974 messages on energy, the President directed the Atomic Energy Commission to speed up the licensing and construction of nuclear

TABLE II. ORDER PLACED FOR NUCLEAR POWER PLANTS

Year of order	Number of units	Capacity (MW(e))	Per cent of total [a]
1953-61	14	1 170	1
1962	2	628	7
1963	4	2 495	15
1964	0	0	0
1965	7	4 423	15
1966	20	16 345	43
1967	30	25 427	47
1968	14	12 872	36
1969	7	7 203	22
1970	14	14 305	30
1971	20	19 921	50
1972	36	39 705	63
1973	38	43 068	59

[a] Per cent of total steam electric capacity ordered.

plants, and make efforts to reduce the time required to bring nuclear plants on-line from the present nine to ten years to five to six years, without compromising safety or environmental standards.

The President's increasing attention to nuclear energy matters reflects, at least in part, the Nation's increasing dependence on nuclear fission as a source of electrical energy. As of 1 December 1974, 52 nuclear power plants were licensed for operation, representing about 35 thousand megawatts of electric power, and about seven per cent of the nation's total installed electrical capacity. Also on 1 December, 74 nuclear power reactors were authorized for construction or site work, 64 were in early stages of the Commission's construction permit review process, and another 44 had either been ordered or announced by utilities but had not yet become the subject of a construction permit application. The total of 234 reactors under construction, under construction review, order or announced, represented an aggregate capacity of some 233 000 megawatts of electric power. It is estimated that nuclear power will provide about 20% of the nation's electricity by 1980 and about 60% by the end of the century (Tables I and II).

SHORT-RANGE REFORMS

Various administrative measures have been and are being taken to improve the present licensing process. One of the most important of these measures, and perhaps also one of the most controversial, is the Commission's developing policy on standardization.

STANDARDIZATION

The standardization policy was first spelled out in concrete terms in a Commission statement issued on 5 March 1973.[1] The goal of the policy is to standardize the designs of nuclear power plants and their components, so as to facilitate selection by utilities of plant designs, contribute to higher plant operating reliabilities and improvement in protection of the public health and safety, and enable safety-related research and development to be concentrated in fewer areas. The Commission's statement indicated that three options would be available for processing standardized designs. The first option involves a "reference system" concept whereby an entire facility design or major parts of it can be identified as a standard design and reviewed by the Commission's regulatory staff. The design could then be referenced in an application for a construction permit and would not ordinarily be subject to a repetitive regulatory staff review. The second option involves essentially duplicate plants to be constructed within a limited time span by either one utility or a group of utilities. Under this option the regulatory staff would review the safety-related features of all the plants simultaneously. The final option involves manufacture of a number of nuclear power plants of identical design at a location different from the site of intended operation.

Regulations to implement the third option were published on 2 November 1973.[2] The manufacture of the reactors requires issuance of a Commission licence to the manufacturer, after review by the regulatory staff and Advisory Committee on Reactor Safeguards[3], and holding of a mandatory formal hearing. A construction permit would be required from the Commission prior to any necessary construction at the utility site to accommodate the reactor and prior to the transport of the reactor to, and its installation at, that site. A Commission licence would also be required prior to any actual operation of the reactor. Under the regulations, matters resolved at any stage of the licensing process would, in general, not have to be reconsidered at subsequent stages of the process unless there is significant new information that substantially affects the conclusions reached at the earlier stage or other good cause.

Regulations to implement the first two standardization options are also under consideration.

RULE MAKING

One feature of the manufacturing licence standardization option as described above is the provision that seeks to minimize reconsideration at subsequent hearings of issues that have been previously decided at earlier hearings. This particular feature is but one example of the increasing use of the Commission's administrative processes to resolve

---

[1] Commission Press Release No. R-85, 5 March 1973.

[2] 38 F.R. 30251, 2 November 1973. The new regulations are set forth principally in a new Appendix M to 10 CFR Part 50.

[3] The Advisory Committee on Reactor Safeguards is an independent committee of experts in the various disciplines important to nuclear reactor safety established by section 29 of the Atomic Energy Act of 1954, as amended (hereinafter "Act"), 42 U.S.C. §2039.

generic issues on a generic basis. The more traditional method for dealing with generic issues is by rule making. The US Court of Appeals for the District of Columbia Circuit has recently observed that rule making gives any agency "an invaluable resource-saving flexibility in carrying out its task of regulating parties subject to its statutory mandate", and that "increasingly, courts are recognizing that use of rule making to make innovations in agency policy may actually be fairer ... than total reliance on case-by-case adjudication".[4]

A number of rule-making proceedings have been initiated by the Commission to resolve generic environmental or safety issues. The most notable of these are the proceedings relating to performance criteria for emergency core-cooling systems[5], establishing numerical guidance for determining when routine discharges of low-level radioactive materials from light-water nuclear power reactors meet the "as-low-as-practicable" regulatory requirement[6], determining the contribution of individual nuclear power reactors to the environmental effects of the nuclear uranium fuel cycle[7], and determining the environmental effects of transportation of radioactive materials.[8] All four of these proceedings have involved rule-making hearings – the first two essentially 'on the record' formal hearings, and the last two the traditional 'legislative type' rule-making hearings.[9] The ECCS proceeding is particularly notable, since it involved a matter that had become the subject of intense controversy in individual licensing cases. The hearings lasted 125 days and generated a record of more than 22 000 pages of transcript and thousands of pages of written testimony and exhibits.

One can expect the Commission to make increasing use of rule making as a tool to resolve generic issues.[10] The combined concepts of standardization and deciding generic issues on a generic basis through manufacturing licence or rule-making proceedings reflect an effort by the Commission to both facilitate management of its case load by discouraging submission of numerous applications for 'custom' plants, and to provide for regulatory decisions that have the maximum impact in terms of settling outstanding issues.

---

[4] National Petroleum Refiners Assoc. v. FTC, F. 2d (D.C. Cir. 1973).

[5] AEC Docket No. RM-50-1, relating to whether ECCS criteria published on 29 June 1971 (36 F.R. 12247) and amended 18 December 1971 (36 F.R. 24082) should be retained or modified. The emergency core-cooling system, or ECCS, is a back-up safety system designed to cool the reactor core in the event of a sudden loss of normal reactor primary system coolant.

[6] AEC Docket No. RM-50-2, relating to proposed 10 CFR Part 50, Appendix I. The Commission's present regulations generally require that all licensees, in addition to maintaining routine low-level discharges of radioactive materials into the environment below specified limits in 10 CFR Part 20, also make every reasonable effort to keep such discharges as far below these limits as practicable. 10 CFR §20.1(c).

[7] 37 F.R. 24191, 15 Nov. 1972.

[8] 38 F.R. 3334, 5 Feb. 1973.

[9] There is no general statutory requirement that the AEC hold hearings of any kind in connection with rule making. Siegel v. AEC, 400 F. 2d 778 (D.C. Cir. 1968). But see International Harvester Company v. Ruckelshaus, 478 D. 2d 615 (D.C. Cir. 1973).

[10] See Remarks by Commissioner William O. Doub, AEC, before the ABA Annual Convention, Administrative Law Section, Washington, D.C., 6 August 1973, AEC Press Release No. S-11-73.

OTHER EFFORTS

A number of other measures have been or are proposed to be taken to improve the licensing process. On 1 February 1973 the Commission published notice that it was considering development of general environmental siting criteria for nuclear power plants[11], and, more recently, on 15 November 1973 the Commission published a notice inviting comments on various alternative policies and procedures pertaining to disclosure of proprietary information exempt from automatic disclosure under the Freedom of Information Act.[12]

In addition, on 5 February 1974 the Commission published proposed regulations to provide a different procedure whereby site excavation and preparation and certain other on-site activities could be undertaken prior to issuance of a construction permit. 10 CFR §50.10(c) of the Commission's present regulations prohibits commencement of construction of a nuclear power reactor until a construction permit has been issued. "Commencement of construction" is defined to include generally any clearing of land, excavation or other substantial construction action that would adversely affect the natural environment of a site. However, the Commission retained the authority to grant exemptions from these requirements of §50.10(c) on a case-by-case basis and thereby permit the conduct of certain on-site activities prior to issuance of a construction permit. Under §50.12(a) the Commission may grant such exemptions where it determines that this would be authorized by law and will not endanger life or property or the common defence and security, and would otherwise be in the public interest, after considering and balancing specified factors relating to environmental impact, redress of any adverse environmental impact, foreclosure of alternatives, and effect of delay in commencement of construction on the public interest, including power needs. However, it has been the Commission's policy to grant such exemptions sparingly and only in cases of undue hardship.[13]

The new proposed procedure would differ from the present procedure under §50.12(a) in several important respects. First, the scope of activities permitted would be defined and limited; second, the activities could be conducted only after the National Environmental Policy Act of 1969 (NEPA) review by the Commission's Regulatory staff had been completed; and third, there would be full public participation in the NEPA decision-making process since a public hearing would be required on the NEPA findings required to be made pursuant to the Commission's NEPA regulations[14] before the activities could be authorized.

---

[11] 38 F.R. 3106.

[12] 38 F.R. 31543. The notice reflected a new Commission policy to encourage increased public participation in the rule-making process by expanding the use of advance notice to the public of proposed rule making. Under the new policy the Commission would invite advice and recommendations at a preliminary stage before the Commission is prepared to issue the specifics of a proposed rule. AEC Press Release No. R-475.

[13] 37 F.R. 5745, 21 March 1972.

[14] 10 CFR Part 50, Appendix D.

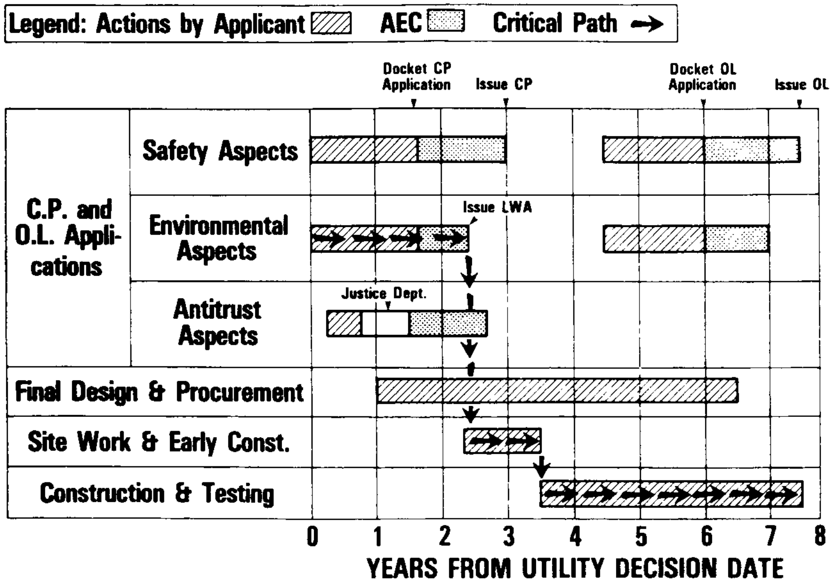

FIG. 1. Time required from conception to operation of nuclear plants (without legislative improvements).

LONG-TERM REFORMS

The measures briefly described above all relate to changes in the licensing process that are possible within the Commission's existing statutory authority. At present the time required to bring a nuclear power plant on-line is about ten years (Figs 1, 2). The administrative measure with the most immediate impact – the proposed procedure to permit certain on-site work to proceed in certain circumstances prior to grant of a construction permit, when combined with an expedited NEPA review, could in favourable cases save about 8-14 months. Clearly, if the President's stated goal to reduce the ten-year period to six years or less is to be met (Fig.3), some more basic reforms will be needed. Thus, the Commission has recently proposed some substantial legislative changes to its present facility licensing system.

On 8 March 1974 the Commission forwarded to the Congress draft legislation which, if enacted, would restructure the nuclear facility licensing process. The proposed legislation has four basic objectives: to obtain earlier decisions on facility siting; to diminish the possibility that operating licence decisions may become delaying factors; to encourage and take licensing advantage of generic design approvals, so structuring the process as to place primary responsibility for this aspect of the licensing cycle on vendors and architect-engineers rather than utilities; and to offer several different approaches for facility licensing and thereby add flexibility to the present process.

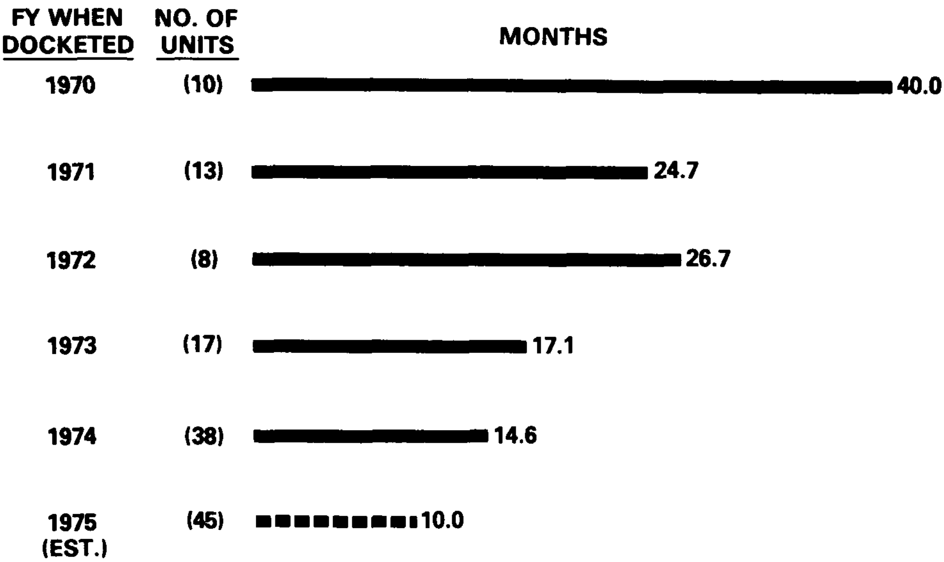

FIG. 2. Average time from docketing of nuclear power plant applications to start of construction.

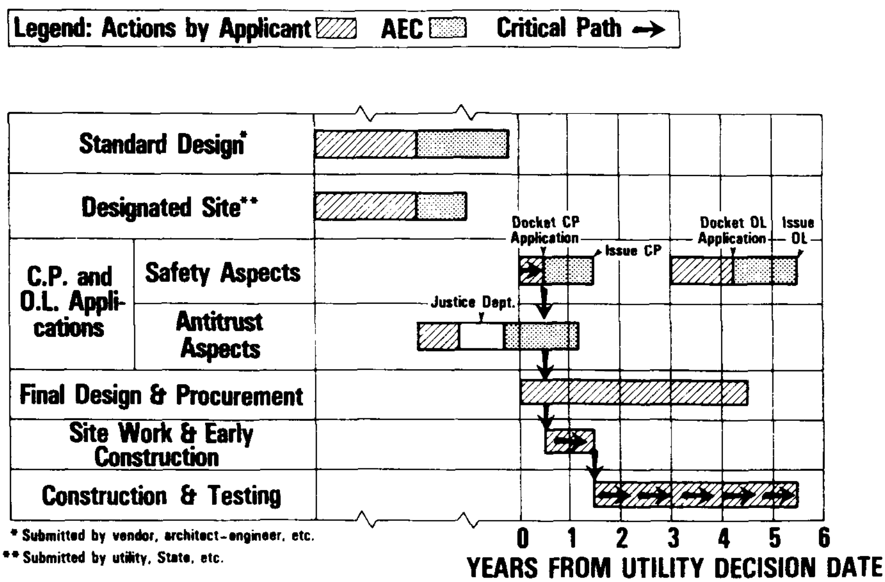

FIG. 3. Time required from conception to operation of nuclear plants (assuming standardized plants and designated sites).

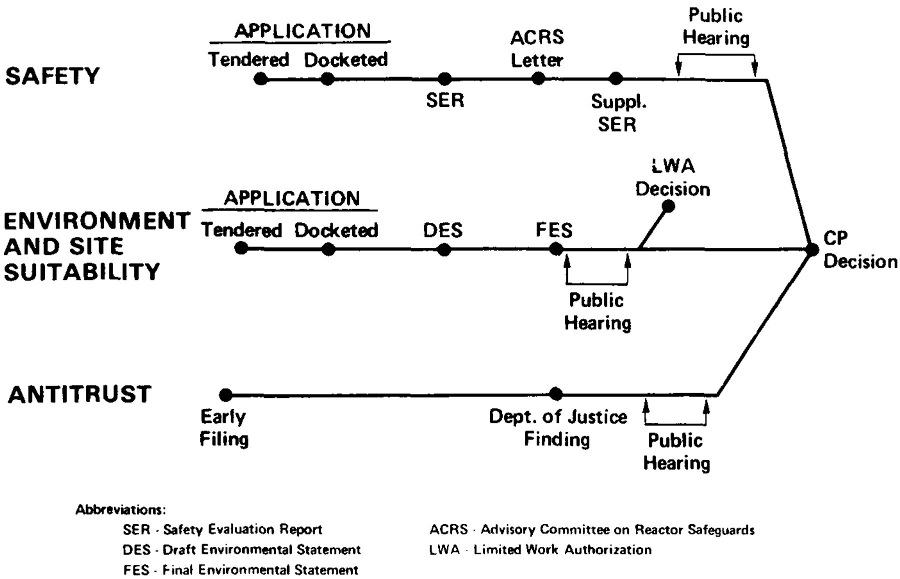

FIG. 4. Parallel tracks in the construction permit review process.

The Atomic Energy Act of 1954 in its present form generally provides for a two-stage facility licensing process. First a construction permit must be obtained from the Commission authorizing construction of the proposed facility at the site where it will be operated.[15] This stage of review has focused on the preliminary design of the facility and the suitability of the proposed site.[16] A formal 'on the record' public hearing must be held by the Commission prior to the issuance of any construction permit for a facility for industrial or commercial purposes, such as a nuclear power plant, or for a testing facility.[17] In addition, no person may operate a facility without first obtaining an operating licence from the Commission.[18] This second stage of review has focused on the final design of the facility[19] and a formal 'on the record' public hearing must be held before issuance of any operating licence if requested by any person whose interest may be affected.[20] The Commission is also authorized by the Act to issue a licence to manufacture to one or more facilities.[21] Thus, in some situations the first step in the facility licensing process may be

[15] Act §185, 42 U.S.C. §2235.

[16] See 10 C.F.R. §50.34(a) and Fig. 4.

[17] Act §§181, 189 a., 42 U.S.C. §§2231, 2239 a. The hearing and decision must be in compliance with sections 5, 7, and 8 of the Administrative Procedure Act, 5 U.S.C. §§554, 556, and 557.

[18] Act §101, 42 U.S.C. §2131.

[19] 10 C.F.R. §50.34(b).

[20] Act §181, 189 a., 42 U.S.C. §§2231, 2239 a.

[21] Act §§101, 103, 104, 42 U.S.C. §2131, 2133, 2134.

TABLE III. THREE ALTERNATIVE TRACKS CONTEMPLATED IN PROPOSED LICENSING LEGISLATION

TRACK 1

Continues two-stage construction permit and operating licence procedures

TRACK 2

Authorizes combined construction permit and operating licence if application includes information on final design

Hearing may be requested prior to operation

TRACK 3

Assumes use of both standardized designs and designated sites

Separate reviews and hearings for site and plant

Applicants for site permits need not be utilities; can be States or other entities.
Site designations expire in predetermined time

Hearings:
- May be requested at site review stage
- None at construction permit stage if designated site and approved standard design are used
- Limited opportunity prior to operation

Preliminary construction can start at once if designated site is used

issuance of a licence to manufacture, followed by issuance of a construction permit and operating licence authorizing installation and operation of the facility on-site. Up to now no manufacturing licences have been issued, although provision for issuance of such licences is made in the Commission's regulations.[22] The Advisory Committee on Reactor Safeguards, a statutory Committee of independent experts on nuclear facility safety, is required by the Act to review each application for a construction permit or an operating licence for a facility for industrial or commercial purposes, such as a nuclear power plant, or for a testing facility and submit a public report thereon to the Commission.[23] In addition, any final licensing decisions by the Commission are subject to judicial review.[24] As discussed more fully below, the Commission's legislation would provide for three alternative facility licensing approaches (Table III). The first two licensing approaches are based to a large extent on the present system as described above. However, the third approach to facility licensing provided in the legislation presents a significantly revised licensing structure that would provide for a decoupling of the site review and decision-making process from that for plant design, and place emphasis on standardization in the design area. The legislation would not mandate a single licensing approach. Thus, as explained below, not only would all three licensing approaches be generally available, but the second and third licensing approaches could be pursued at the same time.

---

[22] See discussion on pp. 5-6 and note 3, supra.
[23] Act §182 b., 42 U.S.C. §2232 b.
[24] Act §189 b., 42 U.S.C. §2239 b.

GENERAL STATUTORY REFORMS

While the three licensing approaches would differ, they would have certain common elements. First, although there would be an opportunity for a formal 'on the record' public hearing at specified key stages of the process, no hearing would be required when none is requested. Thus, section 189 a. of the Act would be amended so as to remove the present statutory requirement for a mandatory public hearing prior to issuance of a construction permit for certain facilities. A public hearing would, however, still be held at the request of any person whose interest may be affected. In addition, the Commission would be required to publish in the Federal Register, at least thirty days prior to the granting of any application for a manufacturing licence, construction permit, or operating licence for a facility for industrial or commercial purposes, such as a nuclear power reactor, any application for a construction permit or operating licence for a testing facility, and any application for an amendment to such a licence or permit, a notice that consideration is being given to the granting thereof. Similar to present section 189 a., such thirty days' notice and publication could be dispensed with in the case of applications for licence or permit amendments which the Commission determines involve no significant hazards consideration. In such cases a hearing on the amendment would still be held upon the request of a person whose interest may be affected, but, as is now the case, the hearing could be held after issuance of the amendment rather than before. The present mandatory hearing provisions were added to the Act at a time when the nuclear power industry was in relative infancy and it was expected that mandatory hearings, even in the absence of any controversy concerning the particular application, would produce significant benefits in terms of such things as familiarizing members of the public with nuclear technology. The nuclear industry now represents a mature technology and the use of nuclear energy for generation of electric power is becoming widespread, as indicated earlier. As a practical matter, moreover, public hearings have become forums for resolution of disputed licensing issues rather than means for public education. Under these circumstances, the holding of a public hearing when none is desired by any interested member of the public appears to serve no significantly useful purpose and can result in expenditure of technical resources that could be devoted to other regulatory matters.

The second common element would be established by an amendment to section 182 b. of the Act, which would remove the present statutory requirement for mandatory review by the Advisory Committee on Reactor Safeguards of certain facility construction permit and operating licence applications as described above. The proposed legislation would provide for Committee review only when requested by the Commission. The present statutory provision for mandatory Committee review was added at a time when nuclear power represented a new technology and, to a large extent, each reactor design was significantly different. Nuclear reactors are now becoming more and more standardized. Relaxation of the mandatory review provisions would enable the Committee to concentrate its efforts on standard designs and on the more novel and difficult questions of nuclear facility safety. It would also place the Committee in a better position to deal with the increasing volume of nuclear reactor licence and permit applications by affording it the flexibility to review certain features of a particular facility design rather than all of several classes of facility applications. Provision for Committee review only when requested by the Commission would also be consistent with the status of the Committee as an advisory body.

The third common element would be established by a proposed amendment to section 189 a. of the Act, which would authorize the Commission, upon determination that such action is necessary in the public interest by virtue of the need for power in the affected area, to issue an interim operating licence or an interim amendment to a manufacturing licence, construction permit, or operating licence for a nuclear power reactor or (in the case where a combined permit and licence had been issued as explained below) allow interim operation of a nuclear power reactor in advance of the conduct of the hearing. In all other respects the requirement of the Act would still have to be met. A hearing would still be held if requested by an interested person under section 189, or if requested by an interested person meeting the requirements of sections 185 or 192 c. The proposed amendment to section 189 a. would provide in such a case that the requested hearing could be held after licence or amendment issuance or interim operation rather than before issuance or interim operation. Any such interim licence or amendment would be issued and any such interim operation would be allowed for a period not to exceed twelve months, unless for good cause shown the Commission extends such a period. This proposed amendment would basically provide 'stand-by' authority. The administration of the facility licensing process has been and would be geared to completing the review and hearing processes by the time the facility is fully constructed and ready for fuel loading or the amendment is needed. Nevertheless, there have been instances where fully constructed nuclear power plants have stood virtually idle for periods of up to a year or more pending completion of the hearing process, and the possibility of delays of this nature in the future cannot be discounted. This amendment recognizes that there may be some circumstances where the public interest requires prompt action prior to the completion of the formal hearing processes.

Any interim licence or amendment so issued in advance of the conduct of the hearing would contain and any interim operation allowed in advance of the conduct of the hearing would be subject to such conditions as the Commission may deem necessary. This would ensure that any subsequent findings and orders of the Commission with respect to the subject matter of the proceeding will be given full force and effect. Thus, where a hearing is held on issuance of an operating licence after a determination by the Commission that issuance of a licence in advance of the conduct of the hearing was necessary in the public interest by virtue of the need for power in the affected area, or should such a determination be made by the Commission while a hearing was in progress, issuance of the interim licence under the proposed legislation would not prejudice the ultimate resolution of the issues placed in controversy on their merits, and if necessary, confirming or vacating of the licence in accordance with the action of the Commission in this regard.

In addition, the proposed legislation would delete the provisions of section 185 of the Act pertaining to the requirement that construction permits state the earliest and latest date for completion of construction or modification of a facility. Experience has shown that these provisions, which track certain provisions of the Federal Communitications Act, have not served any significantly useful purpose in the context of nuclear facility licensing.

THE FIRST FACILITY LICENSING APPROACH

The first approach for nuclear facility licensing would be the present licensing system, with the four reforms described above. Thus, there would still be the two-stage construction permit and operating licence process, but hearings would only be held when requested by a person whose interest may be affected, there would be no mandatory requirement for review by the Advisory Committee on Reactor Safeguards, the earliest and latest completion dates would no longer need to be set forth in the construction permit, and in limited circumstances an operating licence could be issued in advance of the conduct of the hearing where a hearing was requested.

THE SECOND FACILITY LICENSING APPROACH

The second approach for facility licensing would be established by an amendment to section 185 of the Act, which would authorize the issuance by the Commission of a combined construction permit and operating licence for a nuclear facility if the application contained sufficient information to support the issuance of both in accordance with the rules and regulations of the Commission. The Commission would be required to publish in the Federal Register, at least thirty days prior to the commencement of operation of any facility for which such a combined construction permit and operating licence has been issued, a notice that commencement of operation is expected to take place and that the Commission will grant a hearing upon the request of any person whose interest may be affected by such operation on whether, as a result of (1) a significant advance or change in the technology, or (2) a violation of a permit or licence or rule, regulation or order issued by the Commission, occurring after the most recent licensing action in the proceeding, there should be some modification of the facility or other appropriate action should be taken that will provide substantial, additional protection required for the public health and safety, or the common defence and security, or the protection of the environment. No request for a hearing pursuant to such notice would be granted unless the person requesting the hearing made a prima facie showing in the affirmative on this issue. Any final Commission decision after such a hearing, or denying a request for such a hearing, would be subject to judicial review in the same manner as prescribed in section 189 b.

The Commission's analysis of the legislation explains in some detail the nature of this 'prima facie' showing. The prima facie showing would be set forth in the petition for hearing itself and, to be granted, the petition would need to set forth with particularity the nature of the alleged advance or change in technology or violation and the nature of the modification or other appropriate action that the petitioner believes should be taken, and set forth such evidence, by affidavit or other appropriate means, as would be sufficient as a matter of law to establish that the issue specified in the section should be decided in the affirmative by the Commission, unless rebutted. It would be expected that the licensee and the Commission's staff would file answers to any such petition, which would address, among other things, whether such a prima facie showing had been made, and the Commission, or a designated presiding officer, would rule on the petition after a full consideration of all the pleadings that had been filed.

Once such a prima facie showing had been made, any hearing held would be a formal 'on the record' public hearing. However, under section 189, as it would be amended as explained above, the Commission would be authorized in appropriate circumstances to allow interim operation of a nuclear power reactor to commence in advance of the conduct of the hearing on the prima facie showing.

THE THIRD FACILITY LICENSING APPROACH

The third approach for facility licensing would be set forth in a proposed revision to section 192 of the Act, which contains authority for the issuance of temporary operating licences that has now expired.[25] The proposed revision would, in effect, offer a review process focusing upon separate site and facility design reviews. Under proposed section 192 a. the Commission would be authorized to issue site permits, i.e. approvals of sites for facilities, notwithstanding that no application for a construction permit or combined construction permit and operating licence had been filed with the Commission. Site permit applications could be filed by persons other than facility licence or permit applicants, such as States. The Commission would by rule or regulation prescribe the period or periods of duration for site permits so that if the time period expired and the site had not become the subject of an application for a construction permit or combined construction permit and operating licence, the site would lose its 'approved' status.

Unless otherwise ordered by the Commission, under proposed section 192 b. any applicant for a construction permit or combined construction permit and operating licence for a facility to be located on a site approved pursuant to the revised section could prepare the approved site for construction and commence such construction activities thereat as the Commission may, by rule or regulation, determine to be permissible.[26] Finally, under proposed section 192 c. the Commission would be authorized to issue a construction permit and/or operating licence for a facility, without a further hearing except as explained below, if the

---

[25] This section was added to the Act by P. L. 92-307, 86 Stat. 191 (1972). Only one temporary operating licence was ever applied for or issued under the section, and the provision expired under its terms on 30 October 1973.

[26] As indicated in the discussion above, the Commission has present authority to permit site preparation and certain on-site work prior to issuance of a construction permit. In its analysis of the legislation the Commission indicated that this particular provision had been included in the bill in order to establish a statutory licensing framework specifically accommodating such action, and thereby add a measure of predictability that should aid facility planning efforts.

facility was to be constructed and operated on an approved site (for which there would have been an earlier opportunity for hearing) and the preliminary design with respect to a construction permit, or the final design with respect to a construction permit and/or operating licence, had been approved in a rule-making or manufacturing licence proceeding in which, if requested by a person whose interest may be affected, a formal 'on the record' hearing had been held.[27] The Commission would be authorized to define the scope of preliminary or final design information that must be previously approved in order for the general opportunity for hearing at construction permit and operating licence stages to be eliminated. In the case of nuclear power plants it is expected that the preliminary or final design, which must be previously approved, would cover the structures, systems and components within the boundaries of the reactor containment, auxiliary building, control building, diesel generator building and radwaste building.

As can be seen, under the third licensing approach if an applicant proposes a design that has previously received generic approval by the Commission, the opportunity for a hearing at the construction permit stage would be eliminated. The justification for this is that matters concerning the suitability of the site and the bulk of the design of the facility will have been the subject of previous review and opportunity for hearing in the site permit proceeding and manufacturing licence or rule-making proceeding. Where the final design has been the subject of such a prior review and opportunity for hearing, the general opportunity for a hearing at the operating licence stage (or combined construction permit and operating licence stage) would be eliminated for the same reason. However, the Commission would publish in the Federal Register, at least thirty days prior to issuance of any operating licence under this provision, or at least thirty days prior to commencement of operation of any facility for which a combined construction permit and operating licence had been issued under this provision, a notice that the Commission is considering granting an operating licence or that commencement of operation is expected to take place, and that the Commission will grant a hearing upon the request of any person whose interest may be affected by such operation on whether, as a result of (1) a significant advance or change in the technology, or (2) a violation of a permit or licence or rule, regulation or order issued by the Commission, occurring after the most recent licensing action in the proceeding, there should be some modification of the facility or other appropriate action should be taken that will provide substantial, additional protection required for the public health and safety, or the common defence and security, or the protection of the environment. No request for a hearing pursuant to such notice would be granted unless the person requesting the hearing makes a prima facie showing in the affirmative on the issue set forth above. In the event such a prima facie showing relates to a proposed modification of a facility the final design of which had been previously approved in a rule-making proceeding or a manufacturing licence proceeding, then the Commission,

---

[27] As indicated in the discussion above, the Commission has authority under existing law to approve facility designs on a generic basis through rule making or issuance of manufacturing licences. In its analysis of the legislation the Commission indicated that these concepts were incorporated into the proposed legislation in the interest of providing a self-contained and integrated licensing framework.

in its discretion, could either confine the hearing to the facility that is the subject of the request for a hearing or consolidate a hearing with respect to such facility with a hearing on whether the prior rule or manufacturing licence should be amended. Any final Commission decision after a hearing on such a prima facie showing or after such a consolidated hearing, and any final Commission decision denying a request for hearing under this provision, would be subject to judicial review in the same manner as prescribed in section 189 b.

As can be seen, these provisions relating to opportunity for hearing in connection with facility operation are substantively the same as counterpart provisions in section 185 as it is proposed to be amended, except that, under section 192, there would be specific authority to consolidate the hearing on the facility with a hearing on whether the prior rule or manufacturing licence should be amended. This would be in keeping with the generic character of the underlying approved design. As in the case of section 185 as it is proposed to be amended, once the requisite prima facie showing has been made, the hearing on the facility as well as any consolidated hearing as described above would be 'on the record'. The Commission would be free to determine that there should be no consolidation of the hearings and institute separate proceedings to amend the prior rule or manufacturing licence. This provision would also not restrict the authority of the Commission to institute, on its own initiative, a proceeding to amend any rule or manufacturing licence. As in the case of the first and second licensing approaches, under section 189 as it would be amended, and subject to the limitations therein, the Commission would be authorized in appropriate circumstances to issue an interim operating licence or permit interim operation of a nuclear power reactor in advance of the conduct of the hearing.

ANTITRUST REVIEW

The present Act provides, in the case of most construction permit applications for nuclear facilities for commercial or industrial purposes, such as nuclear power plants, for review of antitrust matters by the Attorney General and Commission and, where necessary, a hearing by the Commission on antitrust issues prior to issuance of the permit.[28] Such a review and hearing are not provided for in the case of operating licence applications for facilities for which there was prior antitrust review at the construction permit stage unless the Commission determines that such review is advisable on the ground that significant changes in the licensee's activities or proposed activities have occurred.

While the legislation would, by virtue of proposed section 192 b., affect the point in the utility planning and construction process when a construction permit must be obtained, since site preparation and commencement of certain construction activities could be carried out prior to receipt of the permit, the existing statutory provision for antitrust review and hearing prior to issuance of a construction permit would not be affected. Proposed section 192 c. expressly provides that its provisions removing the general opportunity for hearing at the construction permit

[28] Act §105, 42 U.S.C. §2135.

and operating licence stages do not affect any requirement for antitrust review and hearing prior to issuance of a construction permit or operating licence. However, the existing statutory provision for antitrust review and possible hearing in certain limited circumstances at the operating licence stage would be affected by the proposed amendment to section 189 a. authorizing issuance of interim operating licences. The provision for antitrust review and possible hearing in connection with issuance of certain operating licences would, of course, not apply where a combined construction permit and operating licence had been issued under the second licensing approach. Under the second licensing approach the antitrust review and, where necessary, hearing, would take place at the combined construction permit and operating licence stage.

ENVIRONMENTAL MATTERS

The Commission's substantive regulatory jurisdiction under the present Act relates essentially to matters of radiological health and safety, common defence and security, and antitrust matters specified in section 105 c.[29] However, the Commission is vested with authority regarding a broad range of environmental matters under NEPA.[30]

Although the proposed legislation would provide for a restructuring of the facility licensing process, the provisions of NEPA are not proposed to be amended. In its analysis of the legislation the Commission indicated that it expected that a detailed statement conforming to the requirements of section 102(2)(C) of NEPA would be prepared in connection with issuance of any site permit for a nuclear power plant pursuant to proposed section 192. The detailed statement would of course recognize that, unlike a construction permit proceeding, no actual facility of a specified design may yet be proposed for the site at the site permit proceeding. Where no actual facility has yet been proposed, the detailed statement would need to be prepared on the basis of an 'envelope' of environmental parameters associated with typical plants. It is expected that the NEPA review at the site permit stage may result in some environmental restrictions regarding the use of the site at the construction permit stage. The Commission also indicated that it expected that a detailed statement would be prepared in connection with any generic approval of a nuclear power plant design by rule making or issuance of a manufacturing licence as referenced in proposed section 192 c. Thus detailed statements would be prepared at the key stages of the licensing process.

ADVANTAGES OF THE THREE LICENSING APPROACHES

The advantages of the first licensing approach, as set forth in the legislation, are chiefly those associated with the four reforms described above. Abolition of the former requirements for mandatory hearings and Advisory Committee on Reactor Safeguards review should streamline the licensing process and conserve technical manpower resources.

---

[29] New Hampshire v. AEC, 406 F. 2d. 170 (1st Cir. 1969), cert. denied, 395 U.S. 962 (1969).

[30] For example, Calvert Cliffs' v. AEC, 449 F. 2d. 1109 (D.C. Cir. 1971).

Abolition of the requirement that construction permits state the earliest and latest completion dates would remove a requirement that serves no useful purpose. Finally, and most importantly, the provision for issuance of interim operating licences should remove the operating licence hearing as a delaying factor in those circumstances where the public interest demanded prompt action.

The second facility licensing approach would avoid a redundant operating licence review and opportunity for hearing where a review had been completed and opportunity for hearing afforded with respect to the final design of the facility at the construction permit stage. However, as explained above, there would still be opportunity for public participation on important questions not previously decided dealing with advances or changes in technology and violations of licence or permit conditions and rules, regulations and orders of the Commission, including those dealing with quality assurance matters. Provision for issuance of a combined construction permit and operating licence would also encourage standardization of nuclear power plants with resulting benefits described earlier.

The third facility licensing approach would offer the most advantages. First, there would be an early decision and opportunity for public participation regarding acceptability of a proposed site. This should not only focus public participation at a crucial aspect of the overall facility planning and construction process, but also provide for such public participation at an early point in time when it can be most effective. Second, should the decision regarding acceptability of a proposed site be favourable, the later construction permit review could proceed concurrently with site preparation and commencement of certain construction activities in accordance with the Commission's rules and regulations. This would substantially remove the construction permit review and hearing process as a delaying factor. This would be appropriate in view of the review of and decision on relevant site matters at the earlier site approval stage. Third, since the rule-making proceeding would relate to approval of facility designs on a generic basis and the manufacturing licence proceeding could also relate to generic approval of facility designs, the proposed legislation would encourage greater standardization of facility designs with the resulting benefits described earlier. Finally, since the petitioner or applicant in the rule-making or manufacturing licence proceeding is expected to be a facility component vendor or architect engineer, the proposed legislation would place increased responsibility concerning nuclear design matters on such persons rather than their customers and clients, who are usually electric utilities. This should make the safety review process more efficient since it will enable the Commission to deal more directly with vendors and architect engineers who are directly involved in actual facility design matters.

As suggested earlier, both the second and third facility licensing approaches could be pursued at the same time. Thus, an applicant could seek a combined construction permit and operating licence for a facility with an approved final standard design to be located on an approved site. Under these circumstances, there would be no hearing at the construction permit stage and site preparation and some on-site construction activities could proceed concurrently with Commission review of the construction permit application. There would be a carefully defined opportunity for hearing prior to operation (or where necessary in the public interest by virtue of the need for power, after interim operation) dealing with technological changes or advances or violations of regulatory requirements.

CONCLUSION

This paper has described a number of administrative and legislative reforms that have been taken or are under way to improve and shorten the present nuclear facility licensing and regulatory process. It is estimated that full implementation of the 'standardization' and early 'site permit' concepts could reduce the overall time required to bring a nuclear power plant on-line from the present ten years to six years or less. It is significant that this would not only meet the President's stated goal, but do so without compromising the thoroughness of the safety, environmental or antitrust licensing reviews, or sacrificing public participation in the licensing process.

THIRD PARTY LIABILITY PROBLEMS CONNECTED WITH NUCLEAR INSTALLATIONS

P. REYNERS
OECD/NEA,
Paris

Abstract

THIRD PARTY LIABILITY PROBLEMS CONNECTED WITH NUCLEAR INSTALLATIONS.

The nuclear liability regime was primarily established at the international level before adoption by domestic laws. The principles embodied in several international conventions to govern third party liability for nuclear damage are recalled. The status and scope of application of the conventions are reviewed. Further harmonization in view of their implementation is desirable and more ratifications will facilitate international trade in nuclear materials and equipment. The various international organizations involved in this field have an important role to play as was the case with respect to the elaboration of existing conventions more than a decade ago.

INTRODUCTORY REMARKS

It is somewhat paradoxical to review the problems connected with the regime of third party liability for nuclear installations since this regime has not had occasion to be put to the test. We have much to be thankful for the fact that no major nuclear incident of a type for which these special liability rules have been devised has yet occurred within an installation or in course of transport, thus entailing serious damage to third parties. An original feature of this regime is that it has greatly anticipated the hazards to be expected from the development of nuclear activities, the result being that, for once, legislation has preceded events. Although there has been no such incident, this can by no means guarantee that this regime still meets the new requirements of nuclear industry, and the difficulty resides precisely in developing it in a way that will enable it to maintain such precedence.

Another characteristic is that with the exception of legislation in some countries, in particular in the United States of America (Price-Anderson Amendment adopted in 1957), the nuclear liability regime was established at the international level before being implemented by domestic laws. When nuclear energy was still at the experimental development stage numerous countries felt the need to cover the potential risks raised by the peaceful uses of nuclear energy by a specific and uniform system of liability. This concern has resulted in the adoption of several international Conventions, the first being the Paris Convention on Third Party Liability in the Field of Nuclear Energy which was signed by sixteen European countries on 29 July 1960. This first Convention was subsequently supplemented by a Convention, adopted on 31 January 1963 in Brussels (hereafter called the Brussels Supplementary Convention) by thirteen of the Signatories to the Paris Convention, for the purpose of providing additional possibilities of compensation for nuclear damage by State financial intervention. On 21 May 1963 in Vienna the Convention on Civil Liability for Nuclear Damage was adopted for the purpose of establishing on a worldwide basis a system similar to that of the Paris Convention.[1]

PRINCIPLES GOVERNING THIRD PARTY LIABILITY FOR NUCLEAR INSTALLATIONS

The production and use of nuclear energy involves hazards of a totally different nature from those with which the world has long been familiar, due to their potential gravity and also because of their specific nature (delayed, insidious, genetic injury); it was consequently felt that a special regime of nuclear third party liability was indispensable. The elaboration of nuclear liability rules was governed by the need to guarantee protection of the public against the special risks of personal injury and damage to property resulting from nuclear activities, and also to avoid hampering the development of the peaceful uses of nuclear energy by imposing too heavy a burden of liability on the nuclear operators. The fundamentals laid down by the nuclear Conventions are the outcome of a compromise between these two requirements.

The principles on which the regime of third party liability is based have frequently been analysed at length and will therefore simply be recalled here.[2]

Nature of liability

It appeared from the start that the traditional system of liability depending on fault was not appropriate. Indeed, it might be extremely difficult in many cases for a claimant to establish the existence of any fault of a nuclear operator. The system of absolute liability, irrespective of fault, has therefore been adopted in accordance with the general tendency in industrial countries to set aside the principle of traditional liability based on fault in case of dangerous activities. In addition, liability is 'channelled' onto one person, namely the operator of the nuclear installation where the nuclear incident occurs, and on whose behalf the nuclear materials are transported. The rights of recourse that constitute an exception to this channelling of the liability are only provided in a very limited number of cases.

The notion of channelling liability onto one single person represents a clear advantage, on the one hand, for possible victims who will undoubtedly know from whom they may claim compensation, and on the other, from the economic angle, for suppliers, contractors and carriers who need not fear that their liability will be involved following an incident. Third party liability is covered by insurance of the sole operator liable, instead of the pyramid of insurance policies required if liability were not channelled onto one person, thus leaving open the possibility of multiple claims and an accrued economic burden for the undertaking concerned.

---

[1] It should also be noted that a Convention on the liability of operators of nuclear ships was adopted in Brussels on 25 May 1962; the aim of this Convention was to set up for nuclear ships a similar liability regime to that for land-based installations. Another Convention, relating to civil liability in the field of maritime carriage of nuclear materials, was also adopted in Brussels, on 19 December 1971, in order to preserve the application of nuclear Conventions and laws in such circumstances.

[2] For further details of this regime, consult the studies given in the bibliography at the end of this paper.

Limitation of liability

The extremely rigorous system of liability that binds the nuclear operator is lightened here: if the liability of the operator were unlimited, he would simply be unable to obtain on the market the financial security (in general, insurance) he is required to provide as cover for his liability. The Paris and Vienna Conventions are slighly divergent on this point as, in principle, the first fixes a maximum ceiling of 15 million units of account[3], the minimum being 5 million; and the second fixes the amount at 5 million dollars.[4]

The nuclear operator's liability is also limited in time. Here again, a compromise was reached between the need to guarantee victims against the fact that nuclear damage may only become apparent many years after the occurrence of the incident, and the practical difficulties insurers would encounter in maintaining cover over too long a period. It is provided that the right to compensation will be extinguished ten years from the date of the nuclear incident, such period then being the maximum time insurers felt they could grant. An exceptional period of twenty years is provided in case of theft, loss or abandonment of nuclear substances. Furthermore, a shorter period may be fixed by Contracting Parties (in practice, three years) when victims have had knowledge of the damage suffered and of the operator liable. It should also be noted that the Conventions authorize extension of the ten-year period if the Contracting Party to which the operator liable is subject has taken the necessary steps to cover the latter's liability for the period corresponding to such extension.

Compulsory financial security

The purpose of the obligation for the operator to provide financial security or to take out insurance up to the maximum amount of his liability is to guarantee that possible victims will in effect be paid the compensation to which they are entitled. In certain instances this requirement has resulted in the nuclear industry seeking a guarantee from the State; more frequently, however, operators have sought such aid on the insurance market, which responded to this new demand by setting up nuclear insurance pools in many countries, resorting to co-insurance and re-insurance techniques. The nuclear Conventions normally lay down that insurance should cover each nuclear incident, but for economic reasons insurers prefer to issue policies providing coverage for an installation for a given period.

State intervention

The State intervenes either to compensate victims from its own funds up to the amount for which the operator is liable or to increase compensation beyond that amount.

The first case applies when the financial security or insurance prove insufficient to cover the amount fixed for the operator's liability, notably in case of default by the guarantor or insurer.

---

[3] These units of account (EMA u/a) were determined by the European Monetary Agreement as being equivalent to 0.88867088 g fine gold, which corresponded to the value of the US dollar at that time.

[4] 1963 value.

The second State intervention occurs when the damage caused by a nuclear incident amounts to more than the operator's liability. In that case the Paris Convention leaves it to the Contracting Parties to take measures to increase compensation beyond the maximum amount of the operator's liability as normally provided (between 5 and 15 million EMA u/a); advantage was taken of this option when the Brussels Supplementary Convention was elaborated. This latter Convention establishes a system of compensation for nuclear damage in three portions: the first corresponds to the amount for which the operator is liable and is covered by insurance or financial security; the second calls for additional compensation from the State on whose territory the installation of the operator liable is situated and covers damage going from the first amount up to 70 million EMA u/a; finally, the third portion involves the joint participation by Contracting Parties and covers damage in excess of 70 million up to 120 million units of account, according to a scale of distribution that takes account of gross national product and the thermal power of reactors situated on the territory of the various Contracting Parties. This system provides a remarkable example of international solidarity and denotes to a high degree the Contracting Parties' mutual trust concerning the safety of nuclear installations implanted in each of their territories. In fact, it paves the way for the constitution of a nuclear liability community in Western Europe.

Jurisdiction

The notion of unity of jurisdiction is yet another novel aspect of the regime of nuclear third party liability established by the Paris and Vienna Conventions. The advantage of this provision lies in the fact that it ensures that the limitation of the operator's liability will be complied with and that compensation will be equitably distributed among all the victims. As a general rule, the court acknowledged as competent is that within whose jurisdiction the nuclear incident has occurred. When such rule cannot apply (on the high seas for example) the competent courts are those of the State on whose territory the installation is situated.

PROBLEMS RAISED BY THE NUCLEAR THIRD PARTY LIABILITY REGIME

The problems raised by the third party liability regime for nuclear installations partly stem from the fact that there are too few ratifications to nuclear Conventions. Moreover, a number of provisions of those Conventions are now raising problems of interpretation and application and might gain from being redrafted in the light of experience and new requirements.

Acceptance of nuclear Conventions

The principles established by the nuclear third party liability Conventions have generally been adopted without great difficulty by most of the countries engaged in nuclear activities, as demonstrated by the numerous national laws that have been patterned on those same principles, also in countries which have neither signed nor ratified the nuclear Conventions. On the other hand, the rate of ratification of the nuclear Conventions has been very slow to date, the consequence being that only two of them are in force at present (see Annex to this paper). Although for several years the Paris Convention – and far more recently, the Brussels Supplementary Convention – have both been applicable between a fairly large number of European countries, the fact nevertheless remains that it has taken many years to achieve this result[5]. The situation regarding the Vienna Convention is even less propitious since more than ten years after its adoption it has not yet assembled the five ratifications required for its entry into force. It is to be hoped however that the presently noted acceleration in nuclear programmes will prompt other countries to become Parties to the Vienna Convention. In actual fact, the speedy development of international transport of fuels and radioactive materials enhances the requirement for a worldwide regime of liability in this field. Furthermore, the chances of a nuclear incident causing damage beyond national frontiers increase with the multiplication of nuclear power stations especially in border areas, and owing to the lack of an international Convention in force, it may not be possible for victims of this type of damage to obtain satisfactory compensation, even if national nuclear third party liability laws do exist, as is sometimes the case.

When the Vienna Convention was elaborated it was assumed that the Contracting Parties to the Paris Convention would also accede to the worldwide Convention. This assumption did not materialize, and such abstention by Western countries, which notably fear the complex legal problems likely to result from this double ratification, has undoubtedly contributed to the comparative indifference to the Vienna Convention, as it was deprived of the support of the most advanced countries in the nuclear field. In all likelihood, however, this situation will no longer remain static, and the matter of the future relationship between the Vienna and the Paris Convention is now being dealt with.

As described above, the international regime of nuclear third party liability is characterized by the co-existence of a regional system constituted by the Paris Convention and the Brussels Supplementary Convention, and a worldwide system established by the Vienna Convention. The responsible authorities immediately became aware of the difficulties likely to arise from this situation, and this led to the adoption on 28 January 1964 of an Additional Protocol to the Paris Convention[6] in order to align the provisions of the latter with those of the Vienna Convention; the differences remaining at present are of a minor nature. Now paradoxically it is precisely the similarity of the provisions of both Conventions, especially regarding the designation of the operator liable, which is likely to create serious conflicts if both Conventions were applied simultaneously and would thus impede the widespread application of their basic principles. A radical solution to this problem would be to maintain only one of the Conventions in force and do away with the other – however, it is clear that this would be unacceptable both from the practical and political viewpoints. Consequently, the two bodies[7] responsible for studying the interpretation and implementation of

---

[5] The Paris Convention came into force on 1 April 1968 whereas the Brussels Supplementary Convention came into force on 4 December 1974.

[6] *An Additional Protocol to the Brussels Supplementary Convention was adopted on the same day, for this same purpose.*

[7] For the Paris Convention: the NEA Group of Governmental Experts on Third Party Liability in the Field of Nuclear Energy. For the Vienna Convention: the IAEA Standing Committee on Civil Liability for Nuclear Damage.

each Convention have recently been considering a solution whereby each Party to one Convention would be considered as being Party to the other, thus enabling problems, raised by the co-existence of the two conventional systems, to be solved. This solution, which would take the form of a Joint Protocol to be adhered to by the Parties to both Conventions, is now being actively studied by the two Agencies concerned, both Secretariats working, as usual, in close collaboration.

Problems of application

During the twelve years or so since the nuclear Conventions were elaborated, the conditions of use of nuclear energy for peaceful purposes have evolved from the experimental and development stages to industrial application, and in the coming years the number of power stations and other nuclear installations will multiply at an accelerated rate. This situation, together with the considerably increased capacity of power stations and the policy of grouping several units on the same site, have led the various competent authorities to question whether the third party liability regime established by the Conventions satisfactorily meets these new requirements. This concerns certain provisions, in particular, the technical scope of application of the Conventions, the amount of the operator's liability and cases where the latter may be exonerated from his liability.

The special regime of nuclear third party liability was devised only to cover risks of an exceptional nature and, therefore, activities that are potentially less hazardous should not come within its scope. To this effect the Paris and Vienna Conventions have empowered the NEA Steering Committee and the IAEA Board of Governors, respectively, to exclude from the scope of application of the Conventions certain categories of nuclear materials or installations (Paris Convention only) owing to their low hazard. Work on this subject has been under way for several years within both Agencies' competent bodies but has not been completed to date, due to the considerable difficulty in arriving at a general agreement on the degree of risk of these materials or activities, and on the calculation of the human and economic cost of the nuclear damage they might cause. More generally, the definition of nuclear installations provided by the Conventions would gain by being adapted to the development and diversification of nuclear activities. An additional problem in the case of the Paris Convention is that it has made no specific provision for the increasing tendency at present to construct several nuclear power stations on one single site.

The amounts that were fixed for the liability of the nuclear operator (between 5 and 15 million EMA u/a) appeared singularly high when the Conventions were adopted. The question is now raised whether they will be sufficient to cover compensation for damage which might be caused by the large nuclear power stations (1000 MW(e) or more) that are being built today. The entry into force of the Brussels Supplementary Convention has undoubtedly improved the situation in respect of the currently limited number of its Contracting Parties, but this question is still pending for the other countries. In fact, the situation has even deteriorated owing to the monetary disorders these past years. As regards both the Vienna Convention, which expresses the amount of liability in 1963 dollars (35 dollars for one ounce fine gold), and the Paris Convention and Brussels Supplementary Convention, whose unit of account is defined according to a certain weight in gold, the considerable increase of this metal on the market (speculative) has distorted the relevant provisions in the nuclear Conventions insofar as it has become impossible to assess with accuracy their real amounts of liability. Even if the official price of gold were to be aligned on the market price, there would be no actual improvement since as a consequence the amounts expressed by national laws would not then meet the requirements of the Conventions. Moreover, these amounts have been significantly eroded by inflation these past years and in certain cases, by devaluations, and most national laws make no provision for an automatic indexing system.

As emphasized above, the ten-year limit for bringing a claim for compensation of nuclear damage is the result of a compromise between the interests of victims and the possibility for insurers to maintain financial reserves over a long period to meet the cost of delayed damage. This ten-year period has increasingly been found too short to cover such damage adequately. Consequently, as allowed by the Conventions, certain Contracting Parties have preferred to keep to the thirty-year ordinary period of prescription, with State intervention.

The Paris and Vienna Conventions exempt the nuclear operator from his liability in case of an incident due to a grave natural disaster of an exceptional character or to an act of armed conflict or to hostilities, civil war, insurrection etc. Apart from the fact that these so-called cases of force majeure might raise delicate problems of interpretation — the notion of natural disaster may vary according to the country involved — it is nevertheless true that such events are almost as likely to cause a nuclear incident as a human or technical fault. In particular, the occurrence of a nuclear incident caused by an act of terrorism must unfortunately be included today among the plausible assumptions. Equally to be considered is cover for financial or other damaging consequences of a successful blackmailing operation, following diversion of nuclear materials. The problem of whether such type of damage should continue to be excluded from the nuclear operator's liability is therefore raised.

One last point concerns justification for State intervention in the operation of the nuclear third party liability regime. There are two trends of thought at present, the first being that the almost geometrical progression of nuclear installations planned or being constructed leads to a significant increase in risks and requires substantial strengthening of the provisions in force and in particular, maintenance of State intervention to guarantee against such risks. The second on the other hand is shown in certain works[8] that tend to demonstrate that the hazards of nuclear installations have perhaps been overestimated, thus questioning the need for involving the State in the exceptional third party liability regime established by the nuclear Conventions. With the increasing economic power of the nuclear industry it may well be wondered whether the time has come for that industry to replace the State in providing a guarantee for nuclear risks, and Bills in this respect, for example, in the United States and the Federal Republic of Germany show an inclination in this direction.

It would be unfortunate indeed if the prevailing problems were solved at national level only as this might prove detrimental to the harmonization of legislation. It would be preferable to solve them in the framework of

---

[8] As the Rasmussen Report, for example: Reactor Safety Study — An Assessment of Accident Risks in US Commercial Power Plants, United States Atomic Energy Commission Draft, WASH — 1400 (1974).

international consultations, and possibly, of a revision of the Conventions, in particular the Paris Convention, which is nearing the end of its first ten years of application, so as to maintain the advantages of the present situation.

CLOSING COMMENTS

The above-mentioned difficulties do not deter from the purpose of nuclear third party liability Conventions, which is to protect the interests of possible victims of nuclear damage, while encouraging the development of the nuclear industry; this seems to have been achieved on the whole even without the test of a grave nuclear incident. Nevertheless, this system must now demonstrate its capacity to adapt to the considerable economic and technological evolution of nuclear energy at the present time. Also, it might well be that the rules of nuclear third party liability will be challenged in the context of nuclear controversy, as is the case concerning the safety of installations. The efficiency of this regime will be maintained and will further resist criticism to the extent it is developed and continues to be harmonized. To this end, it is desirable that, in future, there should be a general impetus to ratify the nuclear Conventions. Apart from the importance of widespread application of the Conventions to achieve a high degree of unification in national laws, this is indispensable for ensuring the development of international trade in nuclear materials and equipment. It is clear from experience that, in the absence of an international system of third party liability, international trade in this field has been seriously hindered, one example being that plans for the supply of nuclear installations have had to be postponed until an appropriate agreement was concluded. This question takes on particular importance given the rapid increase in the supply of nuclear materials and equipment by industrialized countries to developing countries.

Another point that merits attention is that the nuclear Conventions are based on solidarity between the Contracting Parties, notably from the financial viewpoint and as regards the harmonization of legislation. It is important therefore that such action to harmonize national legal systems be undertaken in parallel with equivalent action on the licensing procedure for nuclear installations. Efforts should be concentrated on standardizing the technical and safety criteria installations should comply with before they are licensed. Improvements in this area can but help to encourage interested countries to adhere to nuclear third party liability Conventions by providing a guarantee that all the Contracting Parties are following a consistent policy in the prevention of nuclear damage.

This paper has several times emphasized the privileged role played by the various international organizations competent in this field. After the nuclear third party liability Conventions were elaborated under the auspices of these organizations, they then set up certain bodies responsible for studying the conditions of application and interpretation of the Conventions with a view to incorporating them in national laws. Their task, which is by no means completed, lies in guiding and encouraging the efforts needed to adapt the third party liability regime, in the light of problems evoked above, to the technical and economic requirements of a nuclear industry that has reached maturity.

ANNEX

The Convention on Third Party Liability in the Field of Nuclear Energy was signed in Paris on 29 July 1960 by the following European countries:

Austria	Germany, Fed.Rep.	Netherlands	Sweden
Belgium	Greece	Norway	Switzerland
Denmark	Italy	Portugal	Turkey
France	Luxembourg	Spain	United Kingdom

The Paris Convention was modified by an Additional Protocol signed in Paris on 28 January 1964 by the Contracting Parties to the Paris Convention.

By December 1974 the Paris Convention had received the instruments of ratification of:

Turkey	10 October	1961
Spain	31 October	1961
United Kingdom	23 February	1966
France	9 March	1966
Belgium	3 August	1966
Sweden	1 April	1968
Greece	12 May	1970
Finland (accession)	8 June	1972
Norway	2 July	1973
Denmark	4 September	1974

The Additional Protocol to the Paris Convention was ratified by the same countries on the following dates:

Spain	30 April	1965
United Kingdom	23 February	1966
France	9 March	1966
Belgium	3 August	1966
Sweden	1 April	1968
Turkey	5 April	1968
Greece	12 May	1970
Finland (accession)	8 June	1972
Norway	2 July	1973
Denmark	4 September	1974

The Supplementary Convention to the Paris Convention was signed in Brussels on 31 January 1963 by the following Contracting Parties to the Paris Convention:

Austria	Germany, Fed.Rep.	Netherlands	Sweden
Belgium	Italy	Norway	Switzerland
Denmark	Luxembourg	Spain	United Kingdom
France			

The Brussels Supplementary Convention has also been modified by an Additional Protocol also designed to avoid possible conflict with the Vienna Convention and signed in Paris on 28 January 1964.

The Supplementary Convention and the Additional Protocol to this Convention have been ratified by the following countries:

United Kingdom	24 March	1966
France	30 March	1966
Spain	27 July	1966
Sweden	3 April	1968
Norway	7 July	1973
Denmark	4 September	1974

The Convention on Civil Liability for Nuclear Damage was elaborated by a worldwide Diplomatic Conference convened in Vienna in May 1963 by the International Atomic Energy Agency.

By December 1974 the Vienna Convention had been signed by the following countries:

China	21 May	1963
Columbia	21 May	1963
Yugoslavia	21 May	1963
Philippines	21 May	1963
Spain	6 December	1963
United Kingdom	11 November	1964
Cuba	10 December	1964
Egypt	19 August	1965
Argentina	10 October	1966

The then state of ratifications of the Vienna Convention was the following:

Cuba	25 October	1965
Egypt	5 November	1965
Philippines	15 November	1965
Argentina	25 April	1967

In addition, the following countries had acceded to the Vienna Convention:

Cameroon	6 March	1964
Trinidad and Tobago	31 January	1966
Bolivia	10 April	1968

BIBLIOGRAPHY

TREVOR, J.P.H., "Principles of civil liability for nuclear damage." Nuclear Law for a Developing World, Legal Series No.5, IAEA, Vienna (1968) 109.

LAGORCE, M., "The Brussels Supplementary Convention and its Joint Intergovernmental Security Fund", Nuclear Law for a Developing World, Legal Series No.5, IAEA, Vienna (1968) 143.

LACROIX, F., "Insurance against nuclear risk in Europe", Nuclear Law for a Developing World, Legal Series No.5, IAEA, Vienna (1968) 159.

CAMPBELL MILES, A., "Some considerations affecting nuclear insurance in respect of land-based installations", Insurance for Nuclear Installations, Legal Series No. 6, IAEA, Vienna (1970) 51.

STROHL, P., STEIN, R.M., "La responsabilité civile des exploitants d'installations nucléaires et l'assurance de cette responsabilité", Peaceful Uses of Atomic Energy (Proc. Conf. Geneva, 1971) 3, UN, New York, and IAEA, Vienna (1972) 389.

STROHL, P., "The concept of nuclear third party liability and its implementation of legislation in OECD Member Countries", Experience and Trends in Nuclear Law, Legal Series No. 8, IAEA, Vienna (1972) 69.

A SURVEY OF DIFFERENT REGULATORY PRACTICES

Prepared by the OECD/NEA Secretariat

Abstract

A SURVEY OF DIFFERENT REGULATORY PRACTICES.

Draft survey of legislation governing the licensing of nuclear installations in OECD Member countries prepared by a Sub-Committee on Licensing for the OECD/NEA Committee on the Safety of Nuclear Installations.

AUSTRIA

INTRODUCTION

The regulations concerning nuclear installations in Austria are governed by the Radiation Protection Act of 1969 (RPA) (Strahlenschutzgesetz), which came into force on 1 January 1971.

Under RPA, no person may, without an authorization, build or operate installations in which radioactive materials are to be handled or radiation-emitting equipment is to be housed and the operation of which requires, from the time of building, suitable measures to ensure adequate protection of the life or health of persons and their descendants against injury by ionizing radiation.

However, nuclear installations and radioactive materials are exempted from authorization if the radiation emitted by them is not dangerous to the life or health of persons and their descendants and does not exceed the permissible dose rates, which are established by Ordinance in the light of existing scientific knowledge.

In Austria there is no Atomic Energy Commission that is empowered to deal with all problems related to nuclear matters. Generally, the Federal Ministry of Social Affairs is competent for the licensing and supervision of nuclear installations such as reactors, processing of nuclear fuel, and particle accelerators, as well as for the approval of models.

LICENSING PROCEDURE

The procedure for authorization of a nuclear installation may involve more than one stage: an operating licence, and, if necessary, a construction permit. A construction permit is required before the operating licence if the operation of the installation requires that measures should be taken at the time of building to protect persons against the hazards of ionizing radiation.

(a) Application for a licence

The application must be sent to the competent authority, which is generally the Federal Ministry for Social Affairs, or the 'Landeshauptmann' (Governor of each 'Land') concerned.

(b) Construction permit

The application for the construction permit must include all necessary data, especially an accurate description of the installation, the safety measures planned and the future use of the installation.

The permit may be granted if safety measures are sufficient to prevent any danger to life and health of persons and their descendants and if there are no known facts giving rise to doubts as to the reliability of the applicant or, if the operation of a nuclear installation is a company, its manager.

The construction permit authorizes construction in accordance with the general specifications submitted with the application.

Conditions and requirements may be imposed as are considered necessary by the authority to achieve sufficient protection against radiation hazards.

A construction permit may be altered, and requirements may be imposed if, where the installation is under construction, practical experience and scientific knowledge show that such measures are necessary.

Construction must be begun within one year dating from the day of issue of the construction permit. Only five years may elapse between the beginning and end of construction.

(c) Operating licence

Installations that do not require a construction permit nevertheless need prior authorization before they are put into operation.

The application for an operating licence must include:

Apart from other documents and explanatory plans and drawings, a detailed description of the operation envisaged from the safety point of view;

The name of the person responsible for radiation protection.

When a construction permit has been issued the authority will investigate whether the following requirements are met:

The installation has been erected pursuant to the construction permit and requirements laid down in the construction permit;

A person who has expert knowledge of radiation protection problems has been appointed by the operator. This person will be responsible for radiation protection;

In the course of ordinary operation all the necessary measures are taken to protect the life and health of persons or their descendants.

A licence is granted if the following main requirements are met and on condition that, with respect to the proposed site, adequate measures have been taken for the protection of life and health of persons and of their descendants against damage from ionizing radiation:

A person with adequate knowledge in the field of radiation protection and physically and intellecutally capable must be put in charge of radiation protection;

The applicant's reliability must be established in relation to the activity that he intends to engage in, or, if the applicant is a legal person or a corporate body under commercial law, such reliability must be established with respect to the manager.

Authorization is issued in writing by the competent Federal Ministry, or the Landeshauptmann of the district authorities respectively according to the type of installation concerned. Authorizations, except for those issued by a Federal Ministry, are subject to appeal.

The authorization is not personal, it is granted for a specific installation. So, if the operator or manager is replaced, the licence is not normally affected. If, however, the new operator or manager taking over the establishment is considered unreliable, the licensing authority will forbid the person to continue operation.

The granting of a licence is subject to such conditions as are necessary to achieve sufficient protection against radiation hazards.

The conditions may be amended, added to, or revoked by the competent authority. However, any right which the operator may have acquired following delivery of the licence must be considered.

INSPECTION OF THE NUCLEAR INSTALLATION

The construction and operation of nuclear installations are subject to supervision. The licensing authorities are responsible for exercising supervisory and control functions.

Nuclear installations are inspected at least once a year. Installations whose operation may give rise to particular hazards to the health or life of persons, however, are inspected every three months at the very least.

The competent authority is empowered to suspend operation temporarily. An installation found to be operating in non-compliance with the provisions of the RPA and whose fault has been remedied, may not be put into operation again unless the authority is satisfied that such a resumption is safe.

BELGIQUE

INTRODUCTION

Depuis 1963, les installations nucléaires sont soumises à une réglementation[1] qui les divise en quatre classes dans l'ordre décroissant du degré de danger que présentent leurs activités. La Classe I comprend tous les établissements dont l'exploitation présente un risque de criticalité, à savoir les réacteurs nucléaires et les autres grandes installations nucléaires. Les autres établissements sont répartis dans les Classes II, III et IV suivant des critères qui font notamment intervenir la quantité de matières radioactives qu'ils détiennent; ils ne seront pas pris en considération dans le cadre de la présente étude. Les grandes installations nucléaires (Classe I) sont soumises en Belgique à un régime d'autorisation préalable. La procédure d'autorisation se déroule sous l'autorité conjointe du Ministre de l'emploi et du travail et du Ministre de la santé publique et de la famille, assistés sur le plan technique par un organe mixte appelé «Commission spéciale».

PROCEDURE D'AUTORISATION

Les grandes étapes du système belge d'autorisation sont la présentation et l'instruction de la demande d'autorisation, puis la délivrance de l'autorisation qui permet la construction de l'installation et enfin l'entrée en exploitation de cette dernière, qui n'intervient qu'après un procès-verbal de réception.

(a) Présentation de la demande d'autorisation

La demande d'autorisation est adressée au Gouverneur de la Province concernée et doit être accompagnée de renseignements et de documents dont les plus importants sont:
- les renseignements relatifs au demandeur,
- les diverses caractéristiques de l'installation,
- les dispositions prévues en matière de sécurité,
- un rapport relatif aux accidents prévisibles et à leurs conséquences,
- la formation du personnel de l'installation,
- un plan des lieux et les caractéristiques démographiques, géologiques, météorologiques et autres de la région où sera située l'installation.
- les mesures prévues pour la gestion des déchets radioactifs;

La satisfaction de cette dernière formalité est indispensable pour que le demandeur se voie reconnaître par Arrêté royal la qualité d'exploitant nucléaire. Une installation nucléaire n'est pas autorisée à recevoir des combustibles ou substances nucléaires si son exploitant n'a pas fait l'objet de cette reconnaissance[2].

---

[1] Il s'agit de l'Arrêté royal du 28 février 1963 pris en application de la Loi du 29 mars 1958 relative à la protection de la population contre les dangers résultant des radiations ionisantes, et portant Règlement général de la protection de la population et des travailleurs contre le danger des radiations ionisantes.

[2] Loi du 18 juillet 1966 sur la responsabilité civile dans le domaine de l'énergie nucléaire.

(b) Consultation et intervention du public et des autorités locales

Dès réception de la demande, le Gouverneur de province en transmet un exemplaire au Maire (Bourgmestre) de la commune où doit être implantée l'installation. La demande est portée à la connaissance de la population par voie d'affiches et peut être consultée pendant une période de 15 jours. Elle est ensuite soumise à l'avis du Conseil municipal (Collège échevinal) en même temps que les observations éventuellement reçues de la population. Elle est ensuite retournée au Gouverneur avec l'avis du Conseil dans un délai de 40 jours.

Le dossier est ensuite transmis par le Gouverneur à la Députation permanente du Conseil provincial qui doit donner son avis dans un délai de 30 jours.

(c) Consultation et intervention des organismes techniques

Après avis de la Députation permanente, le dossier est communiqué à une «Commission spéciale» qui doit elle-même statuer dans un délai de trois mois en principe.

Cette Commission spéciale est un organe qui rassemble des personnalités choisies en raison de leurs compétences ainsi que des représentants des diverses autorités responsables en matière de sécurité des installations nucléaires (Administration de l'hygiène publique, Institut d'hygiène et d'épidémiologie, Administration de la sécurité du travail, Commissariat à l'énergie atomique). La Commission émet ses avis à la majorité absolue des voix. Les renseignements et avis qui lui sont communiqués doivent être considérés comme confidentiels. Son avis définitif doit être motivé et peut s'accompagner de recommandations particulières relatives aux conditions d'exploitation de l'établissement en question.

Dans les cas prévus à l'Article 37 du Traité Euratom (risque de contamination radioactive des autres pays membres), la Commission spéciale doit solliciter l'avis de la Commission de l'Euratom sur l'intervention de l'Administration de l'hygiène publique. La Commission de l'Euratom peut être également consultée sur les aspects généraux ou particuliers de la sécurité ou de la salubrité de l'établissement.[3]

La Commission émet un avis provisoire qui est communiqué au demandeur, ce dernier disposant alors d'un délai de 30 jours pour présenter ses remarques éventuelles. La Commission émet ensuite son avis définitif. Un avis défavorable de la Commission conduit automatiquement au rejet de la demande d'autorisation.

(d) Délivrance et conditions de l'autorisation

La décision relative à l'autorisation est prise sous la forme d'un Arrêté royal contresigné par le Ministre de l'emploi et du travail et par le Ministre de la santé publique et de la famille. La décision est communiquée à la Commission spéciale, au Gouverneur de la province et au demandeur ainsi qu'à certaines personnes ayant une mission de surveillance et de contrôle.

---

[3] Dans le cas des centrales nucléaires de Doel et de Tihange, ce sont des Comités d'experts internationaux réunis par la Commission de l'Euratom qui ont effectué l'étude technique des projets.

Les autorisations peuvent être accordées pour une durée déterminée ou sans limitation. Elles peuvent être également transférées d'un exploitant à l'autre, à condition que la cession soit notifiée sans délai à l'autorité ayant accordé l'autorisation. Les changements intervenant dans la personne du responsable direct de l'installation doivent être également signalés immédiatement.

L'autorité compétente peut décider de compléter ou de modifier l'Arrêté d'autorisation, soit sur proposition de la Commission spéciale, soit sur la demande du titulaire de l'autorisation en cas de projet de modifications substantielles de l'installation concernée.

La réglementation applicable ne prévoit pas de recours contre les décisions relatives à l'autorisation des établissements de la Classe I.

(e) Construction et entrée en exploitation des installations nucléaires

L'autorisation octroie au demandeur le droit d'entreprendre sous sa responsabilité la construction de l'installation. Cette dernière et plus particulièrement les dispositifs de protection font ensuite l'objet d'une réception.

Cette réception est effectuée par un organisme agréé conjointement par le Ministre de l'emploi et du travail et par le Ministre de la santé publique et de la famille. Ces organismes agréés de contrôle physique sont des associations sans but lucratif et ne peuvent utiliser pour l'exécution des contrôles qui leur sont confiés que des experts eux-mêmes agréés par les Ministres précités.

La mise en marche de l'installation ne peut avoir lieu que si le procès-verbal de réception dressé par cet organisme est entièrement favorable et l'autorise formellement.

INSPECTION DES INSTALLATIONS NUCLEAIRES

La surveillance des installations nucléaires est assurée notamment par:

- les fonctionnaires de l'Administration de l'hygiène publique, en ce qui concerne la protection sanitaire de la population;
- les ingénieurs de l'Administration de la sécurité du travail, en ce qui concerne la sécurité des travailleurs et du voisinage des installations;
- Les fonctionnaires de l'Administration de l'hygiène et de la médecine du travail, en ce qui concerne la surveillance médicale des travailleurs.

D'autre part, en cours d'exploitation, les organismes agréés mentionnés précedemment sont également chargés d'assurer le contrôle physique de protection des installations.

CANADA

INTRODUCTION

All nuclear activities in Canada are governed by the Atomic Energy Control Act 1946 (as amended) and by the Regulations made pursuant thereto and entitled the Atomic Energy Control Regulation. "Nuclear facilities", which include nuclear reactors and other large nuclear establishments, are submitted to the provisions of Regulations adopted on 1 May 1974 (SOR/74-334, 4 June 1974). The Regulations were made by the Atomic Energy Control Board in accordance with the powers conferred upon it by the Atomic Energy Control Act. Regulations made by the Atomic Energy Control Board must first obtain the recommendation of the Minister of Energy, Mines and Resources and then be approved by the Governor General in Council.

Under the supervision of the Minister of Energy, Mines and Resources, the Atomic Energy Control Board regulates and conducts the licensing procedure for nuclear installations in Canada.

LICENSING PROCEDURE

Nuclear installations in Canada are governed by a preliminary licensing system divided into three main steps, which comprise: siting, construction and entry into operation of the installation. A feature of the Canadian system is at the beginning of the procedure the applicant, together with the Board, prepares a schedule of all the formalities to be completed up to the final licence.

(a) Application for a licence

The initial application for a licence concerns approval of the site selected for the installation.

This application is sent to the Board and must contain information on the particular site and on the general features of the installation proposed. The application for a licence must provide all the information the Control Board requires to determine whether the location is suitable for siting a nuclear installation. Such information mainly includes the topography of the site envisaged together with the demographic, meteorological, hydrological, seismological aspect.

(b) Consultation and participation of the public and local authorities

In parallel with the application to the Board the applicant is required to prepare an announcement for the public stating his intention to construct and operate a nuclear installation on a given site. The public is consulted by the relevant local authorities and information meetings and discussions may be held between persons of the public directly concerned by the siting of the installation and the representatives of the utility company involved. Members of the Control Board may also take part in such meetings to supplement information given to the public.

(c) Consultation and participation of technical bodies

The Board identifies the Federal and Provincial bodies concerned by the projected installation and consults them in this connection.

The Reactor Safety Advisory Committee set up by the Board is responsible throughout the licensing procedure for examining, with the company's representatives, all aspects dealing with the safety of the installation. This study is based on the preliminary safety report, which is prepared by the utility company and updated regularly until the licensing procedure is completed.

In addition, as soon as the application for site approval is received, the representatives of the utility company and of the Board discuss adaptation of the projected installation to the schematic drawn up by the Board, which sets out in detail the particulars and timing of the licensing procedure.

(d) Construction permit

Once the Control Board is able to ascertain from its enquiry that the site is suitable and it approves the project and the Reactor Safety Advisory Committee is for its part satisfied by the information on the installation provided by the applicant, the latter may apply to the Board for a construction permit. The permit is granted if the enquiry on the preliminary safety report is favourable.

(e) Authorization for operation

During the period of construction of the installation consultations are pursued between the applicant and representatives of the Control Board (in particular the Advisory Committee) to complete the different steps leading to the entry into operation of the installation:

Agreement of the Board on acquisition of heavy water and loading;
Agreement of the Board on acquisition of fuel and loading;
Schedule for appointment and training of personnel;
Organization for radiation protection;
Finalization of Safety Report;
Acceptance by Control Board of certification that the installation complies with prerequisites.

When all the above requirements are met the applicant may apply for an operating licence.

The successive licences granted by the Board are issued by an Order of the Board itself published in the Canada Gazette.

The licence may be subject to compliance with the conditions set by the Board concerning in particular radiation protection of personnel and their instruction, management and disposal of radioactive waste, physical security of nuclear substances within the installation.

INSPECTION OF NUCLEAR INSTALLATIONS

Orders granting operating licences for nuclear installations also prescribe the conditions whereby such installations are submitted to control and inspection by representatives of the Control Board. The operator of a nuclear installation must supply an annual report on its operation and keep up to date records of exposure to radiation as well as personnel medical records. He must also be prepared to provide the Board with any information it requires for control purposes.

Inspectors responsible for the safety control of nuclear installations are appointed by the Board.

Control of the radiation protection system and medical surveillance are respectively carried out by radiation protection specialists and medical specialists, also appointed by the Board.

ESPAGNE

INTRODUCTION

L'autorisation des installations nucléaires en Espagne est soumise en premier lieu à la Loi de 1964 sur l'énergie nucléaire. Cette Loi a fait l'objet plus récemment d'un texte d'application: le Règlement sur les installations nucléaires et radioactives du 21 juillet 1972.

Conformément aux dispositions de ce Règlement, les installations visées par le régime d'autorisation préalable sont:
- les centrales nucléaires destinées à la production d'énergie au moyen d'un réacteur nucléaire,
- les réacteurs nucléaires,
- les usines utilisant ou traitant des combustibles nucléaires et les usines de traitement de substances nucléaires,
- les installations de stockage de substances nucléaires.

La procédure d'autorisation des installations nucléaires se déroule sous l'autorité du Directeur général de l'énergie, qui appartient lui-même au Ministère de l'industrie. Le Directeur général de l'énergie est assisté dans sa tâche par les services de la Junta de Energía Nuclear (JEN, Commission de l'énergie atomique).

PROCEDURE D'AUTORISATION

Le régime d'autorisation des installations nucléaires se compose de trois autorisations distinctes:
- l'autorisation préliminaire,
- l'autorisation de construction,
- l'autorisation de mise en marche.

Il convient toutefois de signaler que les installations nucléaires destinées à la recherche ainsi que les installations de stockage peuvent solliciter directement l'autorisation de construction.

(a) Autorisation préliminaire

La demande d'autorisation doit être adressée à la Division provinciale du Ministère de l'industrie, du ressort de laquelle est prévue l'installation. Des copies de cette demande sont communiquées au Directeur général de l'énergie, d'une part, et à la JEN, d'autre part.

La demande doit être accompagnée de la documentation nécessaire portant notamment sur la description du site et sur le financement du projet.

Dès que la Délégation provinciale du Ministère de l'industrie considère que les renseignements fournis sont suffisants, elle procède à l'information du public, qui s'opère par la publication dans les journaux officiels de l'Etat et de la province concernée d'une annonce relative au projet d'installation.

Les observations des personnes intéressées doivent être transmises à la Délégation provinciale dans un délai de 30 jours, qui ensuite les communique à la Direction générale de l'énergie ainsi qu'à la JEN.

La JEN, dès la réception de la demande d'autorisation préalable et de la documentation jointe, prépare un rapport technique préliminaire à l'intention de la Direction générale de l'énergie.

De son côté, le Ministère de l'industrie consulte les divers ministères et organismes publics intéressés, notamment le Ministère de l'intérieur et les municipalités concernées ainsi que le Ministère des travaux publics.

C'est au Directeur général de l'énergie qu'il revient, une fois en possession de tous les avis, de se prononcer sur la demande. La décision d'autorisation préliminaire fixe en même temps un délai au requérant pour présenter la demande d'autorisation de construction.

L'autorisation préliminaire traduit la reconnaissance officielle du projet d'installation et du choix du site.

(b) Autorisation de construction

(i) Présentation de la demande d'autorisation

La demande d'autorisation de construction est elle aussi présentée à la Division provinciale concernée du Ministère de l'industrie qui la transmet au Directeur général de l'énergie et à la JEN. La demande doit être accompagnée d'un ensemble de documents parmi lesquels figurent:

- le projet général de l'installation,
- le programme d'acquisitions et de réalisation,
- le plan de financement,
- l'étude du marché,
- le rapport préliminaire de sécurité.

Le rapport préliminaire de sécurité doit décrire toutes les caractéristiques du site et de l'installation projectés, susceptibles d'avoir un effet sur la sécurité.

(ii) Consultation et intervention des organismes techniques

La JEN confie à son Département de radioprotection et de sûreté nucléaire le soin de procéder à une évaluation du projet du point de vue de la sécurité, en liaison avec le requérant. Les critères de sécurité de la réglementation américaine ainsi que les autres normes nationales et internationales sont largement utilisés à cette occasion.

La JEN prépare ensuite un avis technique préliminaire à l'intention du Directeur général de l'énergie auquel il incombe de se prononcer finalement sur la demande d'autorisation.

(iii) Délivrance et conditions de l'autorisation

L'autorisation de construction désigne l'exploitant responsable et contient notamment une définition précise de l'installation et de son emplacement, les délais d'exécution, les programmes de recherche et de formation du personnel, ainsi que toutes autres conditions jugées nécessaires dans chaque cas particulier.

Afin de permettre une exécution efficace de toutes les conditions prévues par l'autorisation, la Direction générale de l'énergie constitue un Comité de coordination composé de représentants de la Direction et des autres services intéressés du Ministère de l'industrie ainsi que de la JEN et des autorités publiques locales. Ce Comité veille, tout au long de la phase de construction, au respect des conditions de l'autorisation et conseille l'exploitant responsable sur tous les aspects susceptibles d'avoir un effet sur la sécurité publique.

Au cours de la construction et du montage des installations nucléaires, l'exploitant nucléaire doit réaliser tout un programme de vérifications et de tests pré-nucléaires. Le programme est approuvé au préalable par la Direction générale de l'énergie et de la JEN et sa réalisation se déroule sous la responsabilité du titulaire de l'autorisation. Les résultats sont communiqués à la Division provinciale concernée du Ministère de l'industrie, à la Direction générale de l'énergie et à la JEN.

(c) Autorisation de mise en marche

L'autorisation de mise en marche d'une installation nucléaire réside dans l'obtention par le requérant successivement d'un permis d'exploitation provisoire puis d'un permis d'exploitation définitif.

(i) Permis d'exploitation provisoire

La demande de permis doit être adressée à la Division provinciale concernée du Ministère de l'industrie et être accompagnée en particulier:
- d'une étude de sécurité contenant les données relatives à la sûreté nucléaire et à la protection radiologique de l'installation,
- du règlement d'exploitation,
- des spécifications techniques du fonctionnement de l'installation,
- du plan d'urgence,
- du programme d'essais nucléaires.

C'est à la JEN qu'il revient d'apprécier si ces documents sont suffisants et de demander, le cas échéant, des informations complémentaires au requérant; lorsqu'elle s'estime satisfaite, elle en avise le Directeur général de l'énergie qui est habilité à délivrer le permis d'exploitation provisoire.

(ii) Permis d'exploitation définitif

Après avoir mené à bien le programme des essais nucléaires et mis au point le rapport final de sécurité, l'exploitant responsable peut solliciter le permis d'exploitation définitif auprès de la Division provinciale concernée.

La JEN dicte alors les conditions de sûreté nucléaires qui devront être observées et élabore les diverses spécifications du fonctionnement de l'installation en exploitation normale. Ces conditions et spécifications seront incluses dans le permis d'exploitation définitif que délivrera le Directeur général de l'énergie sur avis favorable de la JEN.

INSPECTION DES INSTALLATIONS NUCLEAIRES

C'est à la JEN qu'il incombe d'assurer la surveillance et l'inspection des installations nucléaires.

La mission d'inspection de la JEN commence avec la phase de construction et de montage de l'installation afin de vérifier que les conditions de l'autorisation sont bien observées. Il en va de même pour la réalisation des essais pré-nucléaires.

Le régime d'inspection par la JEN se poursuit au cours de la période d'exploitation normale, sans préjudice des autres types de contrôle non nucléaire dont peuvent être l'objet les installations nucléaires.

FRANCE

INTRODUCTION

La réglementation française des grandes installations nucléaires est assurée par un Décret du 11 décembre 1963 qui a été modifié le 27 mars 1973 ainsi que par des instructions du Ministre de l'industrie et de la recherche, qui est l'autorité de tutelle dans ce domaine d'activités.

Cette réglementation vise:

1) les réacteurs nucléaires, à l'exception de ceux qui font partie d'un moyen de transport;
2) les accélérateurs de particules, susceptibles de communiquer à ces particules une énergie supérieure à 300 MeV;
3) les usines de préparation, de fabrication ou de transformation de substances radioactives;
4) les installations destinées au stockage, au dépôt ou à l'utilisation de substances radioactives, y compris les déchets.

Les installations des deux dernières catégories ne sont toutefois classées comme des installations nucléaires de base que lorsque la quantité ou l'activité totale des substances radioactives est supérieure à un seuil fixé selon le type d'installation et le radioélément considéré.

La procédure d'autorisation préalable des grandes installations nucléaires fait principalement intervenir deux autorités, le Ministre de l'industrie et de la recherche et le Ministre de la santé, dont dépendent un certain nombre d'organismes spécialisés.

PROCEDURE D'AUTORISATION

La procédure d'autorisation des installations nucléaires se déroule en deux temps: le premier est consacré à l'autorisation de la création de l'installation; le second est marqué par les formalités qui conditionnent l'entrée en exploitation de l'installation.

(a) Présentation de la demande d'autorisation

La demande d'autorisation est adressée au Ministre de l'industrie et de la recherche. Elle doit indiquer le périmètre du site sur lequel il est envisagé de construire l'installation. L'instruction du dossier d'autorisation comporte, d'une part, une procédure d'enquête locale et, d'autre part, un examen technique.

Le dossier de la demande d'autorisation est également communiqué aux différents ministères intéressés: intérieur, santé, agriculture, environnement, transports, etc.

(b) Consultation et intervention du public et des autorités locales

L'enquête locale est confiée au Préfet du département dans lequel doit être implantée l'installation. Le dossier d'autorisation doit notamment contenir des renseignements sur l'identité du demandeur, l'objet de l'enquête, la nature et les caractéristiques essentielles de l'installation ainsi qu'un plan de cette dernière, une carte de la région, etc. Les collectivités locales sont consultées et la population informée par les soins d'un commissaire enquêteur désigné par arrêté préfectoral.

Dans la pratique, cependant, l'enquête locale est remplacée fréquemment par une «déclaration d'utilité publique» de l'installation, procédure d'usage très général et qui comporte aussi la consultation de la population intéressée; celle-ci intervient avant même le dépôt de la demande d'autorisation de création de l'installation.

(c) Consultation et intervention des organismes techniques

Parallèlement à la consultation des autorités locales, le rapport préliminaire de sûreté qui accompagne la demande d'autorisation est soumis à l'examen du «Groupe permanent»[4] du Service central de sûreté des installations nucléaires; ce dernier est un organisme technique qui dépend du Ministre de l'industrie et de la recherche mais dans le fonctionnement duquel les représentants du Commissariat à l'énergie atomique (CEA) jouent un rôle essentiel. L'analyse de sûreté de l'installation est notamment effectuée pour le compte du Groupe permanent par le CEA. Le Groupe donne ensuite son avis sur la sûreté de l'installation au Service central. Ce dernier, muni de cet avis et informé des résultats de la consultation des autorités locales et éventuellement des observations des ministres intéressés, prépare un projet de décret autorisant la création de l'installation.

Ce projet est alors communiqué pour avis à la Commission interministérielle des installations nucléaires de base où siègent des représentants des différents ministères et organismes concernés. La Commission, ou sa section permanente pour les affaires courantes, doit se prononcer dans les trois mois.

Le projet est enfin soumis pour avis conforme au Ministre de la santé qui peut, à cet effet, consulter la section compétente du Conseil supérieur d'hygiène publique de France. Le Ministre de la santé doit se prononcer dans un délai de trois mois également, passé lequel le décret d'autorisation peut être signé sans plus attendre par le Premier Ministre, sur proposition du Ministre de l'industrie et de la recherche.

Ce décret d'autorisation de création de l'installation permet d'entamer sa construction. Il fixe le périmètre de l'installation et les prescriptions auxquelles doit se conformer l'exploitant; il arrête également les modalités de la procédure qui va conduire à l'entrée en opération de l'installation.

(d) Entrée en exploitation de l'installation

Dans le cas des réacteurs nucléaires, l'entrée en exploitation est précédée de deux étapes:

(i) Le rapport provisoire de sûreté

Six mois avant le chargement du réacteur, l'exploitant doit adresser au Ministre de l'industrie et de la recherche un rapport provisoire de sécurité accompagné de règles générales provisoires d'exploitation. Ce rapport est

---

[4] Il y a trois Groupes permanents, un pour les réacteurs, un pour les accélérateurs de particules et un troisième pour les autres installations.

communiqué pour avis au Groupe permanent du Service central de sûreté des installations nucléaires. Compte tenu de cet avis, le Ministre peut alors accorder l'approbation d'essais et de mise en service, sous réserve de l'observation d'un certain nombre de prescriptions techniques.

(ii) Le rapport définitif de sûreté

Afin de passer à l'exploitation normale du réacteur (qui doit intervenir dans un délai fixé par l'autorisation de création), l'exploitant doit soumettre au Ministre de l'industrie et de la recherche un rapport définitif de sûreté, accompagné des règles générales définitives d'exploitation. Le Groupe permanent est à nouveau invité à donner son avis dont le Ministre tient compte à l'égard de sa décision d'approuver la mise en exploitation normale du réacteur; le Ministre fixe en même temps les prescriptions techniques auxquelles devra se conformer l'exploitant.

Pour les autres types de grandes installations nucléaires, il n'y a en principe qu'une seule étape, celle de la mise en exploitation normale.

Une fois l'installation entrée en exploitation, l'exploitant est tenu au respect des termes de l'autorisation et des normes figurant dans le rapport définitif de sûreté qui doit être tenu à jour. Toute modification de l'installation ou des conditions d'exploitation entraînant une dérogation aux prescriptions techniques imposées doit être préalablement autorisée par le Service central de sûreté qui fera étudier la demande par les équipes de sûreté du CEA. Cependant, si les conditions mêmes de l'autorisation sont mises en cause, un nouveau décret d'autorisation est nécessaire.

INSPECTION DES INSTALLATIONS NUCLEAIRES

Les installations nucléaires sont pour l'essentiel soumises à une double surveillance de la part des autorités de tutelle:

- La première est exercée par les inspecteurs des installations nucléaires de base qui dépendent du Service central de sûreté des installations nucléaires et porte naturellement sur la sûreté de ces installations et la vérification du respect des prescriptions techniques imposées à l'exploitant. Les présidents des Groupes permanents du Service central sont informés des résultats des visites des installations. Ces visites n'ont pas de caractère systématique et sont généralement préparées en liaison avec les équipes de sécurité du CEA.
- Le second type de surveillance incombe aux agents du Service central de protection contre les rayonnements ionisants (SCPRI) qui dépend du Ministère de la santé. Elle a pour objet de vérifier que les règles relatives à la radioprotection sont bien observées.

D'autres types de contrôles peuvent être prescrits par la réglementation applicable, notamment en ce qui concerne les services de l'Inspection du travail du Ministère du travail ainsi que la surveillance des appareils à pression. Ces contrôles doivent s'exercer en liaison avec les inspecteurs des installations nucléaires de base et les agents du SCPRI.

GERMANY, FEDERAL REPUBLIC OF

INTRODUCTION

As indicated by its name, the Federal Republic of Germany is a federal State. The Federal Constitution (Basic Law, Grundgesetz) therefore contains detailed provisions on the legislative competence of the Federal State (Bund) and the individual States (Länder).

In the nuclear field the Basic Law provides that "the production and use of nuclear energy for peaceful purposes, the construction and operation of installations serving such purposes, protection against hazards arising from the release of nuclear energy or from ionizing radiation, and the disposal of radioactive substances" is within the concurrent legislative competence of the Bund. This means that the Länder may legislate in this field only insofar as the Bund has not exercised its legislative authority. The Basic Law lays down further that laws enacted by virtue of the provision cited above may, with the consent of the Bundesrat (Federal Council composed of members of the governments of the Länder), provide for their implementation by the authorities of the Länder acting as agents of the Bund.

The Bund has made use of its legislative competence by enacting the Federal Act on the Peaceful Uses of Atomic Energy and Protection Against its Hazards (Atomic Energy Act – Atomgesetz).

Under this basic Act, any person must obtain a licence who constructs, operates or otherwise holds any stationary or non-stationary installation for the production or fission of nuclear fuel, or for the reprocessing of irradiated nuclear fuel, or who substantially alters such installations or their operation. Nuclear fuel (= special fissionable material) means plutonium-239 (and plutonium-241)[5]; uranium-233, uranium enriched in the isotopes 235 or 233, any substance containing one or more of these substances, and uranium and substances containing uranium of the natural isotopic mixture of such purity as to enable a continuous self-sustaining chain reaction to be maintained in a suitable installation (reactor).

The Atomic Energy Act empowers the Federal Government to issue ordinances for its implementation. Such ordinances are in particular:

- The Nuclear Installations Ordinance (Atomanlagen-Verordnung), which deals with certain aspects of the licencing procedure;
- The Ordinance concerning Costs (Kostenverordnung), which sets forth the licensing fees;
- The First and Second Ordinance on the Protection Against Radiation Hazards (Erste und Zweite Strahlenschutzverordnung).

The Act and the Ordinances issued thereunder are largely implemented by the Länder as agents of the Bund. This means in particular that:

- The Länder determine the competent (licensing and control) authorities;
- The Bund, with the consent of the Bundesrat, may issue general administrative regulations;

---

[5] A Bill amending the Act, which is at present being considered by the Federal Parliament, proposes the inclusion of plutonium-241.

The authorities of the Länder are subject to the directives of the competent supreme federal authorities (in this case, the Federal Ministry of the Interior);

Federal control and supervision relates to the legality and expediency of the implementation; to this end, the Federal Government may require the submission of reports and relevant documents.

Thus, in contrast to other countries, there is no single central body in the Federal Republic of Germany in which all executive responsibilities related to nuclear energy are vested.

LICENSING PROCEDURE

(a) Application for a licence

The applicant presents his application to the competent authority of the Land in which the installation is to be erected.

The application must contain:

Explanatory plans, drawings and descriptions

A safety report specifying all hazards involved in the installation as well as the planned safety measures

The necessary data for an examination of the reliability and expert knowledge of the persons responsible for the erection of the installation and the management and control of its operation.

In practice, the application is made and the licence granted in several stages.

(1) Even before applying for a (partial) construction permit, the applicant may require the competent authority to issue a preliminary decision (Vorbescheid) on specific questions necessary for the granting of a licence. Such questions concern in particular the site chosen for the installation and its basic design. In the further licensing procedure the licensing authority is bound by its positive decision as regards these questions, but may improve conditions not covered thereby.

(2) Having obtained a positive preliminary decision, the applicant applies for a construction permit and eventually for an operating licence. As a rule, such permits and licenses are applied for and granted in several stages.

(b) Consultation and participation of the public and local authorities

The licensing authority has to announce the project in its official bulletin and a daily newspaper of substantial circulation in the area where the installation is to be located. Such announcements must:

(1) Specify the place where the application for a preliminary decision or for a (partial) licence and the supporting documents are available for public inspection;

(2) State that objections, if any, must be brought before the body specified in the announcement within one month from the day of publication;

(3) Determine the date of a hearing at which the objections raised will be discussed regardless of whether the applicant or the intervenor(s) are present or not.

Announcement and public inspection may be dispensed with if they have previously been made with respect to the installation in question and their repetition is not likely to reveal circumstances affecting rights of third persons. They may be further dispensed with if the application concerns a reactor with which a ship is or is to be equipped.

When granting the preliminary decision or (partial) licence, the competent authority, after consultation with the competent technical bodies, must either expressly reject interventions or impose corresponding conditions upon the licensee. The decision has to be served on the applicant as well as the intervenors, who may challenge it in the administrative courts whose decisions may be further appealed against.

Once the licensing authority's decision has become effective and final, third parties are precluded in any subsequent proceedings from raising objections on the basis of facts that has already been put forward or that they might have put forward within the period of public inspection or within two weeks after publication of the decision. This does not apply to objections based on the special titles under civil law (e.g. a servitude), which have to be referred to the ordinary courts.

(c) Consultation and intervention of technical bodies

Technical bodies are involved at both the federal and the state levels.

(i) The licensing authority of the Land forwards copies of the request for preliminary decision or application for licence to the Federal Ministry of the Interior. In the discharge of its supervisory and control functions, the Ministry is advised by the Commission on Reactor Safety (Reaktor-Sicherheitskommission – RSK), which is composed of independent experts. This Commission deals with questions of general importance and is also responsible for examining, in the context of individual licensing procedures, the safety reports on the construction and operation of nuclear installations. To prepare its recommendations, the Commission has set up a number of sub-committees, which carry out detailed examinations.

The Federal Ministry consults also the Institute for Reactor Safety (Institut für Reaktorsicherheit – IRS) on many questions of detail. This Institute was established by the Technical Control Services (Technische Überwachungsvereine – TÜV). The Federal Ministry may further engage the services of other competent bodies.

After consultation with the RSK has been concluded, the Federal Ministry of the Interior informs the authority of the Land of the findings and issues relevant instructions.

(ii) The licensing authority of the Land demands expert opinions from independent experts. The Technical Control Services of the Länder have established nuclear energy departments for this purpose. The RSK Secretariat established at the IRS is reponsible for co-ordinating the work and the findings of the various federal and state technical bodies.

(d) Delivery and conditions of the licence

All permits and licences issued under the Atomic Energy Act may be subject to certain conditions that are necessary to achieve the objective of the Act, i.e. in particular to protect life, health and property from the hazards of nuclear energy and from the harmful effects of ionizing radiation and to prevent danger to the internal or external security of the Federal Republic arising from the use or release of nuclear energy. To achieve these purposes subsequent conditions may be imposed.

(i) The preliminary site approval (Standort Vorbescheid) is not mandatory but is in practice always requested. The relevant procedure is limited to the question of whether a given site is suitable for the construction and operation of a nuclear installation, but affords an opportunity to decide on certain basic questions most likely to be subject to objections by public intervenors. When such an approval has become final, the licensing authority is bound thereby; it may, however, in the further proceedings impose further conditions regarding the design and construction of the planned installation.

(ii) The same applies, mutatis mutandis, to the preliminary design, which, if final, binds the licensing authority as to the site and the basic design of the installations. Further conditions may be imposed only if they are within the basically approved design.

(iii) The construction permit is usually applied for and granted in several stages. The first partial construction permit concerns, inter alia, a specified construction volume. If no preliminary approvals have been granted, it covers also the site and the basic safety design with the consequence that the licensing authority may change neither.

(iv) The operating licence may also be applied for and granted in several stages. Before issuing an operating licence, the licensing authority must ascertain that other provisions of public law, such as those relating to buildings and zoning, water and environmental protection, trade and nuisance control, have been observed and the requisite permits and licences have been granted by the appropriate (federal, state or local) authorities.

INSPECTION OF NUCLEAR INSTALLATIONS

The construction, operation and possession of nuclear installations are subject to continuous Government supervision. The supreme authorities of the Länder are responsible for exercising supervisory and control functions, which they may delegate to subordinate agencies in individual cases.

Accompanying controls are carried out during the construction of a nuclear installation. These are designed to ensure that all safety systems and components comply with the requirements of the permit.

After the nuclear installation has started operation inspections are carried out at regular intervals. Both the inspectors authorized by the supervising authorities and experts consulted by them have access at all times to nuclear installations. They may carry out necessary examinations and request pertinent information. The supervisory authority may order the discontinuance of any situation that is contrary to legal provisions or conditions of the licence or that causes danger to life, health or property through the effects of ionizing radiation. It may, in particular, order that (specific) safety measures be taken, that radioactive substances be stored or kept in custody in a place designated by it and that the construction or operation of a nuclear installation be suspended temporarily or, if the requisite licence has not been granted or finally revoked, permanently.

GRECE

INTRODUCTION

Les grandes installations nucléaires sont soumises, en Grèce, à un régime d'autorisation qui est établi par le décret-loi n° 854 du 15 mars 1971, en attendant l'adoption de dispositions réglementaires plus détaillées.

Aux termes de ce décret, les installations nucléaires, c'est-à-dire les installations destinées à la production de l'énergie nucléaire ou qui utilisent, fabriquent ou traitent des combustibles nucléaires ou d'importantes quantités de produits radioactifs, ou enfin les installations de stockage et de gestion des déchets radioactifs, sont soumises à un régime d'autorisation préalable. C'est la Commission grecque de l'énergie atomique (CGEA) qui, en liaison avec le Ministre de l'industrie, est responsable du déroulement de la procédure d'autorisation des installations nucléaires.

PROCEDURE D'AUTORISATION

La procédure d'autorisation des installations nucléaires comporte quatre étapes qui sont respectivement:

- l'approbation du site,
- l'autorisation de construction,
- l'autorisation de fonctionnement expérimental,
- l'autorisation d'exploitation normale.

Chacune de ces autorisations successives est délivrée par le Ministre de l'industrie, sur l'avis de la CGEA. Ces autorisations prennent la forme d'un arrêté ministériel.

Le Ministre de l'industrie, après avis de la CGEA et pour des raisons de sécurité, peut modifier les mesures de sécurité qui sont spécifiées dans l'autorisation ou même retirer cette dernière.

INSPECTION DES INSTALLATIONS NUCLEAIRES

Le contrôle des installations nucléaires de façon générale et, plus particulièrement, la vérification du respect des conditions de sécurité énoncées dans l'arrêté d'autorisation, sont confiés à un organisme d'Etat qui doit être institué à cet effet par le Ministre de l'industrie, sur l'avis de la CGEA.

JAPAN

INTRODUCTION

In Japan the establishment and operation of nuclear installations are governed mainly by the Regulation Law[6]. This Law lays down the regulations and conditions for the licensing of the various installations involved in the nuclear fuel cycle, namely the licensing of installations for refining, fabricating and reprocessing and reactors. Although procedures for the installations listed above vary, depending on the installation concerned, only those relating to construction and operation of reactor facilities will be analysed in this study as the conditions and principles applying to licensing and control of other installations are, to a large extent, similar to those for reactor facilities.

The competent bodies responsible, inter alia, for the licensing of nuclear activities and for radiation protection are, in general, placed under the direct authority of the Prime Minister's Office.

The Prime Minister's Office has, as an advisory body, the Atomic Energy Commission (AEC). The AEC is the competent body in charge of preparing, examining and taking the necessary decisions in respect of regulations concerning nuclear fuels and reactors, basic principles of protection against hazards that may result from the use of atomic energy. The AEC may, on its own initiative, make recommendations through the Prime Minister to the Ministerial Departments and Agencies. Thus, the AEC plays an important part in the reactor licensing procedure.

The implementation of the AEC's decisions and the running of its administrative affairs are the responsibility of the Atomic Energy Bureau of the Science and Technology Agency, which is an administrative body attached to the Prime Minister's Office.

LICENSING PROCEDURE

The licence for a nuclear installation covers both construction and operation. However, before starting construction and operation of the reactor facility, the operator has to go through certain procedures that require the sanction or approval of the Prime Minister.

(a) Application for a licence

Applications for a licence should be addressed to the Prime Minister. In addition, an application for approval by the Minister of International Trade and Industry (MITI) of the construction plan of the facility should be made under the Electric Enterprise Law[7] in the case of reactors for electrical power generation.

---

6 The Law for Regulation of Nuclear Source Material, Nuclear Fuel Material and Reactors (Law No. 166, 10 June 1957, as amended).

7 The Electric Enterprise Law (Law No. 170 of 1969 as amended).

The application form should include the items listed below:

The name or title and the address and, in the case of a juridical person, the name of the representative
The purpose for which reactors are to be used
The type, thermal output and number of reactors
The name and address of the factory or the place of business where the reactors are to be established
The location, structure and equipment of reactors and their related facilities
The plan of construction of reactor facilities
The type of nuclear fuel material to be used in reactors and the estimated annual consumption
The method of disposal of spent fuel.

Before granting the authorization, the Prime Minister must ascertain from the Atomic Energy Commission that:

The reactor will not be used for non-peaceful purposes
Permission will cause no hindrance to the planned development and utilization of atomic energy
The applicant's technical ability and financial position is sound enough to establish reactors, and he has sufficient technical ability to operate them competently
The location, structure and equipment of the reactor facilities are such that they will cause no hindrance to the prevention of hazards from nuclear fuel, material contaminated by nuclear fuel material and from reactors.

When the Atomic Energy Commission is asked for its opinion by the Prime Minister, the Commission entrusts the examination of the safety of the reactors to the Committee on Examination of Reactor Safety, which is established in the Commission to research and deliberate on matters concerning the safety of reactors. In addition, in the case of reactors for electrical power generation the Prime Minister must also obtain the consent of the MITI.

Following this, the Minister of International Trade and Industry must ask the Advisory Committee on Technical Matters concerning Nuclear Power, established in the MITI as an advisory body, about the safety and performance of the reactor. Thus, in the case of reactors for electrical power generation the Committee on Examination of Reactor Safety and the Advisory Committee on Technical Matters concerning Nuclear Power call the specified meetings or groups for each reactor in order to examine the safety of the reactor and make joint examinations to be reported to the Prime Minister.

(b) Delivery and conditions of the licence

The licence is granted by administrative Decision of the Competent Minister, i.e. the Prime Minister (with the approval of the MITI in the case of reactors for electrical power generation).

Any change in the contents of application form should be subject to the permission of the Prime Minister.

The transfer of reactors or facilities including reactors should be subject to the authorization of the Prime Minister, which is granted subject to the same requirements as for a reactor licence. The transfer of a licence under the merger of legal persons is also subject to the authorization of the Prime Minister.

Besides, various conditions may be attached to the licence, with the object of the fulfilment by the operator of his obligations. However, these conditions must be limited to the minimum necessary and should not impose unreasonable obligations on the operator.

(c) Construction and start-up of nuclear installations

Before starting construction and operation of the reactor facilities the operator must comply with following obligations:

Before starting construction

(1) Obtain the sanction of the Prime Minister with respect to the design and method of construction of the reactor facilities

(2) Obtain the approval for the construction plan of the reactor facilities from the MITI (in the case of reactors for electrical power generation).

Before starting operation

(1) Submit the construction work and the performance of the reactor facilities to the inspection of the Prime Minister

(2) Undergo an MITI inspection or test at each of the construction stages (in the case of reactors for electrical power generation)

(3) Prepare the operating programme of the reactor for submission to the Prime Minister (also to the MITI in the case of reactors for electrical power generation)

(4) Lay down safety regulations and obtain the sanction of the Prime Minister

(5) Appoint the chief technician of reactors from among the persons who have a chief technician's certificate and give him authority to supervise safety maintenance concerning the operation of reactors, and report his appointment to the Prime Minister within thirty days of the date of such action.

INSPECTION OF NUCLEAR INSTALLATIONS

In addition to the inspections carried out as regards construction and performance of the reactor facilities, before starting operation of the facilities ("Pre-Use Inspection" mentioned before) certain reactor facilities designated by the Prime Minister have also to undergo annual inspections. As for reactors for electrical power generation, inspections at regular intervals are carried out by the MITI. Moreover, the competent Ministry, i.e. the Prime Minister (also the MITI in the case of reactors for electrical power generation) may, within the limits necessary for enforcement of the Law, empower their officials to enter the offices, and factory of a reactor establishment to inspect their books, documents and other necessary objects.

The inspectors of nuclear installations are appointed from among the officials of the Science and Technology Agency, which is the administrative body attached to the Prime Minister's Office.

THE NETHERLANDS

INTRODUCTION

The basic provisions governing nuclear installations in the Netherlands are set out in the Nuclear Energy Act of 21 February 1963. These basic provisions are elaborated in the Nuclear Installations, Fissionable Materials and Ores Decree of 4 September 1969, as amended.

Under the Act a licence is required for the erection, putting or keeping in operation or altering of any establishment where nuclear energy can be released. These establishments include:

- Land reactors
- Establishments where uranium or thorium are extracted from ores
- Establishments where natural uranium is enriched in the isotope uranium-235 or where fissionable materials are separated in any manner
- Establishments where uranium or plutonium are processed into nuclear fuel elements or where uranium and thorium blankets for converter or breeder elements are manufactured
- Reprocessing plants
- Establishments where fissionable materials for non-nuclear purposes are treated or processed, such as the production of compounds of natural uranium or thorium for pharmaceutical or chemical purposes or the use of natural or depleted uranium or thorium for industrial purposes
- Establishments where research is carried out with fissionable materials
- Establishments where fissionable materials are stored, whether specially designed for the purpose of storage or whether in temporary storage in laboratories or other places.

The Ministers responsible for the licensing of nuclear installations are the Minister of Economic Affairs, the Minister of Public Health and Environmental Control and the Minister of Social Affairs. There is no Minister of State, as in other countries, who is in charge of co-ordinating the licensing procedure.

LICENSING PROCEDURE

The licensing procedure in the Netherlands is conducted in two main stages involving first the construction licence and subsequently the operating licence.

(a) Application

The licensing process is initiated by an official notification of the intent to construct a nuclear power installation to the three above-mentioned Ministries competent for licensing questions. The notification should include a designation of the site where the installation is to be constructed.

Subsequently, the utility company wishing to construct a nuclear installation submits an official application for a construction licence to the three above-mentioned Ministries. At this stage the Sub-Committee on Licences, which forms part of the Inter-Ministerial Committee for Nuclear Energy, is consulted in order to distribute the different legal aspects of the licence application over the various Ministries involved, e.g. insurance questions to the Ministry of Finance, discharge of effluents in open waters to the Ministry of Traffic and Water, etc.

If no serious objections to the choice of the site and the safety of the installation as described in the application emerged, the legal procedure as such is started.

(b) Consultation and intervention of the public and the local authorities

The legal procedure is intended to inform and consult the public and the local authorities of the district where the nuclear plant is to be constructed and includes the following stages.

The first stage consists in the publication by the responsible Ministries of the filing of the application for construction of the plant. Then, the Provincial Council involved is informed of the plans to construct a nuclear plant on its territory. This Provincial Council forwards the information received to the municipality where the plant is to be built and to all other municipalities within a range of 10 km from the site, and also notifies the Council(s) on water resources, if any are involved. The municipality in question makes the licence application available for public inspection and organizes a hearing. Interested parties may raise objections against the granting of the licence on the grounds of fear of danger, damage or nuisance. These objections have to be submitted to a committee set up for this purpose, either during a public session or in writing. The committee reports its findings to the responsible Ministries and to the applicant of the licence, who may comment on the objections or on the way he is prepared to meet the objections.

(c) Consultation and intervention of technical bodies

Several technical permanent and ad hoc technical bodies are consulted during the various stages of the licensing procedure.

A Sub-Committee on Siting of Nuclear Installations considers the acceptability of the site from the viewpoint of aesthetics, population density and regional planning. The Public Health Council establishes an ad hoc study group that is responsible for the evaluation of the radiological impact of the plant both during normal operation and in accident conditions. A Reactor Safety Committee examines all safety aspects of the plant as set out in the safety analysis report (SAR) submitted by the applicant, and issues an interim statement authorizing construction, if no serious objections are found.

(d) Delivery and conditions of the operating licence

After consultation of all interested parties, i.e. technical bodies, public and local authorities, the three responsible Ministries issue a construction licence, which may be accompanied by a number of conditions.

After the construction of the installation has been started, the utility company submits an application for an operating licence to the three responsible Ministries. At this stage the Reactor Safety Committee, on the basis of further detailed discussions on design questions with the applicant, issues a final statement on the safety of the installation and, if necessary, makes suggestions for conditions to be attached to the operating licence.

At the same time the licensing authorities consult with the Public Health Council, the Sub-Committee on Licences and any other Ministries and bodies that may be involved in the issuing of the licence.

(e) Delivery and conditions of the operating licence

Hereafter the decision regarding the licence is made. In granting the licence the competent Ministries may make certain conditions, provided that they serve one or more of the following purposes: the protection of persons, animals, plants and foods; the security of the State; the safe storage of fissionable materials and ores; the supply of energy; ensuring the payment of compensation in connection with third party liability or the observance of international obligations.

INSPECTION OF NUCLEAR INSTALLATIONS

Regular and, during the start-up phase, very frequent inspections are carried out by three different bodies, the Inspectorate of Nuclear Installations, the Pressure Vessel Inspectorate and the Inspectorate for Environmental Control. Any matters discovered by the inspecting authorities bearing safety consequences for the plant operation are reported to the Reactor Safety Committee, which may give directives to the inspecting authorities and may, if necessary, propose changes in the operating licence. These changes are subsequently put in the legally appropriate form by the licencing authorities.

NORWAY

INTRODUCTION

In Norway the regulations concerning nuclear installations are governed by Act No. 28 of 12 May 1972 as amended.

Under the Act, no person may, without a licence granted by the Ministry of Industry with the consent of Parliament, construct, own or operate:

- A nuclear reactor
- A factory for the manufacture or processing of nuclear substances
- A factory for the separation of isotopes of nuclear fuel
- A factory for the processing of irradiated nuclear fuel
- A facility for the storage of nuclear substances other than storage incidental to the carriage of such substances
- Such other installations in which there are nuclear fuel or radioactive products as determined by the Ministry of Industry.

However, the Ministry of Industry may exempt from the provisions of the Act, either in whole or in part, certain types of nuclear installations that, in the Ministry's own opinion, constitute no significant hazard.

LICENSING PROCEDURE

A licence is granted in respect of the 'site' (a specific place of operation) not the installation itself, and the Ministry of Industry may determine that two or more nuclear installations having the same operator and that are situated on the same site shall be considered in whole or in part as a single installation.

The licence for a nuclear installation covers both construction and operation. However, before starting construction and operation of the nuclear installation the operator must undertake certain procedures that require the approval or authorization of the Nuclear Energy Safety Board, which is the advisory body of the Ministry of Industry for the co-ordination and evaluation of the safety aspects of the licensing of nuclear installations.

(a) Application for a licence

Applications for a licence should be addressed to the Ministry of Industry and should contain particulars of the building site, the purpose, nature and size of the installation as well as an account and evaluation of the installation's safety features (The Safety Assessment Documents).

(b) Consultation and participation of technical bodies and public authorities

The Nuclear Energy Safety Board prepares and submits recommendations to the Ministry of Industry on all applications concerning licences and has authority, on its own initiative, to put into effect all such measures as it deems necessary for reasons of safety. The members of the Board are appointed by the King for a term of four years.

In addition, the local authorities concerned are consulted on the application of the licence and public enquiries are initiated.

(c) Delivery and conditions of the licence

As a rule, the licence is limited to a specified period. A separate licence is required for the transfer of a nuclear installation or the operation thereof to a new owner or operator.

The granting of the licence is subject to such conditions as are considered necessary with regard to safety requirements and the public interest. The conditions may be amended, added to and revoked by the Ministry of Industry. However, if such fresh conditions entail an unreasonable alteration in the economic conditions upon which the recipient of the licence had based his assumptions, and they exceed that which ordinarily follows from his obligation to maintain the installation and equipment in good and proper order and to secure it against causing damage, the Court may grant him compensation from Government funds to the extent that this is found reasonable.

(d) Construction and start-up of the nuclear installation

Before starting construction and operation of the nuclear installation, the operator is required to take all necessary measures to ensure that no damage will be caused as a result of radioactivity or other hazardous features of such nuclear fuel or radioactive products that are to be found on the installation site, or that are removed or discharged therefrom, or which are undergoing transportation on the operator's behalf, and to obtain the approval on the measures by the Nuclear Energy Safety Board.

In addition, before a nuclear installation is put into operation, the operator must have obtained authorization from the Board. Such authorization is granted subject to:

The technical standards of the installation, the operating regulations, safety measures and accident emergency plans being sound

The management and personnel of the installation having the necessary qualifications and clearly defined spheres of responsibility

All the necessary authorization being obtained with other legislative provisions.

Besides that, the operator should, in good time before starting operation of the nuclear installation, submit to the Board a complete safety report on the installation concerned.

The Board may, if it believes this will assist it in its appraisal of the installation, give separate consent to a limited trial operation, subject to such conditions as may appear necessary.

INSPECTION OF NUCLEAR INSTALLATIONS

The Nuclear Energy Safety Board exercises continuous supervision over the construction and operation of nuclear installations. The Board may also at any time demand access to a nuclear installation and the surrounding area and may also require all the particulars it needs in order to exercise its supervision.

PORTUGAL

INTRODUCTION

Le cadre réglementaire de l'autorisation et de l'exploitation des installations nucléaires au Portugal est tracé par le décret-loi n°49 398 du 24 novembre 1969 qui fixe le régime d'autorisation de l'ensemble des activités nucléaires. Ce décret-loi a fait ensuite l'objet d'un décret d'application qui fixe la procédure d'autorisation des centrales nucléaires destinées à la production d'électricité; il s'agit du décret n°487 du 5 décembre 1972.

Il convient, d'autre part, de signaler que le système d'inspection des installations nucléaires est régi par le décret-loi n°48 568 du 4 septembre 1968.

Les autorités responsables au premier chef de l'autorisation et du contrôle des installations nucléaires sont la Junta de Energia Nuclear (JEN, Commission de l'énergie atomique) et la Direction générale des services électriques qui dépend du Secrétaire d'Etat à l'industrie.

PROCEDURE D'AUTORISATION

C'est la Direction générale des services électriques (DGSE) qui a la responsabilité de l'ensemble de la procédure d'autorisation des installations nucléaires, en collaboration étroite avec la JEN, notamment en ce qui concerne les aspects techniques et de sécurité.

La procédure se déroule en trois étapes qui donnent lieu chacune d'elles à la délivrance d'une autorisation préalable.

Ces trois étapes sont:
- l'approbation du site,
- l'autorisation de construction,
- l'autorisation d'exploitation.

(a) Approbation du site

(i) Présentation de la demande d'autorisation

La demande d'autorisation préliminaire, accompagnée de tous les éléments d'appréciation des points de vue technique et économique ainsi que du point de vue de la sûreté de la centrale et de sa localisation, doit être adressée à la DGSE. Cette dernière la communique pour avis à la JEN. Ces éléments d'information sont déterminés en commun par la DGSE et la JEN.

La demande est également transmise pour avis aux différents départements ministériels et organismes intéressés.

(ii) Consultation et intervention du public et des autorités locales

Dans un délai d'un mois suivant la réception de la demande, la population locale est informée du projet d'installation par voie d'affichage et d'annonces légales effectuées par la DGSE et le Conseil municipal de la commune intéressée. La DGSE doit communiquer aux personnes intéressées, dans un délai de 30 jours à compter de la dernière publication de la demande d'autorisation dans le Journal Officiel, la demande en question et les documents d'information fournis par le requérant.

Les réclamations doivent être adressées dans les limites de ce délai, soit directement à la DGSE, soit au Conseil municipal qui les transmet à la DGSE. Cette dernière en envoie une copie à la JEN.

(iii) Délivrance de l'autorisation préliminaire

La DGSE prépare, en collaboration avec la JEN, un rapport sur la demande d'autorisation à l'intention du Gouvernement. Ce rapport doit être accompagné de l'avis de la Commission des combustibles et des centrales nucléaires.

C'est au Gouvernement qu'il appartient d'accorder l'autorisation préliminaire pour l'installation de la centrale sur le site proposé. Cette autorisation reste subordonnée à l'exécution par le requérant des conditions qu'elle contient, en particulier en ce qui concerne le délai de présentation pour la demande d'autorisation de construction.

(b) Autorisation de construction

La demande d'autorisation de construction, accompagnée de tous les éléments d'information requis et en particulier du rapport préliminaire de sécurité, doit être adressée à la DGSE qui la communique à la JEN et sollicite son avis.

Les autorités compétentes que la DGSE et la JEN décident en commun de consulter sur cette demande, doivent se prononcer dans un délai de 60 jours.

La demande d'autorisation de construction est examinée du point de vue de la conception de l'installation, des techniques de construction, de la sécurité, etc. La conception du Rapport préliminaire de sécurité est arrêtée cas par cas par la JEN et la DGSE.

Au terme de cet examen, la DGSE prépare, en liaison avec la JEN, un rapport destiné au Gouvernement; ce dernier se prononce ensuite sur la décision de délivrer l'autorisation de construction.

(c) Autorisation d'exploitation

La construction de la centrale s'effectue sous le contrôle permanent des agents de la DGSE et de la JEN, suivant un plan général d'inspection élaboré par un Groupe composé de représentants de ces deux organismes. Les inspections s'effectuent sur le plan de la sécurité électrique comme sur celui de la sécurité nucléaire.

L'exécution de la construction de l'installation se divise en plusieurs étapes successives, chacune sanctionnée par un permis spécial délivré par la DGSE et la JEN:

– la charge initiale en combustible,
– les essais nucléaires et préopérationnels,
– la montée en puissance.

Afin d'obtenir ces permissions, l'entreprise doit présenter au préalable le Rapport final de sécurité ainsi que des programmes détaillés de ces opérations. La composition du Rapport final de sécurité est elle aussi définie cas par cas par les deux organismes de tutelle.

La demande proprement dite d'autorisation d'exploitation est ensuite adressée par le requérant à la DGSE qui, après avoir recueilli l'avis de la JEN, prépare un rapport à l'intention du Gouvernement.

Le Gouvernement prend sa décision sur la base de ce rapport. L'autorisation d'exploitation reste subordonnée à l'exécution par son bénéficiaire des diverses conditions et prescriptions qu'elle comporte.

INSPECTION DES INSTALLATIONS NUCLEAIRES

L'exploitation de la centrale nucléaire est sujette en permanence à des inspections effectuées par les services compétents de la DGSE et de la JEN, en ce qui concerne respectivement la sécurité électrique et la sécurité nucléaire.

La société responsable de la centrale doit tenir un journal d'exploitation dont le modèle est arrêté par la DGSE et la JEN. Les modifications de l'installation susceptibles d'avoir un effet sur la sécurité doivent être approuvées par ces deux organismes.

La qualification du personnel chargé du réacteur doit être déterminée au préalable par la JEN.

Les services de la JEN exercent également une surveillance sur les zones avoisinant les installations nucléaires. Ces zones sont considérées comme des zones de protection et sont soumises à un certain nombre de servitudes.

SWEDEN

INTRODUCTION

Licensing of nuclear installations in Sweden is governed primarily by the Atomic Energy Act of 1956, the Radiation Protection Act of 1958, as well as regulations on building, environmental protection, and supervision of waters and waterways. Safety measures for the prevention of nuclear incidents are also taken into consideration.

Nuclear reactors and plants for nuclear fuel reprocessing are submitted to a prior licensing system.

LICENSING PROCEDURE

(a) Application for a licence

The application for a licence to construct and operate a nuclear installation must be sent in the first instance to the DFA[8] (Delegationen för Atomenergifragor – Atomic Energy Board). The application must provide all the particulars required to appraise whether the site proposed is suitable and the safety features have been taken into consideration appropriately (preliminary safety report).

The enquiry conducted by the DFA includes two sets of consultations.

(b) Consultation and participation of the public and local authorities

The file of the application for a licence is forwarded to the Provincial Council concerned. The latter authority may oppose granting of the licence.

The National Board of Labour Market is also consulted.

The opinions of these bodies are forwarded to the State Planning Authority, which transmits them to the Government.

(c) Consultation and participation of technical bodies

The licensing procedure may be divided into two stages. This may occur when the initial application only concerns obtaining authorization to use a specific site to construct a given installation. The following is based on this procedure, as it seems to be the most frequently used.

(i) Construction licence

Investigations on the application for a licence are conducted by the DFA, under the supervision of the Ministry of Industry. The Reactor Safety Committee (RFK) within the DFA, studies the questions relating to siting and reactor safety. Within the Ministry of Agriculture, the National Commission for Environmental Protection and the Swedish Meteorological

[8] Since 1 July 1974 this body has been called the Statens Kärnkraftinspection (The Swedish Nuclear Power Inspectorate). No details of its organization are known as yet.

and Hydrological Institute are consulted. Finally, the Swedish Institute of Radiation Protection (SSI), under the Ministry of Health, also examines the application.

These various opinions are collected by the DFA, which transmits them to the Ministry of Industry, together with its own comments. The DFA may impose further conditions that it considers should be met before the licence is issued.

The construction licence takes the form of a Government decision, in this instance by the Ministry of Industry.

(ii) Operating licence

Construction of the installation requires a series of partial licences concerning the commissioning of the reactor's various components. Certain prior checks may be conducted by independent bodies on behalf of the DFA.

In addition, the Swedish Institute of Radiation Protection (SSI) examines the safety measures taken and may prescribe rules and special requirements in this connection regarding operation of the installation, in particular standard permissible radiation doses and releases of radioactive substances.

The operating licence is issued by the Minister of Industry, following the favourable opinion of the DFA on the final safety report and satisfactory performance of the testing programme.

INSPECTION OF NUCLEAR INSTALLATIONS

The DFA is also responsible for the inspection of nuclear installations during their commissioning and operation. The DFA Reactor Safety Committee is especially responsible for the technical safety of the installation.

The Occupational Medicine Board (KAS) and the Swedish Institute of Radiation Protection (SSI) ensure compliance with requirements for the protection of workers and the neighbouring population against the hazards of ionizing radiation.

SWITZERLAND

INTRODUCTION

The basic provisions governing nuclear installations in Switzerland are set out in the Atomic Energy Act of 23 December 1959. Under the Act a licence is required for the construction and operation of nuclear installations, which include installations that are used to produce nuclear energy, or for obtaining, processing, storing or rendering harmless nuclear fuels and radioactive wastes. Thus, nuclear installations comprise, in addition to reactors, experimental installations and laboratories working with nuclear fuels or wastes, together with storage facilities.

The Federal Department of Transport, Communications and Energy is responsible for drawing up and implementing legislation on the use of atomic energy, and is empowered to grant licences relating to the construction and operation of electricity generating nuclear installations. Within this Department the Federal Office of Energy Economy is responsible for considering requests concerning construction and operation of nuclear installations, and is empowered to grant licences concerning nuclear installations other than those generating electricity.

LICENSING PROCEDURE

The licensing system in Switzerland is a two-step procedure; the first being an authorization for construction, and the second for operation.

(a) Construction licence

Applications for a licence to construct nuclear installations should be addressed to the Federal Department of Transport, Communication and Energy if the installation is intended to generate electricity, and to the Office of Energy Economy of the Department for other installations.

All applications for a construction licence must provide the following information and documents:

The name of the applicant
An exact description of the installation
A detailed technical report on the safety of the installation.

An initial evaluation of the safety reports relating to the approval of the site and authorization for construction is carried out by the Section for questions of safety of nuclear installations in the Office of Energy Economy. The Section then submits them for the opinion of the Federal Commission for the Safety of Nuclear Installations.

The Federal Commission for the Safety of Nuclear Installations, which comes under the Federal Department of Transport, Communications and Energy, comprises a maximum of nine experts in atomic science and technology and radiation protection, nominated by the Federal Council, on the proposal of the Department. The Commission gives its opinion to the Department, after having examined the designs and documents, and also advises the Department on all questions relating to the safety of nuclear installations. Then the opinion of the Commission is communicated to the applicant.

The Office of Energy Economy must also obtain the opinion of the Canton in which the installation is to be constructed.

The Federal Council may make the granting of a licence subject to the condition that the applicant is a Swiss citizen living in the country. If the licence is sought by a body corporate, the Federal Council may require that at least two-thirds of the members of the Board of Management are Swiss citizens living in the country and that such a body corporate shall have its headquarters in Switzerland.

Authorization for construction is granted by the Federal Department of Transport, Communication and Energy if the installation is intended to generate electricity, and by the Office of Energy Economy for other installations in the form of a letter addressed to the applicant, stipulating the different obligations incumbent on the operator as regards safety in accordance with the Act.

(b) Operating licence

Any request for a licence to operate a nuclear installation must be accompanied by a detailed technical report on the safety of the installation, which is submitted for assessment by the Federal Commission for the Safety of Nuclear Installations.

Procedures up to the granting of the operating licence and its conditions are very similar to the ones for the construction licence. The operating licence is granted with no limit as to duration, it is non-transferable and may be revoked.

INSPECTION OF NUCLEAR INSTALLATIONS

Nuclear installations are subject to supervision by the Confederation.

The Federal Council and the bodies designated by it are authorized, in exercising their powers of supervision, to order the measures necessary at any time for the protection of persons and property and other valuable rights, for safeguarding the external security of Switzerland, and for ensuring the observance of the country's international commitments; they are also empowered to supervise the implementation of these measures.

From the technical standpoint, it is the Section for questions of safety of nuclear installations in the Federal Office of Energy Economy that is responsible for carrying out the greater part of the monitoring inspections of installations, on behalf of the Federal Commission for the Safety of Nuclear Installations. This Commission is empowered to inspect regularly from the standpoint of technical safety the construction, operation or modification of nuclear installations. During its periodic checks the Commission examines in particular whether these installations are well maintained and whether the operating rules are properly drawn up and observed; the Commission also makes sure that the staff have the necessary technical knowledge and experience. In addition, it ensures that the special conditions contained in the authorization are observed.

TURKEY

INTRODUCTION

Atomic Energy Act No. 6821 of 27 August 1956 amended by Act No. 7190 of 14 January 1959 setting up the Turkish Atomic Energy Commission made the latter responsible for protection of public health and safety and national security in the peaceful uses of atomic energy. The Turkish Atomic Energy Commission (TAEC) is responsible for defining safety in respect of all nuclear activities and for drawing up regulations concerning radiation protection and the safe utilization of nuclear installations. The TAEC, which is the ruling body for licensing of nuclear installations, is attached to the Prime Minister's office. The TAEC is chaired by the Prime Minister or by a Minister of State appointed by him.

Decree No. 6/7946 of 25 April 1967 of the Council of Ministers laid down general provisions applying to protection against ionizing radiations. This Decree was subsequently completed by detailed procedures on safety measures against ionizing radiations and by the TAEC Regulations of 16 December 1968, which laid down rules for the safe utilization of ionizing radiations. The special conditions governing the granting of authorizations are specified in Regulations for Licensing of Nuclear Installations presently being prepared by the TAEC.

LICENSING PROCEDURE

In Turkey the licensing procedures for nuclear installations other than nuclear power plants (reactor) and for nuclear power plants (reactor) are somewhat different.

A two-step licensing procedure is applied for a nuclear installation other than a nuclear power plant: construction permit, and operating licence. A three-step licensing procedure is applied for a nuclear power plant (reactors): site approval, construction permit; and operating licence.

Any application for a licence must be sent in writing to the office of the Secretary General of the TAEC.

(a) Site approval

The applicant – usually the Turkish Electric Authority (TEK) – must submit to the TAEC a letter of intent to build a nuclear power plant at a particular site. The reactor types considered, their size and other necessary information such as utility organization, schedule for design, qualifications of the architect-engineer, should also be included.

In parallel with his application the applicant must also file a Site Evaluation Report including all relevant information on the geological, seismological, hydrogeological, and meteorological characteristics of the site and vicinity, in conjunction with population distribution, land use, and site activities and controls.

The TAEC staff briefly reviews the application and the applicant's Site Evaluation Report to determine if information on all required subjects has been supplied. The application is accepted unless the information is incomplete, in which case the application may be returned to the applicant within 30 days with a request for further details.

The TAEC's Safeguards Committee (see below) reviews the application and submits its recommendations in a report to the TAEC. The Commission must submit its decision in a letter to the applicant within 5 months.

The information required when applying for a licence for a nuclear installation other than a nuclear power plant is directly forwarded at the stage of the construction permit and consists of:

The purpose and preliminary plans of the installation, of the site, and of apparatus and methods

The name, address, legal status and technical qualifications of the applicant

A preliminary study on arrangements for the disposal of radioactive wastes.

(b) Construction permit

After obtaining site approval, the application for a construction permit should be prepared by the applicant with the help of the reactor manufacturer and the architect-engineer. The TAEC's regulations describe the information that should be supplied by the applicant. The main document is the Preliminary Safety Analysis Report, including a description of the facility and particulars of the safety and protection measures envisaged. A review must be included in the Report to determine that the environmental impact of the plant will be minimal.

After acceptance of the application, the next step is the TAEC's regulatory staff intensive review of the application. The objectives of this review are to:

Obtain adequate technical information on the reactor design

Reach an understanding of the technical bases for the safety of the proposed plant

Permit the staff to make an independent safety analysis.

The TAEC has a Licensing and Safeguards Division, directly subordinate to the Secretary-General. This executive branch consists of four groups each responsible for following functions: radiation protection, licensing of nuclear installations, inspection of nuclear installations, and the standard development for the regulatory processes.

A Safeguards Committee has also been set up within the TAEC. This Committee consists of 7 members, experts in various technical and scientific disciplines related to reactor safety, elected by the TAEC for a three-year term. The Chairman of the Safeguards Committee must be a specialist working in the field of nuclear safety and should be elected by the TAEC from the TAEC members.

The application for a licence for a nuclear installation is reviewed by this Safeguards Committee, which provides a formal channel for expert advice to the TAEC for the final decision on the grant or denial of nuclear installation licence.

The licensing review is performed by the functional units of the Licensing and Safeguard Division of the TAEC Secretariat. The Chairman of the Safeguards Committee puts together the work of the functional groups and the survey of the Safeguards Committee and prepares a Safety Evaluation Report. The Chairman of the Safeguards Committee serves as the principal spokesman for regulatory matters before the TAEC.

The reactor group of the Secretariat performs the project management function by planning, scheduling and providing technical know-how necessary at all stages of the nuclear reactor project.

(c) Operating licence

The procedures for granting an operating licence for nuclear installations other than nuclear power plants and for nuclear power plants (reactor) are slightly different.

(i) Operating licence for nuclear installations other than nuclear power plants

Upon completion of the construction in compliance with the terms and conditions of the construction permit, the filing of any additional information needed to bring the original application up to date and to clarify operational qualifications, and the TAEC finding that the facility has been constructed and will operate in conformity with safety regulations, an operating licence may be issued to the applicant.

(ii) Operating licence for nuclear power plant

When construction of the plant is nearing completion, the applicant should apply for an operating licence. The application should include the Final Safety Analysis Report, in which the technical information is brought up to date as practicable with the actual design and accident analysis of the plant. It also includes plans for operating and for coping with emergencies.

The TAEC staff and the Safeguards Committee again evaluate the reactor project and prepare a report in this connection. The operating licence is a three-step procedure:

Fuel loading permit
Reactor start-up permit
Full load operation permit.

In advance of fuel loading, TAEC must determine that all the commissioning tests are properly performed and before reactor start-up must determine that the persons who are to manipulate the controls of the reactor are qualified.

The special conditions governing the granting of authorizations are to be specified in Regulations currently being prepared by the Commission.

INSPECTION OF NUCLEAR INSTALLATIONS

The TAEC is empowered to inspect nuclear installations to ascertain whether the conditions laid down in the relevant regulations and in the authorization are being observed. Persons responsible for installations subjected to this inspection are obliged to supply all necessary information and to allow the Commission's officials free access to premises.

UNITED KINGDOM

INTRODUCTION

The regulations concerning nuclear installations in the United Kingdom are governed by the Nuclear Installations Act[9]. Under the Act, no person other than the UKAEA may, without a licence from the competent Minister, use any site for the purpose of installing or operating:

A nuclear reactor (other than one comprised in a means of transport); or
Any other nuclear installation that may be prescribed under the Act, namely the following classes of installations prescribed by the Nuclear Installations Regulations 1971:
An installation manufacturing fuel elements from either enriched uranium or plutonium;
An installation used for producing alloys or chemical compounds from enriched uranium or plutonium;
An installation manufacturing rigs that incorporate enriched uranium or plutonium for subsequent irradiation in a reactor;
An installation comprising a sub-critical nuclear assembly in which a neutron chain reaction can be maintained;
An installation for processing irradiated nuclear fuel;
An installation involving the extraction of plutonium or uranium by the treatment of irradiated matter or an installation for the enrichment of uranium;
An installation for the production of radioisotopes from nuclear matter. Storage facilities for unirradiated enriched uranium or plutonium fuel elements or for irradiated nuclear fuel of any kind.

Other types of installations, however, may be prescribed from time to time.

In addition, the use of a site is prohibited under the Act, whether the site is licensed or not, for the purpose of:

Extracting uranium or plutonium from irradiated matter either directly or incidentally to other treatment of such matter; or
Increasing the proportion of isotope 235 in uranium, except in accordance with the terms of a permit given in writing by a Government Department or by the Atomic Energy Authority.

The responsible Minister for the licensing of nuclear installations in England and Wales is the Secretary of State for Energy. For installations in Scotland the responsible Minister is the Secretary of State of Scotland, and in Northern Ireland the Minister of Commerce. The expression "the Minister" is used throughout to mean whichever of the Ministers may be appropriate.

---

[9] The Nuclear Installations Act 1965 as amended by the Nuclear Installation Act of 1969 and by the Atomic Energy Authority Act 1971.

LICENSING PROCEDURE

A licence is granted in respect of the "site" (a specified area of land) not the installation itself, and the Minister may treat two or more installations in the vicinity of one another as being on the same site for the purpose of a licence. The licence covers both construction and operation. However, full use is made of the Minister's power to amend, add or revoke licence conditions at his discretion, and only those conditions appropriate to the state of nuclear installation are attached to the licence which are varied according to the each stage of construction and operation of nuclear installation. In addition, many of the conditions attached to the licence provide for various matters to be approved by the Minister, or for certain action not to be taken without the consent of the Minister.

(a) Application for a licence

In practice, an applicant for a nuclear site licence consults the Nuclear Installations Inspectorate (described later) on the information required in a submission for a licence and on the detailed procedures to be followed. These will vary with the type and size of the proposed installation. However, sufficient information must be provided to enable the Inspectorate to satisfy itself as to the safety of the proposed plant and the suitability of the site. For power reactors applicants are required to submit details of the basic safety principles on which the design is based and indicate how these principles are to be incorporated in the plant (Preliminary Safety Report). Information must be given on the main pressure containment system and cooling arrangements both in normal and accident conditions, the layout of the site, the expected radiation contours and arrangements for dealing with radioactive effluents, waste storage and the handling of irradiated fuel elements.

The submission has to include an outline of the fault studies and other investigations and tests planned to support the design assumptions.

Then, if the assessment of the proposed site and installation proves to be favourable, the applicant can make the more detailed proposals to submit a formal application to the Minister.

In addition to the formal application, in the case of power stations the applicant has to make an application for the consent of the Minister under the Electric Lighting Act 1909 in order to build the power station.

Therefore, it is normal practice that before a construction licence is issued, the Inspectorate carries out a preliminary safety assessment of the site and the reactor design based on the Preliminary Safety Report.

(b) Consultation and participation of the public and the local authorities

The Minister, on receiving a formal application for a nuclear site licence, can at his discretion direct an applicant for a licence to serve notice on local authorities, river boards, local fisheries committees, statutory water undertakings and other similar bodies. He must then consider any representation they may make and may not grant a licence until three months after the service of the last notice.

In the case of nuclear power stations these matters are dealt with by the Electricity Acts, which make similar provision for publication and notification to interested parties of any proposed power station.

When all interested parties have been given an opportunity to comment on or object to the proposed station, the Minister decides whether or not the proposals affect their interests to an extent that makes it desirable to hold a public enquiry. If, however, the local Planning Authority objects, the Minister is obliged to hold such an enquiry.

(c) Consultation and participation of technical bodies

The Minister has a body of inspectors, known as the Nuclear Installations Inspectorate, to assist him in the implementation of the Nuclear Installations Act. The Inspectorate assists the Minister in controlling the design, construction and operation of nuclear installations in the interest of the safety of the operators and the general public. The Inspectorate has a group of safety assessors whose principal task is to examine those areas of reactor designs that have the greatest significance for safety and to recommend, if necessary, where improvements should be made. The Inspectorate also examines the Preliminary Safety Report and assists the Minister in framing the conditions attached to the licence.

(d) Delivery and conditions of the licence

A licence may only be granted to a corporate body and is not transferable.

The Minister is required to attach to the licence whatever written conditions appear to him to be necessary or desirable in the interests of safety. Conditions may be varied, revoked or added at any time. In particular, these may include:

Securing the maintenance of an efficient system for detecting and recording the presence and intensity of any ionizing radiations emitted from anything on the site or from anything discharged on or from the site;
Regulating the design, siting, construction, installation, operation, modification and maintenance of any plant or other installation on the site;
Providing measures to be taken in the event of an accident or other emergency on the site;
Controlling the discharge of any substance on or from the site; and
Dealing with the handling, treatment and disposal of nuclear matter.

(e) Construction and start-up of the nuclear installation

The form of the licence itself is substantially standard in every case and authorizes the applicant to install and operate installations at the particular specified site, subject to the various conditions that may be attached to the licence from time to time. However, where the Minister wished initially to authorize only the construction of an installation and not its operation (as might be the case with a nuclear power station), the conditions attached to it will cover such matters as requiring the licensee to construct the installation to the design approved by the Minister and to obtain such approval at specified stages, the compliance with inspection and testing requirements and other similar matters relevant to the construction stage. At this stage the conditions will also forbid the bringing on to the site of nuclear fuel.

Before the licensee is permitted to operate the installation a safety assessment of the detailed design and of the proposed operating procedures has to be made. The conditions relating to construction will then be replaced by more detailed conditions appropriate to the operation of the installation, and will cover, for example, the loading and commissioning procedures to be followed, the operational limits to be observed, the storage of nuclear fuel and the provision of emergency services.

Other matters that will normally be covered will be the requirement of approval for significant modifications to the installation, preservation of records, the security of the site, the appointment of suitably qualified persons to be in charge of operations, the maximum permissible dose of radiation for persons classified as exposed to radiation in their work and for other persons on the site, medical examinations, film badges, maintenance, contamination, protective clothing, first aid, the setting up of a Safety Committee for the site to advise the licensee on all aspects of safety, consignment of nuclear matter from the site and the accumulation of radioactive waste.

INSPECTION OF NUCLEAR INSTALLATIONS

Any inspectorate staff may at all reasonable times, subject to production, if requested, of written evidence of his authority, enter any licensed site with any equipment and may carry out any tests or inspections that they may consider necessary or expedient. Any inspector may also require the licensee (or his employees) to provide him with information or to permit him to inspect any documents concerning the use of the site.

UNITED STATES OF AMERICA

INTRODUCTION

The regulations concerning nuclear installations in the United States are governed by the Atomic Energy Act of 1954 as amended. Under the Act, it is unlawful to construct or operate a "utilization facility" or a "production facility" without a licence issued by the Atomic Energy Commission.

The "utilization facility" and "production facility" are defined by rules of the Atomic Energy Commission as follows:

Utilization facility

Any nuclear reactor other than one designed or used primarily for the formation of plutonium or uranium-233.

Production facility

Any nuclear reactor designed or used primarily for the formation of plutonium or uranium-233; or

Any facility designed or used for the separation of the isotopes of plutonium, except laboratory scale facilities designed or used for experimental or analytical study only; or

Any facility designed or used for the processing of irradiated materials containing special nuclear material, except (I) laboratory-scale facilities designed or used for experimental or analytical purposes, (II) facilities in which only the special material contained in the irradiated material to be processed are uranium enriched in the isotopes ^{235}U and plutonium produced by the irradiation, if the material processed contains not more than 10^{-6} grams of plutonium per gram of ^{235}U and has fission product activity not in excess of 0.25 millicuries of fission products per gram of ^{235}U; and

Facilities in which processing is conducted pursuant to a licence issued, or equivalent regulation of an Agreement State, for the receipt, possession, use and transfer of irradiated material on a batch basis for the separation of selected fission products and limits the process batch to not more than 100 grams of uranium enriched in the isotope-235 and not more than 15 grams of any other special nuclear material.

However, the requirements of a licence for any utilization or production facility provides for an exception in the case of the Atomic Energy Commission itself. There is also excluded from the need for licences the construction or operation of facilities under contract with the Commission. In addition, the Commission has power to exempt, on application, any person from the requirements if such exemption is authorized by law and will not endanger life or property or the common defence and security.

The Atomic Energy Act is supplemented by the Rules and Regulations issued by the Atomic Energy Commission, which deal in more detail with the implementation of the Act and its purposes and are constantly reviewed and amended to take account of changing circumstances. The Atomic Energy Commission retains sole authority to issue licences for the construction and operation of nuclear installations.

LICENSING PROCEDURE

The licensing process in the United States is a two-step procedure. Namely, the Act requires the issuance of a construction permit before a nuclear installation may be constructed. Then, when the construction of the installation is nearing completion, the construction permit must be converted to the licence to operate the installation.

(a) Construction licence

A prospective applicant for a licence to construct a nuclear installation usually asks the Commission's regulatory staff for an informal evaluation of the suitability of one or more sites that he is considering. The application for a construction permit is then prepared by the applicant, with the help of the equipment supplier and the architect-engineer.

Each application for a construction permit should be filed with the Atomic Energy Commission with the following:

General information concerning applicant, such as name, address, principal place of business, citizenship etc.;

Information sufficient to demonstrate to the Commission the financial qualifications of the applicant to carry out, in accordance with the regulations in the Act, the activities for which the permit is sought. Such information shall show that applicant possesses the funds necessary to cover estimated construction costs and related fuel cycle costs or that the applicant has reasonable assurance of obtaining the necessary funds, or combination of two;

Information on the earliest and latest dates for completion of the construction.

In addition to the very general information mentioned above, as the Atomic Energy Commission's review for award of the construction permit for nuclear installation consists of three main parts conducted in parallel; the antitrust review, the environmental review, and the radiological safety review, somewhat specific information is required for the respective reviews as follows:

(i) Antitrust review

About ten months before tendering the application, the applicant submits information requested by the Attorney General, which he has determined to be necessary in his antitrust review.

The information requested by the Attorney General is listed in USAEC Rules and Regulations (Part 50 – Appendix L). This information is reviewed by the US Attorney General who issues a recommendation within 180 days of docketing as to whether an antitrust hearing is or is not necessary. In the latter case the Commission publishes the Attorney General's advice in the Federal Register; this starts the 30-day period within which interested parties may request to intervene. If an antitrust hearing is necessary, it is anticipated that within 13 months an initial Hearing Board decision can be rendered. This decision would include the determination by the Hearing Board as to the necessity of any antitrust conditions that should be included in the construction permit.

(ii) Environmental review

The applicant submits the environmental report within six months before or after the date of tendering his application and after acceptance the environmental review begins. This document, entitled Applicant's Environmental Report — Construction Permit Stage, discussed the following environmental considerations:

The environmental impact of the proposed action
Any adverse environmental effects that cannot be avoided should the proposal be implemented
Alternatives to the proposed action
The relationship between local short-term use of man's environment and the maintenance and enhancement of long-term productivity
Any irreversible and irretrievable commitments of resources that will be involved in the proposed action should it be implemented.

The Environmental Report shall also include a cost-benefit analysis, which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects, as well as the environmental, economic, technical and other benefits of the facility.

About three months after the formal review begins the AEC Regulatory Staff publishes its draft environmental impact statement for comment by other responsible State and Federal agencies and by the public. After 45 days for comment, the Regulatory Staff prepares and publishes the final environmental impact statement. The public is given an opportunity to participate in an environmental hearing. If all environmental and site suitability issues can be resolved during the hearings, it is expected that a Limited Works Authorization (LWA), which entitles the applicant to start site preparation work and to proceed with construction of temporary and support buildings, can be issued in about 10-11 months. If there are no contested environmental issues, a hearing is still required. In such a case it is expected that an LWA will be issued about 7-8 months after docketing.

(iii) Radiological safety review

Each application for a construction permit should include a Preliminary Safety Analysis Report. The minimum information to be included consists of the following:

A description and safety assessment of the site on which the installation is to be located, with appropriate attention to features affecting the design of the installation;
A summary description of the installation, its design and operating characteristics, any unusual or novel design features and principal safety considerations;

The preliminary design, including the principal design criteria and information relating to construction materials, general arrangement and dimensions, so as to ensure that the final design will confirm to the design basis with an adequate safety margin;
An analysis of the design and performance of the installation in order to enable the risk to public health and safety to be assessed;
An identification and justification of variables that are the subject of the technical specification;
A preliminary plan for the applicant's organization, training of personnel, and conduct of operation;
A description of the quality assurance programme to be applied to the design, fabrication, construction and testing of the structures, systems and components of the installation.
An identification of any structures, systems or components that may need further research;
Technical qualifications of the applicant.

Moreover, in the case of application for the construction permit of a nuclear power reactor, the application should also include:

A description of the preliminary design of equipment to be installed to maintain control over radioactive materials in gaseous and liquid effluents produced during normal reactor operations, including expected operational occurrences;
An identification of the design objectives and the means to be employed, for keeping levels of radioactive material in effluents to unrestricted areas as low as practicable;
An estimate of the quantity of each of principal radionuclides expected to be released annually to unrestricted areas in liquid effluents produced during normal reactor operations;
An estimate of the quantity of each of the principal radionuclides of the gases, halides, and particulates expected to be released annually to unrestricted areas in gaseous effluents produced during normal reactor operations;
A general description of the provisions for packaging, storage and shipment offsite of solid waste containing radioactive materials resulting from treatment of gaseous and liquid effluents and from other sources.

(b) Consultation and participation of technical bodies and public authorities

When the application is filed with the Commission copies are made available to the public and are sent to interested state and local officials and the Advisory Committee on Reactor Safeguards, which is composed of qualified members appointed by the Atomic Energy Commission and is in charge of studying reactor safety and advising the Commission on the safety aspects of the applications for licences.

The Commission's regulatory staff then review the application in order to obtain adequate technical information on the design, to reach an understanding of the technical basis for safety, to discuss the preparation of the technical specifications and to reach an independent safety analysis.

In conducting its safety review the Commission, to the extent necessary or appropriate for the particular application, seeks the advice of expert consultants from outside the Commission, including those from other Federal agencies. The US Geological Survey is consulted regarding the geological aspects of the site. The US Fish and Wildlife Service is consulted regarding potential radiological effects on fish, other marine life and wildlife from operation of the proposed reactor. The US Weather Bureau and the Coast and Geodetic Survey are called upon for advice on meteorology and seismology. The US Army Corps of Engineers may also be consulted to furnish hurricane data on coastal areas to enable the Commission to determine whether special protection construction would be required. In addition to experts from Government agencies, the Commission staff may consult experts from universities and private organizations on special problems.

Concurrently with staff consideration of the application in the licensing process is the review by the Advisory Committee on Reactor Safeguards. As mentioned above, upon receipt of the application copies are sent to this Committee. To facilitate the Committee's review, the Commision's staff prepares a preliminary analysis of the application shortly after it is received, identifying the principal safety issues and providing a starting point for the detailed review by the staff and the Committee which follows. There continues to be an exchange of technical comment between the staff and the Committee as the review proceeds. After completion of their initial review, the staff prepare a report to the Advisory Committee on Reactor Safeguards discussing their evaluation of the major safety issues that have been identified (the AEC Staff Safety Evaluation Report).

The recommendations of the Committee are submitted by letter to the Commission when its review is concluded. The recommendations of the Committee and the safety evaluation by the Commission are both made public and communicated to the interested State and local officials before the public hearing held by an Atomic Safety and Licensing Board.

Upon receipt of the Advisory Committee's letter on Reactor Safeguards and completion of the staff safety evaluation, a notice of hearing, setting out the issues to be considered, is published in the Federal Register. In an uncontested case the issue to be decided is whether the application and record contain sufficient information and the review of the application by the Commission's regulatory staff has been adequate to support the issuance of a provisional construction permit. If the case is contested, the issue will be whether:

The proposed design has been adequately described and major features for the protection of the health and safety of the public identified;

Any further information required to complete the safety analysis will be supplied;

Any safety features requiring research and development will be subject to a research and development programme;

There is reasonable assurance that any remaining safety questions will be satisfactorily resolved before completion of the construction and that the facility can be constructed and operated without undue risk to the health and safety of the public;

The applicant is technically and financially qualified to construct the reactor;

The granting of a construction permit would be inimical to the common defence and security or to the health and safety of the public.

The notice designates the Atomic Safety and Licensing Board that will conduct the hearing and states procedures by which persons interested can participate in the proceedings, whether as a full party, or only by a limited appearance.

The purpose of the public hearing is to inform the public as well as to develop a record to support the issue of a construction permit by the Commission. In the absence of intervening parties, the parties will be the applicant and the Commission's regulatory staff representing the public interest. Documentary and oral evidence may be presented and the proceedings are intended to be as informal and expeditious as is consistent with the object of the hearing. The Atomic Safety and Licensing Board does not conduct a de novo review of the application, but rather determines whether there are any significant gaps in the consideration of safety measures and in contested cases determines the issue in controversy.

After the Atomic Safety and Licensing Board has issued its decision a party may appeal to the Commission (or in some cases to the Atomic Safety and Licensing Appeal Board) as a matter of right. The Commission reviews the decision and may either accept it, modify it, or send the case back for further consideration.

It is expected that an initial decision on the construction permit can be issued within about 30 days after the hearings are concluded in an uncontested case and within about 65 days in a contested case.

The form of a construction permit will be such as the Commission deems necessary and appropriate, and it may contain conditions and limitations, including technical specifications, as may be appropriate and necessary.

The Commission may specify in the construction permit the period for which the subsequent licence will be issued.

The construction permit will be subject to the following terms and conditions:

The earliest and latest dates for construction will be given;

If construction is not complete by the latest completion date, the permit will expire, subject to extension by the Commission on cause being shown;

On completion of construction the applicant will provide any additional information required;

The construction permit will be subject to the same conditions as the operating licence itself.

(c) Operating licence

When construction of the plant is nearing completion the applicant (repetitions) applies for an operating licence.

The applicant should submit his Final Safety Analysis Report, which includes plans for operation and for coping with emergencies and details of the final reactor design that have not been ready earlier. The Commission's staff and the Advisory Committee on Reactor Safeguard again evaluate and make a public report on the facility. However, a hearing on the operating licence is not held unless required by a party or ordered by the Commission. When the hearing on an application for an operating licence is held, the Commission tries to use the same Board that conducted the construction permit hearing.

The operating licence is granted by the Commission upon finding that:

Construction of the facility has been substantially completed in conformity with the construction permit and the application as amended, the provisions of the Act, and rules and regulations of the Commission;

The facility will operate in conformity with the application as amended, the provisions of the Act, and rules and regulations of the Commission;

There is reasonable assurance that the activities authorized by the operating licence can be conducted without endangering the health and safety of the public, and that such activities will be conducted in compliance with the rules and regulations of the Commission;

The applicant is technically and financially qualified to engage in the activities authorized by the operating licence in accordance with the rules and regulations of the Commission;

The issuance of the licence will not be inimical to the common defence and security or to the health and safety of the public.

The Commission's regulations authorized the issuance of a provisional operating licence when there are features or components on which it appears desirable to obtain operating licence experience before issuance of a full-term operating licence. The provisional operating licence is for a period not to exceed eighteen months. At the end of that term, and following the Regulations Staff review of the conditions of the licence, a full-term licence is issued.

When significant changes in the design or components of the facility become desirable or necessary, they must be reviewed and authorized by the Commission. Similarly, changes in the technical specifications or other conditions of the licence must be reviewed and approved.

These changes may, on some occasions, be sufficiently significant to be reviewed by the Advisory Committee on Reactor Safeguards and for interested persons to be afforded an opportunity to request a hearing on them.

Before facility start-up the Commission must determine that all persons who are to manipulate the controls of the facility are qualified.

The licence is issued by the Atomic Energy Commission in accordance with the provisions of the Act and with such conditions as the Commission may by rule or regulation establish to effectuate the purposes and provisions of the Act.

The licence shall be issued on a non-exclusive basis to an applicant whose proposed activities will serve a useful purpose proportionate to the quantities of special nuclear material or source material to be utilized, who is equipped to observe the appropriate safety standards to protect health and to minimize danger to life or property, and who agrees to make available to the Commission technical information and data concerning licensed activity.

The licence is issued in such form and subject to such conditions and limitations, including technical specifications, as the Commission deems necessary and appropriate.

Each licence will be issued for a fixed period of time to be specified in the licence but in no case to exceed 40 years from the date of issuance.

The Commission may combine in a single licence the activities of an applicant that would otherwise be licensed separately.

Whether the licence expressly states them or not, the following should be deemed to be conditions in every licence:

The licence confers no right to the special nuclear material except as defined in the licence;

The licence or any right thereunder may not be transferred, assigned or disposed of without the Commission's consent in writing;
The licence is subject to suspension in the case of war or national emergency;
The licence is subject to revocation, suspension, modification, or amendment for reasons set out in the Act or Regulations;
The licensee must, at any time before the expiration of the licence, if requested, submit written statements to enable the Commission to determine whether the licence should be modified, suspended or revoked;
No waiver of the antitrust laws is implied;
The licence is subject to the provisions of the Act in effect and to all rules, regulations and orders of the Commission;
No person other than the operator or senior operator licensed as competent under the Act can handle the controls;
A licensed operator or senior operator must be present at the controls at all times during operation;
No alterations constituting a change from the technical specifications should be made, except as authorized by the Commission.

INSPECTION OF NUCLEAR INSTALLATIONS

The Division of Compliance of the Commission carries out a programme of inspection and enforcement to ensure that the installation is constructed and operated in accordance with the appropriate provisions. The frequency of inspections depends on whether the installation is under construction or in operation or on other special considerations. After an operating licence has been issued the installation continues to be subject to regulatory surveillance. The purpose of this is to ensure that it is operated safely and in accordance with the regulations and licence conditions.

In addition to regular inspections, the Commission investigates any significant incident and determines what hazards exist, if any. It also makes sure that the licensee has taken or is taking timely and proper action to protect public health and safety.

Inspections are directed towards five principal areas:

Organization and management
Quality control
Test programmes
Procedures
Plant operation.

Compliance inspection reports serve as the basis for action required to achieve compliance with the Commission's requirements. Action might include the amendment of licences so as to require design changes or changes in the technical specifications, notice of alleged violation, conferences with the management or, if necessary, the shut-down of the installation until some important safety consideration is satisfied.

LIST OF PARTICIPANTS

REGIONAL SEMINAR IN NUCLEAR LAW FOR LATIN AMERICAN COUNTRIES

Rio de Janeiro, 25 - 29 June 1973

PARTICIPANTS

BRAZIL

A. Cabral Simões	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.

CHILE

S. Benadava	Permanent Mission of Chile to the IAEA, Am Lugeck 1/V/18, A-1010 Vienna, Austria

COLOMBIA

G. Sarmiento Gonzalez	Institute of Nuclear Sciences, Apartado Aéreo 8595, Bogotá, D.E.

MEXICO

E. Ortiz Monasterio	National Institute of Nuclear Energy, Avenida Insurgentes Sur 1079, Primer Piso, Mexico 18, D.F.

PARAGUAY

J. Danilo Pecci	National Atomic Energy Commission, Ministry of External Relations, Mcal. Estigarribia 279, Casilla de Correo No.1055, Asunción

PERU

Silvia Romero Mendoza	National Atomic Energy Commission, Paseo de la República 3361, Piso 11-San Isidro, apt. 1687, Lima

VENEZUELA

Mercedes Flores Jimenez	Venezuelan Institute of Scientific Research, Apartado de Correos 1827, Caracas

OBSERVERS

BRAZIL

H.F.S. Bittencourt	Permanent Mission of Brazil to the IAEA, Am Lugeck 1/III/10, A-1010 Vienna, Austria
P.S. de Araújo e Silva Fabião	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
Clotildes do Amaral Linhares	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
Zulita Lindolpho Costa	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
C. Infante Vieira Jr.	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
N. Machado de Faria	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
A. Callegaro Pezzutti	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.

P.R. Noronha da Silveira	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
F.C. Buys Filho	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
Áurea Lustosa	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
Maria R. de Toledo Muller Torres	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.
T. Godinho	National Nuclear Energy Commission, Rua General Severiano, 90-Botafogo, Rio de Janeiro, G.B.

SPAIN

Maria I. Tocino	National Nuclear Energy Commission, Ciudad Universitaria, Madrid 3

IANEC/OAS

A. Sá Pinto de Paiva	National Nuclear Energy Commission, Rua General Severiano, 90-Gotafogo, Rio de Janeiro, G.B.

OPANAL

A. Gonzalez de León	OPANAL, Avenida Morelos 110, Despacho 506, Mexico 6, D.G.

BOLIVIA

M. Zambrana Terán	Consulate General of Bolivia, Rio de Janeiro, Brazil

INVITED EXPERTS

CANADA

J.H.F. Jennekens	Nuclear Plant Licensing, Atomic Energy Control Board, P.O. Box 1046, Ottawa, K1P 5S9

GERMANY, FEDERAL REPUBLIC OF

L.F. Franzen	Institut für Reaktorsicherheit, Glockengasse 2, D-5 Cologne 1

SPAIN

A. de los Santos	National Nuclear Energy Commission, Ciudad Universitaria, Madrid 3

UNITED STATES OF AMERICA

Joanna M. Becker	Office of the General Counsel, Director of Regulation, US Atomic Energy Commission, Washington, D.C. 20545

EUROPEAN INSURANCE COMMITTEE

F. Lacroix	Centre d'Etudes du Risque Atomique, Comité Européen des Assurances, 29 Square de Meeus, Brussels 4, Belgium
A. Campbell Miles	British Insurance (Atomic Energy) Committee, Aldermary House, Queen Street, London EC 4N 1TH, England

SECRETARIAT

R. Stein	Legal Division, International Atomic Energy Agency, Vienna
Ha-Vinh Phuong (Technical Secretary)	Legal Division, International Atomic Energy Agency, Vienna

STUDY GROUP MEETING ON REGULATIONS AND PROCEDURES FOR LICENSING NUCLEAR INSTALLATIONS

Athens, 16 - 29 December 1974

PARTICIPANTS

EGYPT

K. Effat	Atomic Energy Establishment, 101, Kasr El-Eini Street, Cairo

IRAN

M. Sarram	Iran Atomic Energy Organization, P.O. Box 2989, Tehran

MALAYSIA

A. Ramanath	National Electricity Board, P.O. Box 1003, Kuala Lumpur

MEXICO

C. Castillo Cruz	National Institute of Nuclear Energy, Apartado Postal 27-190, Mexico 18, D.F.
R. Mendiola Gomez C.	Federal Electricity Commission, Mexico 18, D.F.
E.Ortiz Monasterio	National Institute of Nuclear Energy, Apartado Postal 27-190, Mexico 18, D.F.

PAKISTAN

M. Nasim	Pakistan Atomic Energy Commission, P.O. Box 1114, Islamabad

PHILIPPINES

G.C. Corpuz	Philippine Atomic Energy Commission, Commonwealth Avenue, Diliman, Quezon City

SINGAPORE

Tay Ah Ong	Ministry of Science and Technology, Government Offices Building, 11th Floor, Kay Siang Road, Singapore 10

YUGOSLAVIA

D. Feretic	Nuclear Power Plant Krśko, Ul. 4, julija 38, 68270 Krśko
Z. Rogel	State Inspectorate of Power Stations, S.R. Slovenia, Gregorćićeva 24, 61000 Ljubljana

GREECE

N. Chrysochoides	Reactor Department, Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
C. Mitsonias	Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
C. Papastergiou	Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
G. Papadatos	Administrative and Technological Branch, Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
Susan Danali	Environmental Radioactivity Laboratory, Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
A. Hadjiantoniou	Health Physics Department, Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki

N. Papadopoulos	Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
J. Antoniades	Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
S. Tsialas	Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
S. Amarantos	Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
J. Kontoleon	Electronics Department, Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
Nadia Kontoleon	Reactor Department, Demokritos Nuclear Research Center, Aghia Paraskevi, Attiki
S. Panopoulos	Legal Division, Public Power Corporation, Arakovis 32, Athens
D. Christophilopoulos	Nuclear Power Stations Division, Public Power Corporation, Arakovis 32, Athens
E. Sakellaropoulou (Miss)	Nuclear Power Stations Division, Public Power Corporation, Arakovis 32, Athens
J. Karangelos	Nuclear Power Stations Division, Public Power Corporation, Arakovis 32, Athens
J. Brunning-Goggin	Public Power Corporation, Arakovis 32, Athens

INVITED EXPERTS

CANADA

J.H.F. Jennekens	Nuclear Plant Licensing, Atomic Energy Control Board, P.O. Box 1046, Ottawa, K1P 5S9

GERMANY, FEDERAL REPUBLIC OF

H.-P. Butz	Institut für Reaktorsicherheit, Glockengasse 2, D-5 Cologne 1

UNITED KINGDOM

W.S. Gronow	Nuclear Installations Inspectorate, Department of Energy, Thames House South, Millbank, London SW1P 4QJ

UNITED STATES OF AMERICA

T.F. Engelhardt	Office of the General Counsel, US Atomic Energy Commission, Washington, DC 20545

OECD/NEA

P. Strohl	OECD Nuclear Energy Agency, 38, Boulevard Suchet, F-75016 Paris
P. Reyners	OECD Nuclear Energy Agency, 38, Boulevard Suchet, F-75016 Paris
Y. Tajima	OECD Nuclear Energy Agency, 38, Boulevard Suchet, F-75016 Paris

SECRETARIAT

Ha-Vinh Phuong (Technical Secretary)	Legal Division, International Atomic Energy Agency, Vienna

M. Rosen
Division of Nuclear Safety and Environmental Protection,
International Atomic Energy Agency,
Vienna

C.N. Welsh
(Editor)
Division of Publications,
International Atomic Energy Agency,
Vienna

HOW TO ORDER IAEA PUBLICATIONS

Exclusive sales agents for IAEA publications, to whom all orders and inquiries should be addressed, have been appointed in the following countries:

UNITED KINGDOM	Her Majesty's Stationery Office, P.O. Box 569, London SE 1 9NH
UNITED STATES OF AMERICA	UNIPUB, Inc., P.O. Box 433, Murray Hill Station, New York, N.Y. 10016

In the following countries IAEA publications may be purchased from the sales agents or booksellers listed or through your major local booksellers. Payment can be made in local currency or with UNESCO coupons.

ARGENTINA	Comisión Nacional de Energía Atómica, Avenida del Libertador 8250, Buenos Aires
AUSTRALIA	Hunter Publications, 58 A Gipps Street, Collingwood, Victoria 3066
BELGIUM	Service du Courrier de l'UNESCO, 112, Rue du Trône, B-1050 Brussels
CANADA	Information Canada, 171 Slater Street, Ottawa, Ont. K 1 A OS 9
C.S.S.R.	S.N.T.L., Spálená 51, CS-110 00 Prague Alfa, Publishers, Hurbanovo námestie 6, CS-800 00 Bratislava
FRANCE	Office International de Documentation et Librairie, 48, rue Gay-Lussac, F-75005 Paris
HUNGARY	Kultura, Hungarian Trading Company for Books and Newspapers, P.O. Box 149, H-1011 Budapest 62
INDIA	Oxford Book and Stationery Comp., 17, Park Street, Calcutta 16
ISRAEL	Heiliger and Co., 3, Nathan Strauss Str., Jerusalem
ITALY	Libreria Scientifica, Dott. de Biasio Lucio "aeiou", Via Meravigli 16, I-20123 Milan
JAPAN	Maruzen Company, Ltd., P.O.Box 5050, 100-31 Tokyo International
NETHERLANDS	Marinus Nijhoff N.V., Lange Voorhout 9-11, P.O. Box 269, The Hague
PAKISTAN	Mirza Book Agency, 65, The Mall, P.O.Box 729, Lahore-3
POLAND	Ars Polona, Centrala Handlu Zagranicznego, Krakowskie Przedmiescie 7, PL-00-068 Warsaw
ROMANIA	Cartimex, 3-5 13 Decembrie Street, P.O.Box 134-135, Bucarest
SOUTH AFRICA	Van Schaik's Bookstore, P.O.Box 724, Pretoria Universitas Books (Pty) Ltd., P.O.Box 1557, Pretoria
SPAIN	Nautrónica, S.A., Pérez Ayuso 16, Madrid-2
SWEDEN	C.E. Fritzes Kungl. Hovbokhandel, Fredsgatan 2, S-103 07 Stockholm
U.S.S.R.	Mezhdunarodnaya Kniga, Smolenskaya-Sennaya 32-34, Moscow G-200
YUGOSLAVIA	Jugoslovenska Knjiga, Terazije 27, YU-11000 Belgrade

---

Orders from countries where sales agents have not yet been appointed and requests for information should be addressed directly to:

Publishing Section,
International Atomic Energy Agency,
Kärntner Ring 11, P.O.Box 590, A-1011 Vienna, Austria