SPAIN

Convention on Nuclear Safety

First National Report

September 1998

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Introduction

Presentation of the report

The present document is the first national report submitted by Spain in compliance with the obligations of the Convention on Nuclear Safety drawn up in Vienna on 20th September 1994. This Convention was signed by Spain on 15th October 1994 and ratified by way of an instrument issued by the Ministry of Foreign Affairs and signed by H.M. the King on 19th June 1995.

The Convention came into force on 24th October 1996, following ratification by a minimum number of countries, in accordance with the stipulations of articles 20, 21 and 22.

The report is scheduled to be reviewed during the first Review Meeting, to be held in April 1999, as stipulated in articles 20, 21 and 22.

Preparation of the document has been coordinated by the Nuclear Safety Council, an organization independent of Government which reports to Parliament and undertakes responsibility for Nuclear Safety and Radiation protection in the Spanish State. Other organizations of the Spanish Administration and representatives of the Spanish Electricity Sector have also participated in reviewing the document.

The report has been drawn up following the same structure as the articles of Chapter 2 of the Convention, beginning with article 6. Each article includes the information considered to be relevant, taking into account the contents of the article itself and the "Guidelines regarding national reports under the Convention on Nuclear Safety" and established by the Contracting Parties in compliance with article 22. At the end of each article there is a brief assessment of the degree of implementation of obligations by Spain.

The Spanish nuclear program

Nuclear energy was introduced in Spain at a very early date. In 1958 the JEN-1 research reactor was started up at the Nuclear Energy Board, which had been created in 1951 as the centre for research and development of Nuclear Technology in Spain.

A distinction may be made between various stages in the subsequent development of Spanish nuclear energy. The first covers the period up to 1972, the year in which the Vandellós I nuclear power plant was started up, this being the last of the first generation of plants, made up of the Westinghouse designed José Cabrera PWR plant, the Stª Mª de Garoña BWR plant, designed by General Electric and Vandellós 1 itself, a French designed graphite-moderated, gas-cooled natural uranium plant. This initial stage was characterized by a diversity of designs, the objective being for Spain to assimilate the different technologies and for national industry to have a limited participation in development.

During the period in which the first generation plants were being developed, the planning of electricity production in Spain was accomplished by way of the so-called National Energy Plans (PEN), which were approved by Government. The 1970 PEN estimated a development of production capacity which led to the conclusion that a large number of nuclear power plants would need to be built up to the first half of the 1980's.

During the second stage, from 1972 to 1984, the second generation plants were designed, constructed and commissioned: the two units of Almaraz NPP and the two of Ascó NPP, all PWR groups designed by Westinghouse, and the Cofrentes NPP, a General Electric BWR plant. This second stage was characterized fundamentally by consolidation of the developments achieved during the first generation and by a significant increase in national participation in the projects.

Also part of this second generation was the Lemóniz nuclear power plant, with two Westinghouse designed PWR units, which never started up. Construction of this plant was halted in 1982, and in 1994 the project was definitively abandoned and the Construction license issued to the licensee ran out.

In parallel to the construction of the second generation plants there were revisions of electricity production estimates in Spain, through the different PEN's. As a result, the 1983 PEN included only the finishing of the Vandellós 2 and Trillo 1 plants, the projects for the General Electric two-unit Valdecaballeros BWR plant, which was in an advanced phase of construction, and the Trillo 2 plant, which had not yet been started, being abandoned. This situation was definitively consolidated with the cancellation of both projects in 1994.

The third stage of development took place between 1984 and 1988, and culminated with the start-up of the third generation plants: Vandellós 2 and Trillo, both PWR plants designed by Westinghouse and KWU respectively.

At the same time as the Spanish plants were being built, there was considerable development of the industries related to nuclear technology, major engineering companies and companies involved in component manufacturing and supply, radioactive waste management and services. In practical terms, this important development led to an increasing degree of national participation in the projects for the successive generations of plants. In the case of the third-generation plants, this participation exceeded 80% of the total cost.

In 1989, a fire broke out in the turbine-generator set of the Vandellós 1 plant, causing important damage to the installation. The plant's operating permit was definitively suspended in 1990.

The final stage, which began in 1990, is characterized by a lack of new construction projects for nuclear installations in Spain, by the beginning of dismantling of the existing installations and by an increase in activities aimed at solving problems associated with the management of radioactive wastes.

The Electricity Industry Law, 54/1997, was promulgated in 1997. This Law establishes the economic deregulation of electricity production activities and introduces the principle of open competition in electricity generation and commercialization. From now on, decisions regarding the type of plants to be installed in Spain will be adopted strictly on the basis of business criteria, without the intervention of the authorities.

Nuclear Safety in Spain

The development of nuclear technology in Spain and the construction of the country's nuclear plants led to the development of nuclear safety. The Nuclear Energy Board was created in 1951, and in 1958 the Nuclear Safety Advisory Commission was set up. Both organizations channeled Nuclear Safety-related activities at national level throughout the sixties and seventies.

During that initial stage there was no clear separation between activities relating to Nuclear Safety and those associated with the promotion and development of nuclear technology. Both types of activities co-existed within the framework of the functions commissioned to the Nuclear Energy Board.

One result of this initial activity was the passing, in 1964, of the Nuclear Energy Act, which defined and established the basic principles of Nuclear Safety and Radiation Protection and structured the procedure for the licensing of installations in Spain.

The Nuclear Energy Act was subsequently developed by the Regulations governing Nuclear and Radioactive Installations, approved in 1972, and the Regulations governing Protection against Ionizing Radiations, promulgated in 1982.

The early approval of the Nuclear Energy Act did not, however, lead to the development of a complete set of standards governing Nuclear Safety and Radiation protection in Spain. Regulation of plant design, construction, start-up and operating activities was carried out on a case-by-case basis, depending on the conditions established in the different licenses.

These licenses included the application of the standards in force in the countries of origin of the plant technologies, and introduced the concept of the reference plant. In this way, the Spanish plants were provided with characteristics, structures, systems and components analogous to those of the plants in the countries of origin of the technology, approved by the corresponding regulatory authorities. As a result, there has been an important degree of learning and assimilation by both the Spanish industry and the regulatory authorities of the standards in force in the countries of origin of the plants, and especially of those developed in the USA. Another important source of knowledge and experience of Nuclear Safety and Radiation protection has been Spain's participation in international organizations, especially the United Nations International Atomic Energy Agency and the OECD Nuclear Energy Agency, as well as bilateral cooperation with the organizations and institutions of other countries.

A fundamental milestone in the development of nuclear safety in Spain was the establishment in 1980 of the Nuclear Safety Council as the organization responsible for Nuclear Safety and Radiation protection, fully independent from the development and promotion of the use of nuclear energy.

From the technical point of view, mention should be made of three milestones which have been especially representative because of their influence on the development of Nuclear Safety in Spain: the accident at the Three Mile Island 2 nuclear power plant (USA) in 1979, the Chernobyl accident in 1986 and the publication, in 1975, of the Reactor Safety Study, which gave rise to the introduction of the probabilistic methodology for quantification of the risk and safety of the installations.

Chapter 2. Obligations

a) General provisions

Article 6. Existing nuclear installations

6.1 General description

The nuclear power plants which are currently in the operating or dismantling phase correspond to the three different generations that make up the Spanish nuclear program:

- **1st Generation**. Plants designed during the 1960's and whose construction was completed at the end of that decade or the beginning of the 1970's. The José Cabrera plant, which started up in 1968, the Santa María de Garoña plant, which went into operation in 1971, and the Vandellós I plant, which started up in 1972 (and has now been definitively shut down), belong to this generation.
- **2nd Generation**. Plants designed at the beginning of the 1970's and whose construction was initiated at that time with a view to starting operation at the end of the decade. Delays in the construction of these plants led to the first (Almaraz I) not entering commercial operation until 1981, and the last (Cofrentes) not starting up until 1984. The plants that make up this generation are Almaraz I and II, Ascó I and II and Cofrentes.
- **3rd Generation**. Plants whose construction was authorized following the approval of the National Energy Plan in July of 1979. Designed at the end of the 1970's, the construction of these plants began in 1979. Start-up of the plants that make up this generation, Vandellós II and Trillo I, began at the end of 1987 (Vandellós II) and the middle of 1988 (Trillo I).

The projects for the Lemóniz I and II, Valdecaballeros I and II and Trillo II Nuclear Power Plants were cancelled. All these plants had received their Construction license, and the first four groups mentioned were in a very advanced stage of construction.

Appendix 6.A includes a table showing the existing plants and their most relevant data as of December 1997, in accordance with the definition included in article 2 of the Convention.

The following sections briefly summarize the most outstanding aspects of the operating history of the plants currently in operation, and the corrective measures adopted as part of the on-going process of nuclear safety review and supervision.

First generation Nuclear Power Plants

The Nuclear Power Plants of the first generation, with more than twenty years of commercial operation, were designed and built in accordance with the criteria imposed by the standards in force when they were designed.

Technology development has made it possible to introduce successive modifications and improvements. This has meant that, in the same way as has been the case for similar plants built during the same period in other countries, the three first generation plants have undergone an on-going process of evaluation and review, that continues today. As an example of the above, mention might be made of the Systematic Evaluation Program designed by the United States Nuclear Regulatory Commission for application to US plants which, due to their age, did not meet the requirements currently demanded by the standards, the aim being to bring them up to date. This program has been applied to the Spanish José Cabrera, Santa Mª de Garoña and Vandellós plants (the last until it was definitively shut down).

a) The **José Cabrera** Nuclear Power Plant, with thirty years of commercial operation, was the first to enter operation in Spain, and also the first to apply the Systematic Evaluation Program (SEP). The first phase of improvements was performed during the outage initiated on 18th October 1982, which lasted until 22nd December 1983. The second phase was carried out during the shutdown that lasted from 28th January 1985 to 25th October of that year. Subsequently, other improvements have been made to the plant and certain main components have been replaced.

The aforementioned modifications and improvements having been made, the Plant currently has safety levels comparable to those plants which entered operation at a later date and which incorporate more up-to-date technology (2nd and 3rd generation plants).

The following may be considered as being the most significant events that have occurred during the operation of this Plant:

- The appearance of defects in the fuel, resulting from vibrations due to free movement of the core support plates. This was finally solved by modifying the internals to reverse the direction of flow between the core barrel and these plates, in 1991.
- The discovery in 1994 of stress corrosion cracking in the reactor vessel head penetrations, caused by the ingress of resins containing corrosive products to the primary circuit. Following the repair of these penetrations, the Plant operated for one cycle, until the vessel head was replaced during the 1997 refueling outage.

b) The **Santa María de Garoña** Nuclear Power Plant, with twenty-seven years of commercial operation, was also subjected to a Systematic Evaluation Program (SEP). The first phase was performed during the last four months of 1983, lasting until 26th January 1984. The second phase of modifications was initiated on 29th June 1985, and completed in January 1986. The majority of the modifications were concluded during the outage that lasted from 25th April to 3rd August 1987.

Subsequently, improvements have been made to the Plant, the most significant being those carried out in relation to Fire Protection and the installation of a remote shutdown panel.

With these modifications and enhancements, the Plant now has safety levels comparable to those of Plants entering operation at a later date (2nd and 3rd generation).

The following may be considered as being the most significant events that have occurred during the operation of the Plant:

- Replacement of the fuel type due to defects in the original fuel producing higher releases of radioactivity than foreseen. This replacement, along with the modification and improvement of the gaseous and liquid waste treatment system, led to a significant reduction of the Plant's radioactive effluents.
- The installation of mechanical seals to prevent the leakage that had been detected in the control rod drive mechanisms.
- Problems of intergranular corrosion in the recirculation lines, which were partially replaced during the 1985 outage.
- Detection of cracking in the reactor shroud horizontal welds and complete repair of this component in 1997.

c) The **Vandellós I** Nuclear Power Plant started operation in 1972. This plant experienced a serious fire in 1989, which arose in the conventional part of the facility (turbine building) and affected plant safety-related equipment. The plant owners decided to definitively close it, and the decommissioning program was approved on 28th January 1998. Consequently, in accordance with article 2, this installation is beyond the scope of the Convention.

Second generation Nuclear Power Plants

The Nuclear Power Plants belonging to the second generation were designed and constructed in accordance with the regulations already in place in Spain, with the guidelines and standards proposed by the International Organizations to which Spain belongs and with the standards in force in the country of origin of the plant design (The United States for all the second generation plants).

Consequently, during their construction period these plants followed the evolution of the reference plants in the United States and the new devices or modifications arising in the project as a result of the studies performed were incorporated. More especially, the recommendations issued as a result of analysis of the Three Mile Island accident were incorporated, to the extent that they were incorporated into the US plants.

a) The **Almaraz** Nuclear Power Plant has two units, the first of which was coupled to the grid on 1st May 1981. During the nuclear testing period vibration-induced wear was detected in the steam generator tubes, in the area of the preheater. This problem caused the Plant to be shut down and subsequently operated at reduced power (50%). Once the problem was solved, the Plant returned to full power operation (100%) on 2nd August 1983.

Unit II, which was coupled to the grid on 8th October 1983, already incorporated the modifications made in response to the problem of steam generator tube wear.

The two units of the Almaraz nuclear power plant are twin units which shared safety-related systems by design. This situation led to an analysis of the availability of these systems and of its effect on plant safety. As a result of this analysis a new emergency diesel generator was incorporated and important efforts were made to physically separate the safety-related systems, fundamentally those in the control and turbine buildings.

The following events have also taken place:

- Differential setting of the fuel buildings of the two units, resulting from geotechnical problems in the surrounding ground.

  In relation to this phenomenon, a mixture of bentonite and cement was injected beneath the foundation slab and the water table was controlled, these solutions having proven to be efficient in halting the problem.

- Intergranular corrosion of the steam generator tubes, this persisting until the steam generators of both groups were replaced in 1996 and 1997.

b) The **Ascó** Nuclear Power Plant has two units. The First was coupled to the grid on 29th August 1983, and the second in October 1985. In both units modifications identical to those performed at Almaraz were incorporated prior to start-up, in order to solve the problems in the steam generator preheaters.

The following are the most significant events that have taken place:

- Lifting of the terrain underlying unit II as a result of expansive clays. The studies performed and the intensive on-going monitoring of this phenomenon ensure that the safety of the facility is not affected, nor will be in the future.

- Intergranular stress corrosion of the steam generator tubes, this being solved by replacement of these components in both units, in 1995 and 1996.

c) The **Cofrentes** Nuclear Power Plant has a single unit and has been in commercial operation for fourteen years. The plant has a boiling water reactor providing an electrical output of 1,025.4 MW. Power upgrading of the plant with respect to the initially licensed level was authorized, to 102% in March 1988 and 104.2% in October 1997.

There have been no significant safety-related events worth mentioning during the operation of this plant.

Third generation Nuclear Power Plants

The third generation Nuclear Power Plants are those which were licensed after approval of the National Energy Plan in July 1979.

a) The **Vandellós II** Nuclear Power Plant has been in commercial operation for eleven years. It has a pressurized water reactor and an electrical output of 1,009 MW. There have been no significant events worth mentioning during the operation of this plant.

b) The **Trillo** Nuclear Power Plant was originally designed to have two units. Unit I has been in commercial operation for eleven years. Unit II was stopped by the National Energy Plan in 1983 and its construction was never initiated.

Trillo I is the only Spanish plant with German technology. It has a pressurized water reactor and an electrical output of 1,066 MW.

Operation of the plant has progressed without significant events. However, in January 1995 the plant owner initiated a general review program known as the Operating Experience and Systems Analysis (OESA) due to the discovery of certain deficiencies in the design, which had not been identified during start-up or subsequent periodic testing. This program was completed in March 1998. As a result, the identified deficiencies are being corrected and various improvements have been made throughout the program with a view to updating the plant, a process which will be completed during the next refueling outage, scheduled for January 1999.

6.2 Plant safety assessment

From the beginning of operation of the Spanish nuclear power plants, there have been continuous safety review programs aimed at maintaining the levels of safety required by the respective plant authorizations and at improving these levels in keeping with technological advances and the new requirements of the standards.

The following warrant special mention as specific indications of this safety review policy:

- Systematic review of the safety of the first generation plants, carried out at the beginning of the 1980's in order to take into account the changes that had occurred in the standards since start-up of these plants.

  This review led to important improvements to the safety systems of the José Cabrera NPP (designed and performed during the period 1981-1985) and the Sta. Mª de Garoña plant (designed and performed during the period 1983-1986).

- Continuous review of nuclear safety during plant operation, through the following:
  - Performance of the CSN inspection and control function
  - Evaluation of the periodic analyses required to the plant operators in relation to analysis of the applicability of new standards (six-monthly report)
  - Analysis of domestic and overseas operating experience (annual report)
  - Analysis of the safety of design modifications (six-monthly report).

- Performance of safety review and updating programs, with special emphasis on the Integrated Program for the performance of level 1 and level 2 PSA's for all the Spanish plants. During the implementation of this program, which was established in 1986 and revised in 1998, various vulnerabilities have been identified and corrected at the different plants, as a result of which their safety has been significantly improved. At present, with the level 1 and 2 PSA's having been practically completed for all the plants, we are in a position to achieve new benefits from these analyses, through applications to various aspects of operation, this being specifically dealt with in the 1998 revision of the Integrated PSA Program.

The following are other significant on-going programs:

- Implementation of measures for the management of severe accidents.
- Implementation of a new systematic approach to maintenance, based on risk and performance.
- Maintenance of design bases and updating of the Safety Analysis Report.
- Enhanced training for operations personnel.
  - Definition and application of Lifetime Management Programs for all the nuclear power plants, with the dual objective of:

    - ensuring surveillance and control of the ageing of important components, in order to ensure their safe operation throughout the design lifetime of 40 years
    - leave the possibility of extending plant lifetime beyond 40 years technically ready and open.
- Establishment of a Periodic Safety Review Program (PSR) for all the plants every ten years, with a view to implementing the continuous review to which they are subjected. The areas to be covered in these reviews are as follows:
    - Operating experience.
    - Analysis of equipment behaviour
    - Analysis of the impact of changes in the standards.
    - Updating of the status of safety evaluation and enhancement programs.

PSR's have been requested from all the Spanish nuclear power plants with the exception of Trillo NPP, which has carried out a complete review of its design bases and operating experience within the framework of its OESA Program. A Review will be requested of this plant in the near future. The reports for each plant will be submitted between 1998 and 2001, one year before expiry of the corresponding provisional operating licenses, and their assessment will be an important element in determining renewal of these permits and their duration.

6.3 Operating lifetime for Spanish Nuclear Power Plants

The levels of safety achieved as a result of the analyses and modifications performed, along with the process of continuous safety review to which the Spanish plants are subjected, do not require the drawing up of plans for their closure, for safety reasons, prior to the end of their design lifetime. The mechanisms for review established will indicate if at any time it is necessary to bring forward the shutdown of any of the plants with respect to their expected lifetime.

6.4 Degree of implementation of the obligations

From the information included in the present article it may be concluded that the Spanish nuclear power plants were subjected to an exhaustive safety examination during licensing. Since their construction, modifications have been performed to enhance and update plant safety and the facilities are permanently subjected to a continuous process of safety review which leads to the establishment of specific safety enhancement programs in relation to various aspects.

In view of the levels of safety obtained as a result of the analyses and modifications performed and of the process of on-going safety review to which the Spanish plants are subjected, these plants are considered to suitably comply with what is established in this article. Consequently, there is considered to be no urgent need for new safety examinations or modifications, nor for plans for plant closure for reasons of safety prior to the end of their design lifetime.

APPENDIX 6.A

Existing Nuclear Power Plant

Basic nuclear power plant characteristics

	José Cabrera	Almaraz	Ascó	Vandellós II	Trillo	Garoña	Cofrentes
Type	PWR	PWR	PWR	PWR	PWR	BWR	BWR
Thermal power (MW)	510	2x2,696	2x2,696	2,775	3,010	1,381	3,015
Electrical output (MW)	160	U-1:973 U-2:982	U-1:973 U-2:966	1,009	1,066	460	1,025.4
Vendor	Westinghouse	Westinghouse	Westinghouse	Westinghouse	Siemens-KWU	General Electric	General Electric
Cooling	Mixed: River Tajo and Towers	Open: Arrocampo reservoir	Mixed: River Ebro and Towers	Open: Mediterranean	Closed: Towers supplied by River Tajo	Open: River Ebro	Closed: Towers supplied by River Júcar
Number of units	1	2	2	1	1	1	1
Preliminary license Units I/II	27-03-63	29-10-71 23-05-72	21-04-72 21-04-72	27-02-76	04-09-75	08-08-63	13-11-72
Construction license. Units I/II	24-06-64	02-07-73 02-07-73	16-05-74 07-03-75	29-12-80	17-08-79	02-05-66	09-09-75
Operating license. Units I/II	11-10-68	10-13-80 15-06-83	22-07-82 22-04-85	17-08-87	04-12-87	30-10-70	23-07-84
Year of saturation of spent fuel pools. Units I/II	2015	2021 2023	2012 2013	2010	2002	2013	2011

b) Legislation and regulations

Article 7. Legislative and regulatory framework

The Spanish legal system relating to nuclear energy was implemented at a very early date through the development in 1964 of the Nuclear Energy Act, which establishes and defines safety principles or criteria, and details the procedures to be applied in obtaining or withdrawing the necessary administrative authorizations, establishing also mechanisms for inspection and evaluation to check that the plant owners meet the requirements established in the legal and regulatory standards and in the authorizations themselves.

The Nuclear Energy Act established that the Nuclear Energy Board (JEN), created in 1951 and reporting to the Ministry of Industry and Energy, would be responsible for verifying correct compliance with the standards in force and with the conditions imposed in the licenses in relation to nuclear safety and radiation protection.

The JEN was gradually broken up with the establishment of the following:

- ENUSA, in 1971, which undertook responsibility for aspects relating to the front end of the fuel cycle;
- The CSN, in 1980, which became the organization responsible for regulatory aspects and for the control and inspection of nuclear installations;
- ENRESA, in 1984, for aspects relating to the management and disposal of radioactive wastes.

The Nuclear Safety Council (CSN) was established by Law 15/1980 and defined as the sole competent Organization in the areas of nuclear safety and radiation protection, thus effectively separating activities relating to the promotion and development of nuclear energy (which continued to depend on the JEN) from control, evaluation and inspection activities, which were undertaken by the CSN. In 1986 the JEN became the Centre for Energy-Related, Environmental and Technological Research (CIEMAT).

The regulations in force also establish the responsibilities of the owners or operators of nuclear installations or activities in relation to nuclear damage, establishing a system of indemnities that correspond to International Treaties and Conventions in this area.

In the development of this basic system, various regulations were drawn up, among them the 1972 Decree governing Nuclear and Radioactive Installations and the 1992 Decree governing Protection for the Public and Workers against the Risks of Ionizing Radiations, which replaced the regulations issued in 1982 and 1987 in these same areas.

7.1 Main legal and regulatory provisions governing nuclear safety

7.1.1 Laws

Nuclear Energy Act (Law 25/1964, of 29th April)

Law 25/64 on nuclear energy has regulated the development and control of nuclear energy in Spain since its publication in 1964. This Act introduced and defined the basic concepts described below:

- *Identification of responsible authorities.* The Act established the Ministry of Industry and Energy as the authority responsible for managing the law, and the Nuclear Energy Board, now the Nuclear Safety Council, as the technical institution competent in this matter.
- *Licensing process for nuclear and radioactive installations and the use of radioactive material.* The Act established the circumstances leading to the need for a license or specific permit for the development and use of radioactive material, radiation sources and nuclear fuel. It also established the system for inspection and control, which was assigned to the Nuclear Energy Board, now the Nuclear Safety Council.
- *Measures for safety and protection against ionizing radiations.* The law acknowledged the risks associated with ionizing radiations and declared that installations and activities subject to authorization must be operated without undue risk to the health and safety of the workers and the general public.
- *Civil liability derived from nuclear damage.* The law admitted that, in spite of preventive safety measures, nuclear damage to third parties may occur. This damage must be covered by insurance policies and through Government intervention if necessary.
- *Faults, penalties and administrative sanctions.* The law is very strict regarding the faults, penalties and sanctions due to the inappropriate use of radioactive materials and radiation sources, particularly if this results in the death or injury of people.

All the concepts described above are developed in detail in the regulations for the different applications.

Law establishing the Nuclear Safety Council (Law 15/1980, of 22nd April)

This Law establishes the Nuclear Safety Council as the sole competent Authority for nuclear safety and radiation protection, independent from Government and from the rest of the Administration and in charge of performing the necessary inspections and assessments of nuclear installations to ensure the aforementioned safety and protection.

Through this Law the CSN undertook all functions relating to nuclear safety and radiation protection previously assigned to the JEN; in addition, the Law:

- establishes the areas of competence of the Council;
- establishes that the CSN shall be accountable to the upper and lower Houses of the Spanish Parliament, to which it shall report every six months;
- defines the collegiate structure of the CSN;
- defines the way in which the Council Members shall be appointed,

- establishes the system for the adoption of agreements;
- creates the Technical Body for Nuclear Safety and Radiation protection;
- identifies which authorities shall impose penalties and determines the amount of such penalties

This Law also establishes the fee to be applied for the rendering of services, by which financing of the CSN is assured (see Art. 8).

Electricity Industry Law (Law 54/1997, of 27th November)

This Law regulates the operation of the electricity industry and is also applicable in certain areas to the nuclear industry, since its additional Provisions contain modifications to the Nuclear Energy Act of 29th April 1964 and the Law establishing the Nuclear Safety Council of 22nd April 1980.

The Electricity Industry Law introduces a new legal framework for faults and penalties in relation to nuclear energy, replacing that previously regulated under Chapter XIV of the 1964 Law. It also modifies the coverage required in relation to civil liability for nuclear damage, which now amounts to 25,000 million pesetas. In addition, it refers to the functions of the Nuclear Safety Council, assigning this Organization a stronger role in the procedure of penalties and allowing it to propose the application of such penalties to the owners of nuclear installations which might have committed the violations specified in the Legislation in force.

7.1.2 Regulations

Of lower standing than the laws are a series of provisions approved by the Government or the Administration which complete and clarify the requirements established by Law.

The following are the most significant regulations:

Decree governing Nuclear and Radioactive Installations (approved on 21st July, 1972)

The objective of this regulation is to specify the system for the licensing of nuclear installations, in development of what is established by the Nuclear Energy Act.

Specifically, the siting, construction, erection, start-up and operation of nuclear installations, and the manufacturing in Spain of devices, equipment or accessories used specifically for nuclear or radioactive applications, are activities subject to authorization by the Ministry of Industry and Energy, following a report by the Nuclear Safety Council.

Decree governing Protection of the Public and Workers against the risks of ionizing radiations (approved on 24th January, 1992)

This regulation includes the basic criteria and measures for radiation protection, as established in the Directives issued by the EURATOM Board in relation to this matter (specifically Directives 80/836 and 84/467, currently revised by way of Directive 96/29).

Decree governing the Coverage of Nuclear Risk (approved on 22nd July, 1967)

This regulation develops the Nuclear Energy Act in relation to the responsibility of the operator, establishing the system providing coverage of such responsibility.

Royal Decree 413/1997, of 21st March, governing the occupational protection of off-site workers potentially exposed to ionizing radiations due to their intervention in the controlled zone

The objective of this regulation is to transpose the contents of EURATOM Directive 90/641, which regulates the obligations of the operator, in order to ensure the protection of all persons intervening in the controlled zones of nuclear installations.

Order of 29th March 1989, publishing the Agreement reached by the Cabinet on 3rd March 1989 approving the Basic Nuclear Emergency Plan

This regulation defines the coordinated action of the different Public Organizations in the event of a nuclear accident. It also establishes the different levels of authority and competence throughout the entire national territory in the event of a nuclear emergency. It defines the emergency plans for each province in which there is a nuclear installation. Article 16 details the contents of the Basic Nuclear Emergency Plan.

Statute of the Nuclear Safety Council (approved by Royal Decree 1157/1982, of 30th April)

This regulations approves the organization and operation of the Nuclear Safety Council, its legal and contracting systems and the statute applicable to its personnel.

7.1.3 Non-binding provisions: Nuclear Safety Council (CSN) Safety Guides

The CSN issues *Safety Guides*, which contain methods recommended by the CSN from the point of view of nuclear safety and radiation protection, the aim being to facilitate application of the Spanish nuclear regulations in force.

These guides are not binding. The user may apply methods and solutions different from those contained in the guides, as long as they are duly justified.

The Safety Guides are currently classified in Sections corresponding to the main areas of competence of the CSN. These Sections are as follows:

- Section 1: Power Reactors and Nuclear Power Plants
- Section 2: Research Reactors and Sub-Critical Assemblies
- Section 3: Fuel Cycle Installations
- Section 4: Environmental Radiological Surveillance
- Section 5: Radioactive Installations and Equipment
- Section 6: Transport of Radioactive Materials
- Section 7: Radiation protection
- Section 8: Security
- Section 9: Waste Management
- Section 10: Miscellaneous

Appendix 7.A lists the Guides published to date.

7.2 Nuclear Installations Licensing System

In keeping with the stipulations of the Regulations governing Nuclear and Radioactive Installations, there are three permits or administrative licenses required prior to the start-up of a nuclear Installation. These are the "preliminary license", the "construction permit" and the "commissioning license". Each and every one of these authorizations must be duly applied for by the operator at the moment established in the regulations.

a) Preliminary License

The preliminary license is official recognition of the proposed objective and of the site selected, and subsequently allows the interested party to apply for the construction license.

Applications for the preliminary license require the following documents:

- Declaration of the needs for the installation and their justification;
- Description of the basic elements that make up the installation, along with basic information on the latter;
- Preliminary economic study, in relation to foreseen financial investments and costs;
- Description of the selected site;
- Preliminary scheme of the foreseen organization for supervision of the project and quality assurance during construction.

The Administration will agree on a period for public information, publishing (in the Official State Gazette and in other official nationwide Bulletins of lower rank) an announcement indicating the objective and main characteristics of the installation, such that within the next 30 days those individuals and Organizations which feel themselves to be affected by the project may present whatever allegations they deem to be fit.

During this process, the Nuclear Safety Council will receive a copy of all the documentation submitted by the future owner of the facility, and will issue a preliminary technical judgement on the safety of the scheduled installation.

On reception of this judgement by the Nuclear Safety Council, the competent Administration (Ministry of Industry and Energy) will adopt the appropriate resolution, awarding or denying the "Preliminary license". This permit is dealt with in greater detail in the section on article 14.

b) Construction permit

In applying for a construction permit, the owner is required to submit new documents, among which the Regulations include the following:

- General design of the installation
- Equipment delivery schedule
- Budget, financing, performance schedule and technical collaboration scheme
- Economic study of the market, repercussions and effects of operation.
- Preliminary safety analysis report, including the following:
    - Description of the site and surrounding area, with accurate data on its topographic, hydrographic, hydrogeological, seismotectonic, meteorological and demographic

characteristics, along with the types of crops, established industries and any other data which might contribute to better knowledge of the site.

- Description of the installation, including the criteria applied in designing safety-related components or systems.
- Justification of the absence of undue risk for the public during normal operation of the installation.
- Analysis of anticipated accidents and their consequences.
- Organization foreseen by the applicant for supervision of the project and quality assurance during construction.
- Organization foreseen for the future operation of the installation and preliminary training scheme for operating personnel.
- Administrative authorizations to be issued by the competent Ministerial Departments and Bodies, or documents accrediting application thereof with all the necessary requirements.

The Nuclear Safety Council will receive a copy of the documentation submitted and will issue the mandatory report referred to above.

In its Resolution regarding the "Construction Permit" the competent Administration will establish conditions relating to the following:

- ❑ Identification of responsible operator;
- ❑ Precise definition of the installation and its site;
- ❑ Performance schedule;
- ❑ Minimum percentage of participation by national industry in the supply of items and equipment
- ❑ Guarantees to be provided by the responsible operator with respect to civil liability for third-party damages which might arise as a result of a nuclear accident, as established in the Decree governing the Coverage of Nuclear Risk, approved on 22nd July, 1967;
- ❑ The need for nuclear research and personnel training programs.
- ❑ Special conditions which might be appropriate in each case.
- ❑ This last section will include the nuclear safety and radiation protection limits and conditions that the Nuclear Safety Council and the authorizing Administration require for suitable operation of the installation. Compliance with all of the above, and with all other conditions established in the Permit is mandatory.

During the construction of the nuclear installations, and prior to the loading of fuel or the entry of nuclear material into the installation, the licensee is obliged to carry out a program of pre-nuclear tests which shall demonstrate the adequate behaviour of the equipment and systems of the installation in relation both to nuclear safety and radiation protection and to the applicable industrial and technical regulations.

The licensee shall likewise be obliged to put in place a control program ensuring the quality of the nuclear safety-related components and equipment during the different phases of manufacturing and assembly in the installation.

The Nuclear Safety Council will undertake surveillance during construction and assembly of the installation and will inspect the pre-nuclear tests affecting its safety and radiation protection.

This license is described in greater detail in article 14.

c) Commissioning license.

The start-up of nuclear installations requires granting of a provisional operating permit (POP).

In order to obtain the POP, the holder of the construction permit is required to submit the following documents to the Ministry of Industry and Energy:

- *Safety analysis report*: This implies an analysis of the installation from the point of view of nuclear safety and radiation protection, and of the risks involved in its operation, under both normal operating and accident conditions. In particular, the following areas should be covered:
  - Complementary data on the site and its physical, geological, seismological and other characteristics, obtained during construction.
  - Description of the installation as built. This description should cover the nuclear and non-nuclear instrumentation, control and protection systems, structures, systems and components, safety and auxiliary systems, waste collection and disposal systems and any other system or component of significance to the safety of the facility.
  - Analysis of anticipated accidents arising as a result of abnormal operation of systems, components and structures, operating errors or external events in the installation, and of the consequences of such accidents.
- *Operating Organization Manual*: This should contain the following information:
  - List of people with nuclear responsibilities, from the Director or Head of Operations to the supervisors, operators, people in charge of radiological surveillance and individuals responsible for the performance of nuclear tests, including documentation accrediting their technical capability for each specific mission.
  - Organization, specifying the organization of the personnel and their functions, under both normal and accident conditions.
  - Operating and radiation protection standards under normal and accident conditions, in reference to the installation and to the various systems of which it is comprised.
- *Technical Specifications Proposal*: This will refer to the limit values of the variables affecting safety, the actuation limits of automatic protection systems, minimum operating conditions, the periodic review, calibration and testing program covering systems and components and operational control.
- *Emergency Plan* : This will detail the measures in place to protect the population of the area potentially affected in the event of an accident, and the degree of responsibility of the operating personnel.
- *Nuclear commissioning program*: This will describe the nuclear tests, their objective, specific techniques and the foreseen results.

- *National participation in construction*: This will justify the percentage of investments made in acquiring items and equipment from national industry.

Once the results of the tests performed have been judged to be satisfactory, and as long as the Nuclear Safety Council concurs with such judgement, the aforementioned Provisional Operating Permit will be awarded (which will establish the nuclear tests to be carried out). Prior to this, the holder of the license shall be required to submit a document accrediting the coverage of nuclear risk, in accordance with the stipulations of the Nuclear Energy Act and the Regulations governing the Coverage of Nuclear Risk.

Any modification to the operating conditions of an installation which, in the opinion of the authorizing Administration, might imply a variation in its operating regime will require a specific authorization, the process being similar to the one described above.

This authorization is described in greater detail in the sections dealing with articles 14 and 19.

7.3 Nuclear installation inspection and assessment system

The Nuclear Safety Council is empowered to carry out all kinds of inspections at nuclear installations, in all the different phases of construction, assembly and start-up and during subsequent operation. The mission of the CSN in these inspections is to ensure compliance with the conditions established in the License and correct application of the specifications set out in the licenses awarded and in the approved official operations documents.

In this respect, the functions of the CSN rely on the following activities:

- Periodic inspections to check for correct compliance with the conditions and requirements established in the licenses.
- Evaluation and tracking of operation of the installation, checking the data, reports and documents submitted by the licensee or gathering new data (see Art. 14 and Appendix 14.A).
- Warnings or requirements to the licensees if there were any omission in their obligations or any deviation in compliance with the requirements of the license not constituting a breach subject to penalty, including information on corrective measures.
- Possibility of suspending the operation of an installation, or agreeing on the ceasing of an activity for safety reasons, if there has been no response to the aforementioned requirements or the corrections necessary to correct safety failures have not been carried out.
- Ultimately, proposal to the competent Authority of the Administration that a procedure of penalty be initiated if any anomaly is detected that might constitute a breach of the regulations governing nuclear safety and radiation protection.

Section IV of the Regulations governing Nuclear and Radioactive Installations includes a summary of the basic standards for the inspection of this type of installations, which are presented below.

- The personnel in charge of the Inspection, appointed by the Ministry of Industry and Energy and by the Nuclear Safety Council, are considered to be “agents of the authority” in the performance of their mission, and may be accompanied by whatever experts they consider necessary.
- The operator being inspected shall be obliged to:
  a) Facilitate access for the Inspectors to whatever parts of the installation they consider necessary for the performance of their task
  b) Facilitate the installation of the equipment and instrumentation required for performance of the necessary tests and checks
  c) Make available to the Inspectors whatever information, documentation, equipment and other items be required for the performance of their tasks
  d) Allow the Inspectors to take sufficient samples to perform the appropriate analyses and checks.
- The result of the Inspection shall be included in an inspection report.
- The owner of the installation, or his delegate, will be invited to witness the inspection and sign the corresponding inspection report. On signing, he may include whatever comments he deems to be appropriate. He may likewise refuse to sign or manifest his objections.
- In response to whatever irregularities might be detected during the inspection, and if these were to imply an obvious risk, the Authorities of the Ministry of Industry might adopt whatever measures they consider necessary, and require that the owner of the installation correct the deficiencies observed. More specifically, for reasons of safety for people and property, the CSN may also adopt whatever urgent measures might be required for the installation to recover safe conditions.

The CSN has a Resident Inspection Team at each of the Spanish nuclear power plants, made up of two inspectors whose main mission is to directly inspect and observe the operating activities performed at the plants and to inform the CSN.

7.4 System of penalties in relation to nuclear installations

Chapter XIV of Law 25/1964, on Nuclear Energy, in its new wording approved by the Electricity Industry Law, 54/1997, establishes a set of violations and penalties in relation to nuclear safety and radiation protection.

The Nuclear Energy Act classifies violations on the basis of their seriousness, making a distinction between “slight”, “serious” and “very serious” violations, depending on the type of risk involved and the act or omission of the owner of the installation.

Depending on the legal qualification of the violation committed, the penalties may consist of fines of up to five hundred million pesetas (500,000,000 Ptas.), combined when deemed necessary with the definitive or provisional withdrawal of licenses and Authorizations. The amount of the penalties will be established on the basis of criteria of risk for the life and health of people, the safety of property and the environment, the intention to violate, negligence in performance, repetition of the violation, the importance of the damages or deterioration caused to people and property, etc.

The Nuclear Safety Council is empowered to propose the initiation of a procedure for penalty with respect to those events which might be defined as violations relating to nuclear safety or radiation protection. For this purpose it identifies the violation committed and events of relevance for its evaluation, issuing whatever reports are required to contribute to suitable qualification of the event to be penalized.

Consequently, the faculty of the CSN is to provide advice and issue proposals within the framework of the procedure of penalties, the Government or authorizing Administration (Ministry of Industry and Energy) having the power to apply whatever penalty is considered to be legally appropriate, following the performance of an administrative procedure in this respect.

The CSN may stop works or suspend the operation of installations if there is obvious danger for people or property, or if the safety of such people or property be jeopardized. In any case it may adopt whatever urgent measures are required to reestablish the safety of the installation. These measures do not constitute a penalty but are simply precautionary, as a result of which they may be applied regardless of whatever penalties the competent public Authorities may apply in each case.

7.5 Degree of implementation of the obligations

From the information included in the previous sections it is concluded that Spain complies suitably with the obligations established in this Article in relation to the setting up and maintenance of a legal framework applicable to nuclear installations.

As has been described above, the Spanish legal framework contemplates the establishment of requirements in relation to safety, of a licensing system and of a system of inspection and assessment to verify compliance with the requirements and measures to ensure such compliance and penalize cases of non-compliance.

APPENDIX 7.A

CSN Safety Guides

CSN Safety Guides

The CSN issues a series of publications known as “Safety Guides”, which contain methods recommended by the CSN from the point of view of nuclear safety and radiation protection, the aim being to orient users and facilitate application of the Spanish nuclear regulations in force. These “Guides” are not binding, that is to say, compliance with them is not mandatory. The user may apply methods and solutions different from those contained in the guides, as long as they are duly justified.

The set of safety guides is divided into ten sections.

Section 1. Power reactors and nuclear power plants

GSG-01.01 Qualification for the acquisition and use of nuclear power plant Operating Personnel Licenses.

CSN, 1986. ISBN 84-87275-31-1

GSG-01.02 Dosimetry model for nuclear emergencies.

CSN, 1990. ISBN 84-87275-48-6

GSG-01.03 Nuclear power plant emergency plan.

CSN, 1987. ISBN 84-87275-44-3

GSG-01.04 Radiological control and surveillance of liquid and gaseous radioactive wastes released by nuclear power plants.

CSN, 1988. ISBN 84-87275-25-7

GSG-01.05 Documentation on refueling activities in light water reactor nuclear power plants

CSN, 1990. ISBN 84-87275-35-4

GSG-01.06 Reportable events at operating nuclear power plants.

CSN, 1990. ISBN 84-87275-47-8

GSG-01.09 Emergency drills at nuclear power plants.

CSN, 1996. ISBN 84-87275-65-6

GSG-01.10 Nuclear power plant periodic safety reviews.

CSN, 1996.I SBN 84-87275-60-5

Section 2. Research reactors and sub-critical assemblies

Section 3. Fuel cycle installations

Section 4. Environmental radiological surveillance.

GSG-04.01 Design and development of the Environmental Radiological Surveillance Program for nuclear power plants.

CSN, 1993. ISBN 84-87275-56-7

Section 5. Radioactive installations and equipment

GSG-05.01 Technical documentation for application for authorization to construct and start up installations for the handling and storage of non-encapsulated radioactive isotopes (2nd and 3rd category). CSN, 1986. ISBN 84-87275-33-8

GSG-05.02 Technical documentation for application for authorization to construct and start up installations for the handling and storage of encapsulated sources (2nd and 3rd category). CSN,1986. ISBN 84-87275-32-X

GSG-05.03 Control of the leak-tightness of encapsulated radioactive sources. CSN, 1987. ISBN 84-87275-26-5

GSG-05.05 Technical documentation for application for authorization to construct and start up radiotherapy installations. CSN, 1988. ISBN 84-87275-37-O

GSG-05.06 Qualifications for the acquisition and use of radioactive installation operating personnel licenses.

CSN. 1988. ISBN 84-87275-30-3

GSG-05.07 Technical documentation for application for authorization to construct and start up X-ray radiodiagnosis installations.

CSN, 1988. ISBN: 84-87275-34-6

GSG-05.08 Bases for the preparation of information on the operation of radioactive installations.

CSN. 1988. ISBN 84-87275-24-9

GSG-05.10 Technical documentation for application for authorization for X-ray installations for industrial purposes

CSN, 1988. ISBN 84-87275-36-2

GSG-05.11 Technical aspects of safety and radiation protection at diagnostic X-ray installations

CSN, 1990. ISBN 84-87275-20-6

Section 6. Transport of radioactive materials

Section 7. Radiation protection

GSG-07.01 Technical and administrative requirements for Individual Personal Dosimetry Services.

CSN, 1985. ISBN 84-87275-46-X

GSG-07.02 Qualifications to obtain accreditation as an expert in protection against ionizing radiations, to take over responsibility for RP Services or Technical Units

CSN, 1986. ISBN 84-87275-29-X

GSG-07.03 Bases for the establishment of Services or Technical Units for Protection against Ionizing Radiations

CSN, 1987. ISBN 84-87275-23-0

GSG-07.04 Bases for the medical surveillance of workers exposed to ionizing radiations.

CSN, (Rev. 1, 1994. ISBN 84-87275-58-3

GSG-07.05 Actions to be taken in the event of people having suffered a radiological accident

CSN. 1989. ISBN 84-87275-19-2

GGG-07.06 Contents of radiation protection manuals for nuclear and radioactive installations involved in the nuclear fuel cycle

CSN. 1992 ISBN 84-87275-49-4

GSG-07.07 Radiological Control of drinking water.

CSN. 1990 (Rev.1, 1994). ISBN 84-87275-27-3

Section 8. Security

Section 9. Waste management

GSG-09.01 Control of the process of solidifying low and intermediate level radioactive wastes

CSN, 1991. ISBN 84-87275-28-1

Section 10 Miscellaneous

GSG-10.01 Basic Quality Assurance Guide for nuclear installations.

CSN. 1985 (Rev.1, 1988). ISBN 84-87275-43-5.

GSG-10.02 System for documentation subject to Quality Assurance programs at nuclear installations

CSN, 1986. ISBN 84-87275-45-1

GSG-10.03 Quality Assurance audits.

CSN,1986. ISBN 84-87275-21-4

GSG-10.04 Quality Assurance for the start-up of nuclear installations

CSN, 1987. ISBN 84-87275-39-7

GSG-10.05 Quality Assurance for tests, checks and inspections at nuclear installations

CSN. 1987. ISBN 84-87275-40-0

GSG-10.06 Quality Assurance in the design of nuclear installations

CSN. 1987. ISBN 84-87275-41-9

GSG-10.07 Quality Assurance at operating nuclear installations

CSN. 1988. ISBN 84-87275-38-9

GSG-10.08 Quality Assurance for the supply of items and services for nuclear installations

CSN, 1986. ISBN 84-87275-42-7

Article 8. Regulatory Body

8.1 Regulatory Body responsible for application of the legislative framework

8.1.1 Description of the mandate and functions of the Regulatory Body

In Spain, the regulatory function in relation to Nuclear Safety and Radiation protection is carried out by the following Authorities:

- *The Government* which, as the executive Political Power, is empowered to direct energy policy and establish the objectives and goals of the Administration, issuing mandatory regulations.
- *The Ministry of Industry and Energy* as the Department of the Administration which, in accordance with governmental strategies regarding this matter, adopts regulatory Provisions in application of parliamentary Laws and Government Regulations. The Ministry likewise adopts binding agreements and decisions in relation to the issuing, modification, suspension or withdrawal of licenses for nuclear installations, and has the authority to apply penalties to operators violating the corresponding legal provisions. It is responsible for the issuing of permits for nuclear installations, following a mandatory and binding report by the CSN (formerly the Nuclear Energy Board) (see Art. 7).
- *The Nuclear Safety Council*, as the Regulatory Body, has the power to continuously inspect and assess such installations during the different phases of construction, start-up and operation. It is likewise responsible for the radiological control and surveillance of both the workers and the general public. The Nuclear Safety Council does not have relationships of dependency with either the Government or organizations in charge of the scientific promotion of nuclear energy. In carrying out its functions, it is fully independent from both the Ministry of Industry and Energy and the other agents participating in the nuclear field. The Council also undertakes executive actions, since it is empowered to suspend the operation of an installation or an activity when there is proven risk for safety, and may award and withdraw the operating licenses for the personnel of such installations.

  The CSN reports directly to Parliament via the Parliamentary Commission for Industry, Energy and Tourism. This Commission reviews and studies the six-monthly reports which, in accordance with Law, the CSN is required to submit to Congress to inform on its activities. Once these reports have been reviewed and analyzed by the Commission, the Chairman of the CSN appears before it to explain and clarify whatever doubts the members might have. The resolutions adopted by the Commission normally contain recommendations relating to the reports submitted. Appendix 8.A includes a copy of the resolution of 7th April 1998.

8.1.2 Faculties and responsibilities of the Regulatory Body

The functions of the CSN may be divided into the following major groups, depending on the responsibilities or faculties that are assigned to the Council by the Law and by its Statute:

a) Mandatory and binding activities.

- Evaluation and inspection activities.

The CSN is required to issue mandatory and binding reports prior to authorizations for siting, construction, start-up, operation and decommissioning.

b) Activities with direct responsibility.

- Every six months a report on its activities is required to be submitted to the two Houses of the Spanish Parliament.
- The faculty to order the suspension of works or operation in the event that anomalies appear affecting safety, and until such time as such anomalies are corrected, including the faculty to propose the withdrawal of authorizations, licenses or permits if the anomalies were not open to correction.
- Proposals regarding standards and regulations; the CSN does not have the faculty to establish standards, but may issue directives or technical instructions to the license holders, advising them of means to better comply with the standards and the authorizations they hold. These directives, which are simple, non-binding recommendations, are the Safety Guides (see Art. 7).
- Surveillance and control of the levels of radiation inside and outside the installations.
- Control of doses received by the operating personnel, and assessment of the radiological impact of the installations on people and the environment.
- Awarding of licenses for the operating personnel of nuclear installations (supervisors, operators and radiation protection service heads);
  - Supervisor license, enabling the holder to direct the operation of a nuclear or radioactive installation and the activities of the operators.
  - Operator license, enabling the holder to manipulate the control and protection devices of the installation under the direct supervision of a supervisor.

  In addition, nuclear installations must have a radiation protection service, the responsible party being a person accredited by the CSN.
- Official relations with similar Organizations in other countries;
- Public opinion information in relation to issues within its realm of competence;
- Establishing research plans and collecting information on the development thereof
- Proposing to the Ministry of Industry and Energy or directly to Government activities for the application of penalties, when this is considered to be appropriate.

c) Advisory and collaboration activities.

- Advising the public Administrations and the Courts in relation to nuclear safety and radiation protection;
- Collaborating in the drawing up of emergency plans
- Advising on the potential consequences for health of ionizing radiations
- Advising the Government in relation to the commitments with other countries or with International Organizations in relation to nuclear safety and radiation protection.

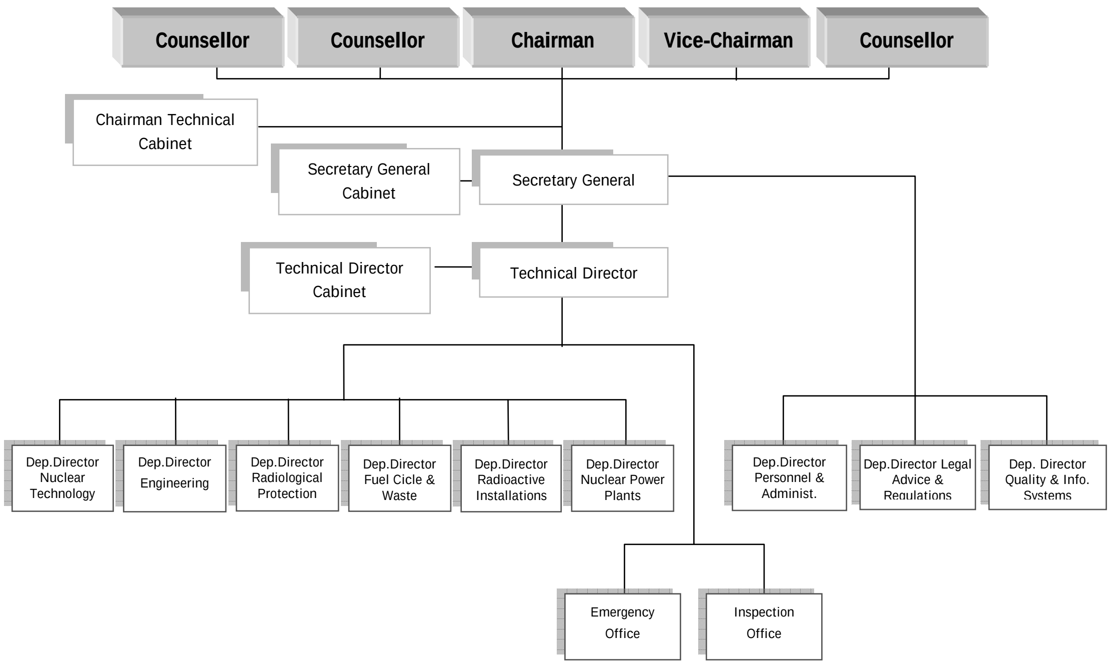
8.1.3 Structure of the CSN

The organizational structure and areas of competence of the CSN are regulated by Law 15/1980, of 22nd April, and by Royal Decree 1157/1982, of 30th April, approving the Council's Statute, with the modifications established basically by the Electricity Industry Law, Law 54/1997, of 27th November.

The Nuclear Safety Council is made up of a Chairman and four Counsellors, in addition to a Secretary General. The Chairman and Counsellors are appointed by Government in response to a proposal by the Ministry of Industry and Energy and following acceptance by a 3/5 majority of the Parliamentary Commission for Industry, Energy and Tourism. The Secretary General is appointed by Government in response to a proposal by the Ministry of Industry and Energy, following a favourable report by the CSN. The period of assignment to the post is six (6) years, and the members may be re-appointed for successive periods by means of the same procedure.

The Technical Directorate and other general and administrative services of the Organization report to the Secretary General.

The following chart shows the organizational structure of the Nuclear Safety Council.



The Technical Directorate draws up the proposals for mandatory reports to be issued to other Organizations, and inspects and controls operation of the nuclear installations, in order to ensure their correct operation under optimum conditions of safety.

As of 31st December 1997, the staff of the CSN amounted to 426 people, in addition to the members of upper management (Chairman, four Counsellors, Secretary General and Technical Director), 187 of which were members of the Nuclear Safety and Radiation protection Technical Staff, dedicated to the inspection, control and monitoring of nuclear and radioactive installation operations, a further 114 being civil servants from other Public Administrations. The remainder of the staff are support personnel.

The Technical Directorate is made up of six Deputy-Directorates and two Technical Offices. Appendix 8.B describes the functions and responsibilities of these areas.

8.1.4 Strategic Guidance Plan

Although the basic functions of the CSN are defined in the Law by which the Council was established, the CSN undertook a self-assessment which was reflected in the Strategic Guidance Plan, approved by the Plenary of the CSN in September 1995. This Plan was the result of assessment of the changes that had occurred since the establishment of the institution in 1980 to that date.

The aim of the 1995 Strategic Guidance Plan was to reflect those orientations that might facilitate compliance with the Council's missions, in the wake of analysis of the changes that had occurred. During the period in question (1980-1995), the CSN had undergone changes, with rapid growth and organizational development. In the middle of 1997, the CSN decided to update the Strategic Guidance Plan and revise its consistency with the objectives mapped out in 1995. This first revision of the Plan, approved by the Plenary of the CSN on 5th February 1998, once again reflects orientations which might be of use to the institution in complying with the missions established for it by Law, mapping out a series of objectives designed to allow the CSN to carry out its functions more efficiently.

In addition to the present Plan, the CSN has approved and under way other plans, such as the Internal Quality Plan and the Information Systems Plan, which are designed to serve as guidelines for the development and correct adaptation of the CSN to the new information technologies currently being implemented.

8.1.5 Financing of the CSN

The CSN has its own budget and assets, these being independent from the Government but integrated into the General State Budget and subject to approval by Parliament.

The Organization is totally self-financing, its income coming from the fees applied to the services it provides. This fee for services rendered was established in the Law by which the CSN was established. The services in question are fundamentally of three types:

a) the inspection and control of nuclear and radioactive installations;

b) the drafting of studies and reports prior to the authorizations awarded to the aforementioned installations by the Ministry of Industry and Energy;

c) the awarding of licenses to the operations and supervisory personnel of the aforementioned installations.

The budget of the CSN for the 1998 financial year amounted to 5,145. 96 million pesetas. As regards costs, somewhat more than half relates to the personnel, and a quarter to normal operating expenses.

In 1997, the CSN proposed a modification to the legislation in relation to the fees that it charges for its services, with a view to updating and rationalizing the system and achieving income more directly related to the services rendered. The proposal has been approved by the Cabinet and sent to the Congress for the corresponding parliamentary procedure.

8.1.6 Working commissions set up by the Plenary of the CSN

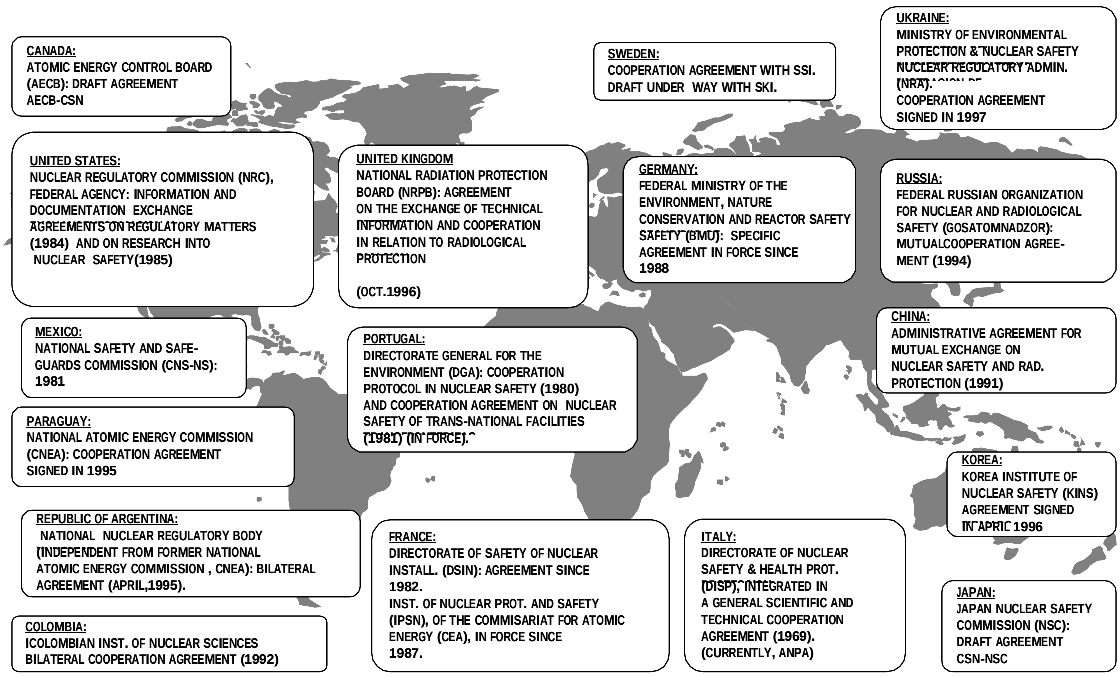
In 1996 the Plenary of the CSN approved the establishment of working Commissions designed to ensure correct compliance with the Council's missions. These Commissions, which are non-executive in nature, are chaired by a member of the Plenary. Appendix 8.C lists these Commissions and their objectives.

8.1.7 International Relations of the CSN

The CSN maintains many official relations of a bilateral nature with similar Organizations in other countries, and actively participates in the working groups of the European Union, the IAEA and the OECD NEA. The CSN has agreements, protocols or treaties signed and in force with 14 countries, and manages agreements with a further 3. These agreements cover the exchange of information and the tracking of the practices of each country in relation to nuclear regulation.

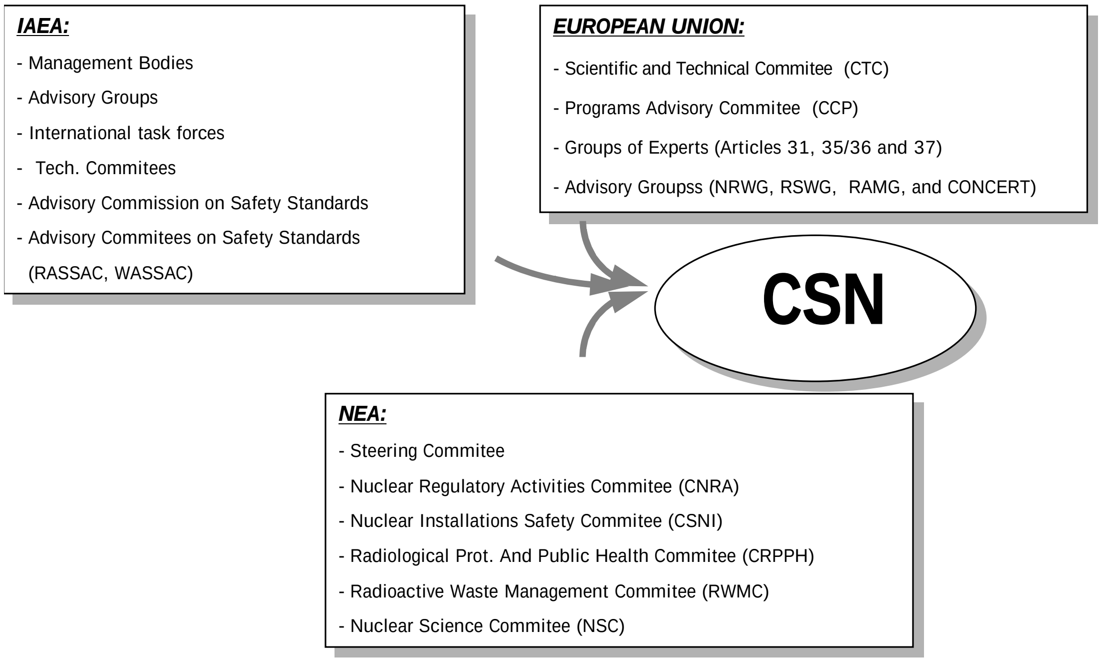
The following figure shows the bilateral cooperation agreements signed by the CSN:

Bilateral Relations of the CSN



The following figure shows the participation of the CSN in the different working groups of the NEA, the European Union and the IAEA.

International Working Groups with CSN Participation



The Council is a founder member of the International Nuclear Regulators Association (INRA) and of the Forum of Ibero-American Nuclear Regulators, and participates actively in all their activities.

In addition, the CSN participates in the European Union's TACIS and PHARE programs in relation to the transfer of the working practices of Western Regulatory Authorities to the Nuclear Safety Authorities of the countries of Central and Eastern Europe and to the Community of Independent States.

8.1.8 Research and development

The CSN does not carry out research activities directly. Its function is to establish plans for research into the fields of nuclear safety and radiation protection. To this end, it collaborates with other public and private Institutions that perform research programs. It promotes the development of projects aimed at optimizing the safety of nuclear and radioactive installations and at improving the capabilities and tools of the personnel of such installations, in order to better ensure safety and protection against ionizing radiations.

In July 1997, the CSN approved the Five-Year Research Plan (1997-2001), which serves to organize research activities along two basic lines of action: radiation protection and nuclear safety. The projects included in the Plan are carried out in collaboration with national organizations (Centre for Energy-Related, Environmental and Technological Research (CIEMAT); Centre for Experimental Studies (CEDEX); National Radioactive Waste Management Company (ENRESA); National Uranium Company (ENUSA); different universities, institutes, research centres and hospitals, etc.), and with foreign institutions (US NRC, French IPSN, etc.).

In addition, the CSN has established a framework agreement for collaboration in research activities with the electricity industry, represented by UNESA. The aim of this agreement is to maintain the efforts made by the nuclear industry in research activities relating to Nuclear Safety and Radiation protection, within the new economic framework of open competition on the Spanish electricity market that came into force at the beginning of 1998. This agreement includes a Joint Research Plan by means of which numerous research projects are promoted in areas of common interest for the CSN and the electricity industry.

8.2 Effective separation between the functions of the Regulatory Body and those relating to the promotion of nuclear energy

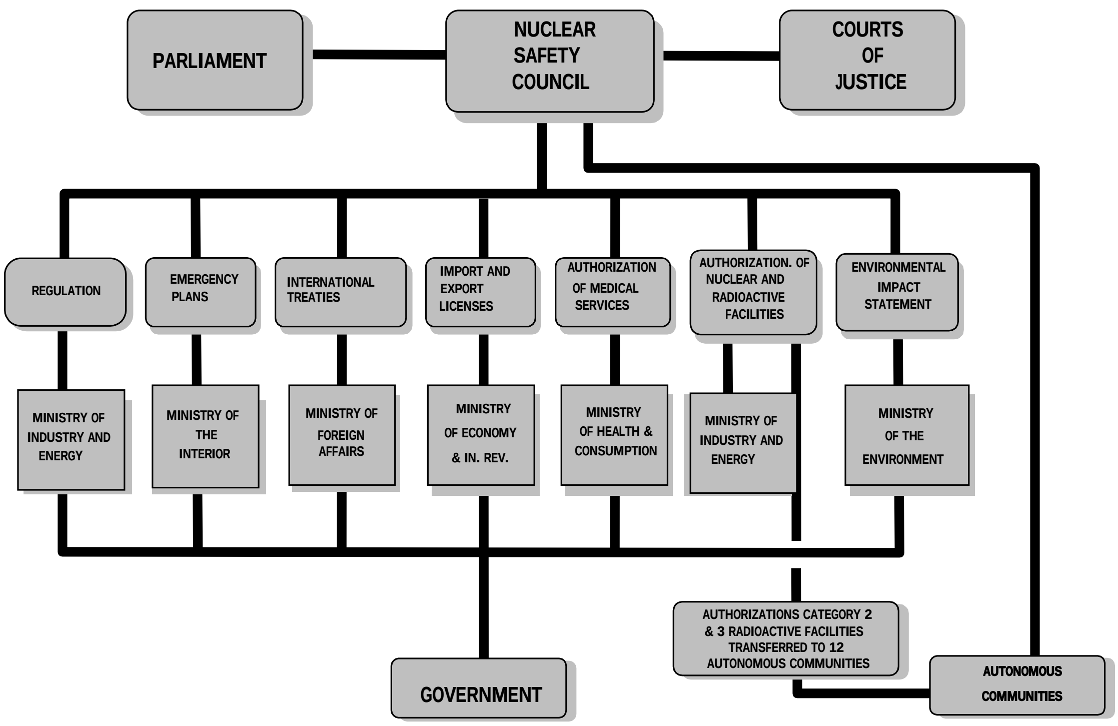
As an organization independent from Government, the CSN does not participate in any activity relating to the promotion or use of nuclear energy. It reports directly to Congress and has the legal obligation to issue a six-monthly Report on its activities, summarizing the situation and the main events occurring in the nuclear installations it is commissioned to supervise.

In addition, the CSN responds in writing to questions posed by different political groups, and provides whatever information is requested of it by the Commissions of the Congress and the Senate.

In compliance with the functions legally attributed to it, the CSN establishes a framework for official relations with other public Bodies and Institutions, belonging to the State Administration or to other Public Administrations.

The relations of the CSN with the public Institutions and Organizations in charge of the promotion and use of nuclear energy may be summarized as shown in the diagram included in the following figure.

Institutional Relations of the CSN



- *Ministry of Industry and Energy,* to which the CSN issues the mandatory reports required for the granting of licenses for nuclear installations and regulatory proposals in relation to Nuclear Safety.
- *Ministry of the Environment,* due to the requirement for a nuclear installation environmental radiological impact statement to be drawn up jointly with this Department.
- *Ministry of the Interior,* with which there is collaboration in the drawing up of provincial Emergency Plans for nuclear accidents and in their implementation.
- *Ministry of Health and Consumption* in relation to those aspects of protection of health which might arise as a result of exposure to ionizing radiations, and as regards regulatory proposals on Radiation protection.
- *Ministry of Foreign Affairs,* in relation to studies and collaboration in the signing of International Treaties by the Spanish Government, and in general to relations with international organizations.

8.3 Degree of implementation of the obligations

The establishment and functions of the Nuclear Safety Council and of its financial and human resources ensure the capabilities required by this article. In addition, the contents of the Law establishing the CSN and the mechanisms established for the appointment of its members guarantee the independence of the organization with respect to any activity involving the promotion or use of nuclear energy, as required by this article.

APPENDIX 8.A

Resolutions of the Parliamentary Commission for Industry, Energy and Tourisme, 7th April 1998[1]

In compliance with the stipulations of article 97 of the Regulations governing the House, we hereby order publication in the OFFICIAL BULLETIN of the Spanish parliament of the Resolutions approved by the Commission for Industry, Energy and Tourism during its session of 31st March 1998, in relation to the reports for the First and Second six-monthly periods of 1996, submitted by the Nuclear Safety Council (numbers 401/000003 and 401/000004, respectively).

House of Congress, 2nd April1998.

The President of Congress,

Federico Trillo-Figueroa Martínez-Conde.

The Commission for Industry, Energy and Tourism of the Congress received, during its session of 31st March 1998 the six-monthly reports on the activities of the Nuclear Safety Council corresponding to the first and second such six-monthly periods of 1996 (401/000003 and 401/0000004) by virtue of article 11 of Law 15/1980, of 22nd April, by which the said Council was established, and, the Chairman of the Nuclear Safety Council having appeared before the said Commission, the latter has unanimously approved the following Resolutions:

One. In view of the two cases of internal contamination of workers which occurred during the dismantling of Vandellós I, the Nuclear Safety Council is requested to appoint a resident inspector for the next three years, in order to reduce the probability of such events re-occurring to the extent possible.

Two. The Nuclear Safety Council is requested to submit to this House a report detailing the activities carried out within the framework of the OESA Program at the Trillo Nuclear Power Plant, the degree to which this program has been performed, the most significant events (included or otherwise on the INES scale) and the plant modifications deriving therefrom. This report should be submitted on completion of the OESA.

Three. The Nuclear Safety Council is requested to request Trillo Nuclear Power Plant to implement whatever modifications are required to the emergency building ventilation system (UV-3), such that the temperature limit be as established in German standard KTA 3601, in the definitive 1990 version.

Four. The Nuclear Safety Council is requested to submit to this Commission every two moths a catalogue of the most representative reports on the operation of the nuclear power plants, independently from the report issued every six moths.

Five. The Commission for Industry, Energy and Tourism takes note of the fact that, according to the Nuclear Safety Council and in compliance with the standards in force, the operation of nuclear and radioactive installations in the territory of Spain has taken place during the periods indicated above without any events that might affect people or the environment.

Six. The Commission takes note of the progressive reduction of the doses received by professionally exposed workers, and of the fact that the radiological quality of the environment has not undergone any detriment as a result of the operation of the nuclear and radioactive installations, and that the activity of the liquid and gaseous releases has been maintained well below the legally established limits.

Seven. The Commission urges the Nuclear Safety Council to promote progressive regulatory and legal modernization in accordance with the new needs, identifying shortcomings in the current standards and drawing up the corresponding proposals.

Eight. The Commission urges the Nuclear Safety Council to continue with improvements to the training programs for nuclear power plant operators and supervisors and to continue also with its study of simulators to be used for the training of such personnel.

Nine. The Commission urges the Nuclear Safety Council to promote to the greatest possible extent the R&D programs in which it participates, as well as its participation in the working groups of international organizations, such as EURATOM, the IAEA, the NEA and its bilateral relations.

Ten. The Commission urges the Nuclear Safety Council to draw up a report on the eventual impact that the new regulatory framework contemplated in the Electricity Industry Law might have on the safety of nuclear power plants and the areas of competence of the CSN, and on the modifications that might have to be made to the structures of the organization in adapting to the said regulations.

Eleven. The Commission urges the Nuclear Safety Council, the Ministry of the Interior and the Ministry of Industry and Energy to strengthen their collaboration, within their respective areas of competence, in relation to the physical protection of nuclear materials, within the framework of the stipulations of Royal Decree 158/1995, of 3rd February, on the physical protection of nuclear materials, with a view to ensuring the greatest protection of such materials.

Twelve. The Commission urges the Nuclear Safety Council and the Ministry of Health to promote the general incorporation of radiation protection services in public hospitals, both those of the national health system (INSALUD) and those pertaining to the Health Services of the Autonomous Communities, within the framework of the special committee on radiation protection created as part of the Interterritorial Health Council.

Thirteen. The Commission notes that delays are occurring in certain Autonomous Communities to which industry-related functions have been transferred from the Ministry of Industry and Energy (in relation to radioactive installations), in the handling of administrative proceedings, as regards both the awarding of permits and the resolution of procedures for penalties, and manifests that this problem should be solved as soon as possible.

Fourteen. The Commission requests that before July 1998 the Nuclear Safety Council provide information on the forecasts of all the Spanish nuclear power plants regarding power upgrading, and on the measures that the Nuclear Safety Council will apply in order to ensure that such upgrading be performed with assurances of all the necessary safety conditions.

Fifteen. The Commission takes note of the need for and urgency of a new Fee Law regulating the payments to be made to the Nuclear Safety Council for services rendered within the new regulatory framework contemplated in the Electricity Industry Law, and urges the Government to draw up a Draft Law and submit it to Parliament at the earliest possible date.

Sixteen. The Commission urges the Nuclear Safety Council and the Ministry of the Environment to progress in marking the limits of their respective areas of competence with regard to environmental radiation protection in the country, in order to guarantee suitable radiation protection for people and the environment.

Seventeen. The Commission considers it necessary that funds be provided to guarantee the suitable operability of the organization of the Nuclear Safety Council and the Directorate General for Civil Protection, for development of the Basic Nuclear Emergency Plan and the Provincial Emergency Plans in close cooperation with the Autonomous Communities involved.

Eighteen. The Nuclear Safety Council is requested to provide information before 30th June 1998 on the measures adopted at the Juzbado Fuel Facility to enhance the controls of nuclear material and prevent the occurrence of new events.

Nineteen. The Nuclear Safety Council is requested to provide information before 30th June 1998 on the inspection program foreseen for the shroud welds and snubbers at the Santa María de Garoña Nuclear Power Plant, along with the Forecasts regarding the future status of this item.

Twenty. The Commission requests that the Nuclear Safety Council strengthen its public information and communication activities in its areas of competence, opening a Public Information Centre and establishing a link to the Internet allowing it to systematically update information on the situation of its installations and environmental surveillance.

Twenty-one. The Commission urges the Nuclear Safety Council to intensify its hospital inspections.

Twenty-two. The Commission urges the Nuclear Safety Council to propose a program for the replacement of obsolete X-ray apparatus in public and private hospitals and clinics.

Twenty-three. The Commission urges the Nuclear Safety Council to make a declaration on the advisability of undertaking a study to clarify which hospital wastes should be considered radioactive wastes and which others should not.

Twenty-four. The Commission urges the Nuclear Safety Council to intensify specialization of the CSN inspection team in radiation protection in hospitals and health centres.

Twenty-five. The Commission urges the Nuclear Safety Council to expressly strive for maximum transparency and information in relation to the entire process of dismantling of the Vandellós I Nuclear Power Plant, in accordance with its areas of competence and with a view to increasing overall safety in the affected area. To this end, it is considered necessary that mechanisms be established ensuring full knowledge of the process and of its consequences by the local organizations (town councils and regional councils), as well as by the national Parliament and the Parliament of Catalonia. Such transparency will undoubtedly serve to increase the confidence and security of the population in the performance of the process, which has already been suitably initiated by ENRESA.

House of Congress, 1st April 1998.

The Chairman of the Commission for Industry, Energy and Tourism.

Francesc Homs i Ferret.

APPENDIX 8.B

Structure of the Technical Directorate of the CSN

- Deputy-Directorate General for Nuclear Power Plants (SCN)

  The SCN is responsible for the drawing up of technical reports, proposals, inspections and tracking of nuclear power plants, as well as for the awarding and renewal of licenses for the operations personnel of nuclear installations.

  The SCN is also responsible for the evaluation and analysis of operating experience, control of the training and licensing of plant operations personnel, updating of the safety requirements applicable to the plants and the evaluation and tracking of plant quality assurance programs and the reports and proposals for the authorization of nuclear component manufacturing, installation and assembly companies.

- Deputy-Directorate General for Radioactive Installations (SIR)

  The SIR is responsible for the drawing up of technical reports, proposals, inspections and tracking of radioactive installations, for transport and companies providing technical assistance and for the awarding and renewal of licenses for the operations personnel of radioactive installations.

  This Deputy-Directorate is also responsible for CSN activities in relation to diagnostic X-ray installations, the homologation and manufacturing of radioactive equipment and radiation protection services and technical units.

- Deputy-Directorate General for Cycle and Wastes (SCR)

  The SCR is responsible for the drawing up of technical reports, proposals, inspections and tracking of fuel cycle and waste installations and of installations in the process of decommissioning and dismantling, as well as for the awarding and renewal of licenses for the operations personnel of such installations.

  It coordinates the participation of the CSN in revision of the General Radioactive Waste Plan and manages and coordinates R&D projects in relation to high level wastes, except those assigned to the STN. It is also responsible for evaluations and inspections in relation to radioactive waste management at operating nuclear and radioactive installations.

- Deputy-Directorate General for Radiation protection (SPR)

  The SPR is responsible for studies, technical reports and inspections in relation to the radiation protection of both professionally exposed personnel and the public in general.

  It is also responsible for the control and surveillance of the levels of radiation inside and outside the installations and of their influence on the areas in which they are located, for proposing independent environmental radiological surveillance programs to be carried out by the CSN and the Autonomous Communities, and for proposing criteria for the establishment of the National Environmental Radiological Surveillance Network.

  The SPR is responsible for the proposal for development and orientation in application of the criteria, methods, standards and procedures for management of the radiation protection program adopted in Spain. The SPR manages and coordinates R&D projects on radiation protection.

  This Deputy-Directorate is responsible for CSN activities in relation to personal dosimetry services and medical services for the surveillance of professionally exposed personnel.

- Deputy-Directorate General for Engineering (SIN)

  The SIN is responsible for studies, technical reports and inspections in areas relating to the construction, design, operation and decommissioning of nuclear and radioactive installations, in those areas in which it specializes.

  The areas in which the SIN specializes are as follows: nuclear systems, mechanical and structural engineering, electrical systems, instrumentation and control, auxiliary systems and maintenance.

  The SIN participates in the assessment of reportable events related to its areas of competence on the CSN Event Review Panel and the Emergency Organization Operational Analysis Group.

- Deputy-Directorate General for Nuclear Technology (STN)

  The STN is responsible for the development and updating of the technical knowledge and methodologies required for better compliance with the functions of the Nuclear Safety Council, and for the performance of studies, technical reports and inspections in those areas in which it specializes.

  The areas in which the STN specializes are nuclear engineering, probabilistic safety assessment, human factors, earth sciences, modeling and simulation and coordination in R&D.

- Inspection Office (OFIN)

  The OFIN is responsible for the coordination of inspection and audit programs, in relation both to installations and activities under the supervision of the Nuclear Safety Council.

  This Office is also responsible for tracking of the inspection programs carried out by those Autonomous Communities which have functional powers in this particular field, and for coordination of proposals for penalty procedures.

- Emergency Office (OFEM)

  The OFEM is responsible for coordination of the prompt, correct and efficient response of the CSN to situations of radiological emergency, in its areas of competence.

  Included within this coordination are activities relating to the CSN Action Plan for emergency situations, nuclear or radiological emergency simulations and drills and those activities which, within the Basic Nuclear Emergency Plan, are performed by the Radiological Groups of the Provincial Emergency Plans, including coordination with the Directorate General for Civil Protection and other organizations and institutions involved in the management of nuclear and radiological emergencies.

APPENDIX 8.C

Working Commissions created by the Plenary of the CSN

- Institutional Policy Commission

  Functions:

  a) Tracking of relations with Political Institutions, the Central and Autonomous Community Administrations, social groups, environmental groups, etc.

  b) Tracking of relations with foreign and international organizations.

  c) Tracking of public information and social communication activities.

  d) Analysis and tracking of budget management.

  e) Analysis and tracking of projects, standards and legal matters.

- Human Resources Commission

  Functions:

  a) Tracking of activities relating to the training of the Organization's personnel, both staff members and civil servants.

  b) Tracking of activities involving relations with the staff and civil servants' labour representatives.

  c) Analysis and proposals in relation to personnel management policy.

- Technological Research and Policy Commission

  Functions:

  a) Analysis of the different aspects of technological development in relation to nuclear safety and radiation protection

  b) Drawing up of the research and development program and subsequent modifications, along with tracking of the results.

- Standards Development and Legal Affairs Commission

  Functions:

  a) Comparative analysis of standards development at international level and current impact, and proposals for optimization.

  b) Proposals for standards development programs.

  c) Analysis of regulatory action and proposals for a plan to improve the efficiency and level of safety of the installations.

- Operating Experience and Licensed Personnel Training Programs Commission

  Functions:

  a) Analysis and proposals in relation to the training programs for licensed personnel of nuclear and radioactive installations controlled by the CSN.

b) Analysis of operating events associated with human factors at nuclear and radioactive installations.

- Organization, Quality and Systems Commission

Functions:

a) Proposals regarding the strategy of the Council in relation to Organization, Internal Quality and Systems, including both development and monitoring of implementation.

b) Analysis of evaluations of the quality of activities performed by the Council and in-house and external perception thereof, promoting and supervising improvement measures.

c) Study of and reporting on the proposals of the Quality Plan and Strategic Systems Plan and their revisions, prior to their being submitted to the Plenary.

d) Tracking of the application of these plans and proposals for whatever revisions might be required.

e) Informing on programs, budgets and the contracting of equipment, systems and services relating to the functions thereof.

Article 9. Responsibilities of the license holder

9.1 Responsibility for the safety of installations

9.1.1 Legal provisions

The legal provisions assigning responsibility for the installations are included in the 1964 Nuclear Energy Act and the 1972 Decree governing Nuclear and Radioactive Installations. As regards coverage of the risk of nuclear damage, the licensee is also identified as being the party responsible for the safety of the installation. The Spanish regulations governing Nuclear Safety establish as a principle that responsibility for the safety of the installations is to the licensee.

The Nuclear Energy Act, Law 25/1964, defines the Operator of a nuclear installation as the physical or legal person holding the authorization required for start-up of the said installation.

The Decree governing Nuclear and Radioactive Installations (RINR) currently in force establishes as follows:

- in order to obtain the Construction Permit, the applicant shall detail the organization foreseen for supervision of the project and assurance of quality during construction of the installation;
- a detailed description be included of each of the organizational units included in the operator's organization and of the responsibilities assigned to each in relation to nuclear safety;
- in addition there be a description of the organization foreseen for the future operation of the installation, and a preliminary operations personnel training schedule;
- during pre-nuclear verification, the licensee shall be obliged to initiate a control program assuring the quality of nuclear safety-related components and equipment;
- commissioning tests and checks shall be performed under the responsibility of the licensee;
- the supervisor and the operators (operating personnel holding licenses issued by the CSN) are directly responsible for the operation of the installation; they shall be obliged to comply with, and ensure compliance with, the authority approved operating documents. They shall act in accordance with the standards contained in the operating manuals;
- the supervisor shall be fully authorized to interrupt operation of the installation at any time if he estimates that the necessary conditions of safety have decreased;
- the licensee shall be obliged to maintain an operations log, numbered and approved by the CSN, in which shall be included operating events.

The Resolutions by which provisional operating permits are awarded:

- identify the licensee organization or organizations, naming them as the Operator Responsible for the Installation;

- approve the revisions in force of official documents. These documents enter into force only after having been evaluated and approved by the CSN;
- indicate the guarantees to be subscribed by the responsible operator in relation to civil liability for third-party damage, in accordance with the Decree governing the coverage of nuclear risk.

9.1.2 Licensee's safety organization

In the Operating Organization Manual of the installation the licensee described his operating organization. This includes a definition of the responsibilities and functions of all safety-related organizational units, along with the training programs required to maintain and improve the capacities of the personnel of the installation (licensed or non-licensed).

Special attention should be drawn to the Quality Assurance unit of the installations (see Art. 13), since this unit reports directly to the management of the plant-owning company, this greatly benefiting its independence as regards criteria due to its not being involved in the production activities of the installation. This unit has to approve all the procedures, manuals, proposals for modifications, etc. concerning safety-related systems.

The Technical Specifications require the existence of Plant and Owner Nuclear Safety Committees, and a description of their composition, functions and responsibilities. Their main mission is to review activities and significant events relating to nuclear safety and radiation protection, analyzing their consequences and proposing appropriate actions or modifications to the management of the plant or owner company, respectively.

The operator's organization for emergencies and the missions and responsibilities assigned to each unit are described in detail in the On-Site Emergency Plan.

The owner of the installation carries out a large number of activities on his own initiative, independently of the legal requirements or requests by the CSN, this representing a self-evaluation with regard to the operation of the installation and possibly implying a certain degree of long-term self-regulation in the long term. This factor should be improved in view of the economic deregulation of the electricity market.

9.1.3 Responsibility for nuclear damage

In accordance with the Nuclear Energy Act, the operator of a nuclear installation, or of any other installation producing or working with radioactive materials or that might produce ionizing radiations, shall be held responsible for nuclear damages. This responsibility shall be objective and restricted to the limit of coverage established by Law.

Indeed, article 55 of the Nuclear Energy Act establishes that all operators of nuclear installations shall, in addition to obtaining prior authorization, subscribe coverage of those risks which might arise in relation to responsibility for nuclear accidents.

The conditions and requirements of this coverage are established in the aforementioned Decree governing the Coverage of Nuclear Risk.

Recently, the Electricity Industry Law of 1997 has updated the amount of the coverage to be demanded of nuclear installations, in accordance with the stipulations of article 57 of the Nuclear Energy Act. Thus, in the case of nuclear installations, the coverage will amount to 25,000 million pesetas. Nevertheless, the Ministry of Industry and Energy may apply another limit, of not less than 1,000 million pesetas, in the case of the transport of nuclear substances or any other activity whose risk, in the opinion of the Nuclear Safety Council, does not require higher coverage. These figures shall be submitted to the Government and, in response to a proposal by the Ministry of Industry and Energy, may be modified when the international commitments accepted by the Spanish State make this necessary or when the passage of time or variations in the consumer price index so dictate.

9.2 Monitoring by the CSN

Although the operator is responsible for the safe operation of his installation, the CSN is responsible for the surveillance and control of the maintenance of safe conditions, in which respect it may perform the necessary inspections of the installations and equipment, and may suspend operation of the installation as a precautionary measure when safety is insufficient or when there are risks beyond tolerable limits. One way or another, compliance with the requirements imposed by the regulatory body does not free the operator from his fundamental obligation to guarantee the protection of the public, the workers and the environment.

The CSN has the power to monitor correct compliance, and in any case any modification proposed and affecting the contents of the licensing documents shall, as required by the operating permits, be once again submitted for express authorization by the Ministry of Industry and Energy, following a favourable report by the Nuclear Safety Council.

The CSN has access to the minutes of meetings of the Plant and Owner's Nuclear Safety Committees, such that it be possible to analyze whether these are complying with the established missions.

Furthermore, the CSN evaluates and inspects all actions by the licensee or modifications, be they procedural or physical, to check that the safe conditions of the installation are being maintained or increased. In addition, through appropriate audits it checks that the licensee has adhered to and met all the requirements established in his internal procedures and, if they were not to have been adhered to, checks that the licensee has analyzed why this occurred and has taken the measures required to prevent repetition of this situation in the future.

9.3 Degree of implementation of the obligations

Although the legislative coverage of this matter has not been sufficiently ample, this circumstance has been made up for by the nuclear safety limits and conditions imposed by the Resolutions by which start-up of the installations is authorized. With the measures established in the Spanish regulations and the practices applied in relation to nuclear safety and nuclear damage, it is considered that the requirements of this article are met.

c) General safety considerations

Article 10. Priority for safety

10.1 Principles governing safety

As laid out in section b) Legislation and regulation, the legal framework currently existing in the Spanish State (Nuclear Energy Act 15/64, Law 15/80 constituting the Nuclear Safety Council, Decree governing Nuclear and Radioactive Installations) establishes the priority of the requirements relating to safety during the different stages of design of nuclear power plants and defines the obligations of the owners of such installations and the responsibility that they acquire as regards their safety.

The operating permits establish that the owner shall be obliged at all times to adhere to the safety requirements defined by the official operating documents and to continuously review plant safety, as well as performing periodic reviews, as described in the section dealing with article 14.

The Decree governing Nuclear and Radioactive Installations define the need for those applying for a Start-Up Permit for a nuclear power plant to submit an Operating Organization Manual. This document, which is evaluated by the Nuclear Safety Council prior to awarding the permit for the plant, defines the safety-related responsibilities of the different organizational units of the licensees organization, beginning with the highest level, and the principles governing operation, underlining the priority given to safety aspects.

As established in the conditions associated with the authorizations for all plants, any change in the Operating Organization Manual must be authorized by the Ministry of Industry, following issuing of a report by the Nuclear Safety Council.

The Operating Organization Manual and the Technical Specifications define the need for there to be a Plant Nuclear Safety Committee (PNSC) and an Owner Nuclear Safety Committee (ONSC) at each plant, the minimum frequency of their meetings and their respective missions.

The PNSC includes the Plant Manager and those responsible for the different plant departments, its functions being as follows:

- ❑ Review of procedures affecting nuclear safety.
- ❑ Review of tests or experiments affecting nuclear safety.
- ❑ Review of changes to the Technical Specifications.
- ❑ Review of changes or modifications to plant equipment or systems affecting nuclear safety.
- ❑ Investigation of all breaches of the Technical Specifications, including the preparation and issuing of reports to the ONSC evaluating the event and proposing recommendations to prevent its repetition.
- ❑ Review of event reports sent to the CSN in 24 hours.
- ❑ Review of Plant operation to detect potential risks for nuclear safety.

- Performance of special reviews, investigations and reports if required to do so by the Plant Manager or the ONSC.
- Review of the Security Plan and complementary procedures, and proposals for changes to the ONSC.
- Review of the On-Site Emergency Plan and complementary procedures, and proposals for changes to the ONSC.

The ONSC includes the licensee's top management (Director, Plant Manager, Head of Quality Assurance, among others) and representatives of the owner companies, its fundamental mission being to ensure compliance with the principles establishing nuclear safety as a priority issue. The functions of the Committee consist of review of the following:

- Safety evaluations for changes in design, equipment or systems and tests or experiments.
- Proposals for changes to procedures, equipment or systems constituting an unreviewed safety issue.
- Proposals for tests or experiments constituting a non-revised safety issue.
- Proposals for changes to the Technical Specifications or Provisional Operating Permit.
- Violations of codes, standards, Technical Specifications, licensing requirements, procedures or instructions of importance from the point of view of nuclear safety.
- Significant operating anomalies and deviations from the normal behaviour expected of nuclear safety-related equipment.
- Events requiring notification of the CSN in 24 hours.
- All indications pointing to important deficiencies in any aspect of the design or operation of safety-related structures, systems or components.
- Reports and the minutes of meetings of the PNSC.

And of auditing plant activities, including the following:

- Verification that the Plant is being operated in accordance with the provisions of the Technical Specifications and the Operating Permit.
- The performance, training and qualification of Plant personnel with nuclear responsibilities.
- The results of actions taken to correct deficiencies in Plant equipment, structures, systems or operating methods affecting nuclear safety.
- The performance of activities required by the Quality Assurance program during Operation.
- The Plant On-Site Emergency Plan and the procedures for its implementation.
- The Plant Security Plan and the procedures for its implementation.
- The Fire-Fighting Manual and the procedures for its implementation.

These Committees are the fundamental element for maintaining the involvement and commitment of the plant management and owners in and to all matters relating to safety. Their activities are inspected by the CSN.

10.2 The safety culture and its development

Although it has existed implicitly since the very beginnings of the nuclear industry, the concept of the safety culture has been developed subsequent to the Chernobyl accident, and implies plant management and the on and off-site organizations involved paying special attention to matters relating to Nuclear Safety, this implying the introduction at all levels of the company (including, and especially, Management) of practices aimed not only at achieving this objective but also at creating an awareness suitable for such achievement.

This concept, although not regulated, has always been applied to varying extents by the organizations involved in Spanish nuclear projects, but its systematic, case-specific implementation has been initiated only recently, within a far-reaching program coordinated by UNESA.

With a view to maintaining and strengthening the safety culture at all the Spanish plants, activities involving all the personnel are carried out, these being tracked by the CSN. These activities include the following:

- Meetings for explanation of the principles of INSAG-4.
- Development of total quality and continuous improvement techniques, emphasizing the involvement of all the personnel in the achievement and improvement of quality in their activities, and thus the enhanced safety of the installation, by means of promotion by plant management of enhancement groups and circles.

10.3 Commitment to safety

The activities described above, carried out both by the Owner Safety and Plant Nuclear Safety Committees, along with the initiatives adopted to reinforce the Safety Culture make the safety commitment of plant management obvious and visible for all the personnel.

10.4 Regulatory control

The application of inspection programs by the CSN with regard to the activities of the licensee and his contractors (main vendor, engineering, manufacturers) constitutes the regulatory instrument for the checking, and enforcement where applicable, of effective awareness of the priority that the licensee is required to give to safety issues. The CSN has in place a systematic approach to evaluation of the behaviour of the plant organizations, through application of the ESFUC program. This program establishes periodic evaluation of plant operation and of its organization in the five following functional areas: operation, radiation protection, maintenance-surveillance, technical support and emergencies. In performing this evaluation, consideration is given to the following criteria following each inspection, these going further than the corresponding checks on the system or component being inspected:

- Management commitment to improving quality and safety.
- Operator's capacity for self-evaluation.
- Consideration of safety implications in the resolution of technical issues. Effectiveness of corrective actions.
- Operating events related to the issues and activities inspected.
- The human resources of the organization.
- Training and qualification programs.
- Deviations, and breaches of safety standards or conditions and non-compliance with programs.

The aspects evaluated are closely related to the attitude of the organization and of those responsible for it towards safety issues and the priority given to them. The ESFUC reports drawn up by the CSN categorize the operation of the plant and of its organization in each of the aforementioned areas. The guideline for development of the program contemplates that these reports be sent to each licensee for knowledge thereof and implementation of the appropriate actions. The results of application of the ESFUC program are used by the CSN to plan inspections for the next period, the aim being to effectively assign the resources of the organization.

The CSN is carrying out a study of the relationships between the organization of the plants and safety, the aim being to determine which organizational and management aspects of the plants may have the greatest impact on safety and how a management policy suitably considering such aspects should be reflected in the organization and transmitted by it.

10.5 Voluntary activities and good practices related to safety

The plants have adopted a number of initiatives aimed at improving safety and going further than the regulatory requirements, such as the introduction of various equipment replacements and design modifications or improvements to working practices, such as the implementation of a systematic approach to the reduction of risk during outages, the modifications introduced on the basis of the results of probabilistic safety analyses and the Trillo NPP Operating Experience and Systems Analysis Program (OESA).

10.6 Degree of implementation of the obligations

The requirements established in the Operating Organization Manual regarding the composition and functions of the Plant and Owner Nuclear Safety Committees, and the activities relating to the development and application of the concept of the Safety Culture, guarantee that the operators of the Spanish plants give priority to Nuclear Safety.

The above, along with the tracking, control and inspection measures taken by the CSN, ensure compliance with the requirements of this article.

Article 11. Financial and human resources

11.1 Financial and human resources of the licensee/applicant

The availability of adequate human and financial resources is a key element for the maintenance of safe conditions in nuclear installations. The Operating Organization Manual of the Spanish plants describes the Licensee's organization, including the functions and responsibilities of all those organizational units which are related to nuclear safety and radiation protection. Likewise, the On-Site Emergency Plan establishes the responsibilities and human resources required to address emergency situations. Modifications to either document must be approved by the Directorate General for Energy of the Ministry of Industry and Energy, following a mandatory report from the CSN.

11.2 Financing of safety improvements

Until the end of 1997, the financing of safety improvements made at the installations during their operation was covered within the system regulating the electricity sector, these being considered as extraordinary investments and their costs being included as part of the electricity tariff. This system disappeared at the beginning of 1998 as a result of economic deregulation of the sector, thus posing an important challenge for both the electricity utilities and the CSN, which are responsible for maintaining and updating conditions of safety within a framework of open competition in which the nuclear installations are required to operate safely and in a profitable manner. Within this new framework, the regulatory body will have to reinforce its attention and monitoring of organizational aspects and of the human and financial resources available to the licensee, in order to avoid such resources being reduced and thus decrease the investments required to improve the physical conditions of the installation and the levels of skill, motivation and qualification of the operations personnel. At the same time, the Nuclear Safety Council must extend its efforts in relation to standards and centre regulatory actions on aspects essential for safety, avoiding unnecessary burdens or emphasis on marginal aspects.

11.3 Financial and human resources provisions for the decommissioning program and radioactive waste management

As regards decommissioning and radioactive waste management, responsibility corresponds to the public company ENRESA, created by Royal Decree 1522/1984, of 4th July, and financed by the waste producers. A centralized facility for the disposal of low and intermediate level radioactive waste is currently available at El Cabril, high level waste being stored in the spent fuel pools of the plants while consideration is given to other medium and long-term solutions.

During the lifetime of the nuclear power plants, ENRESA makes a provision of funds to cover the costs associated with the removal of low and intermediate level wastes from the site, the future management of high level wastes and dismantling activities. This provision is covered by a percentage of billing of electricity sales by the entire sector.

11.4 Personnel qualification, training and retraining

Decree 2869 of 1972 governing Nuclear and Radioactive Installations (RINR), establishes that the posts of Head of the Radiation protection Service (HRPS), Control Room Supervisor and Operator of Nuclear or Radioactive Installations shall require the incumbent to hold a specific license. Each such license is personal, allows the holder to carry out his functions at a given installation and is awarded by the Nuclear Safety Council following examination of candidates by a Tribunal appointed by the CSN.

The tribunals have 5 members. Those judging NPP Supervisors and Operators are plant-specific, and their members are experts in the technology and operation of the plant in question, one of the members being proposed by the plant owner from among its technicians. The HRPS tribunal is the same for all the installations in Spain and all its members are CSN experts. Apart from the technical skills described below, the candidates are required to accredit adequate physical and psychological conditions for the performance of their functions.

CSN Safety Guide (SG) 1.1, *Qualifications for the acquisition and use of nuclear power plant operations personnel licenses*, establishes the requirements to be met for the awarding of operator and supervisor licenses, these being basically as follows:

- *Academic qualifications*: University intermediate Degree in a scientific or technical subject; a four-month course on basic nuclear technology (nuclear physics, thermohydraulics, chemistry, materials, instrumentation, etc.); a four-month course on plant-specific design and operation; basic knowledge of nuclear legislation.
- *Experience*: A minimum two years of work at a nuclear power plant (supervisors 3), at least one of which must have been in operations (supervisors must have spent at least 1 year as an operator and another as assistant supervisor).
- *Initial training*: The operator shall receive at least 120 hours of training on a suitable full-scope simulator, including normal operating, transient and accident scenarios, and work at least 480 hours as control room operator, closely watched over by a supervisor. The supervisor shall receive at least 40 hours of training on a suitable simulator and make an in-depth study of the operating technical specifications, treatment of radioactive wastes and effluents, plant design basis, etc.
- *Retraining*: This will include 20 hours per year on the simulator and 100 hours of planned study, including modifications to the design, procedures and administrative standards and plant and industry operating experience.

Competence in all these areas is demonstrated by means of three examinations before the Tribunal of the CSN: theoretical, simulator and plant. All three must be passed with a mark higher than 80%. Licenses are awarded for two-year periods, and their extension requires documentary demonstration of the maintenance of skills and successful attendance within the retraining program.

Simulator training of operators is considered to be of the utmost importance, and a plan drawn up in accordance with the directives of the CSN is currently under way to improve current full-scope simulators. All the plants also have Interactive Graphic Simulators as a training tool.

CSN SG 7.2. *Qualifications for recognition as an expert in protection against ionizing radiations to take charge of RP services or technical units,* or Head of Radiation protection Service (HRPS) establishes the requirements for awarding of this license, these basically being as follows:

- *Academic qualifications*: University Degree in a scientific or technical speciality; a four-month course on radiation protection (the physics of ionizing radiations, detectors, biological effects of radiation, dosimetry, handling of equipment or substances producing ionizing radiations, shielding and confinement systems); knowledge of the applicable legislation and regulations and of the nuclear safety of the installation.
- *Experience*: A minimum five years of work in radiation protection, of which three may be in related techniques and the remaining two in techniques directly linked to radiation protection.
- *Initial training*: Of the total time dedicated to radiation protection, candidates must have had a minimum six months of training at an installation of the type in which they are to render their services.

The level of skill required to obtain the license, which is awarded indefinitely, is demonstrated by examination before the Tribunal of the CSN.

The RINR itself requires that prior to start-up of a nuclear installation the licensee submit to the CSN an "Operating Organization Manual" listing all the operations personnel, from the director to the control room operators, those performing nuclear tests and others, accrediting the technical competence of the incumbents of each post. The CSN evaluates this document and, once the installation is in operation, carries out periodic inspections aimed mainly at checking the academic qualifications, experience and training required for each job post, the basic training in radiation protection of all the workers, the scope of the on-going training programs and the coverage by such programs of changes to standards, design modifications and relevant operating experience. A check is also made to ensure that the design of such programs is based on the Systematic Approach to Training methodology proposed by the US NRC and included in 10CFR50.120, also adopted by the IAEA in its document Technical Report Series 380, "NPP personnel training and its evaluation".

Licensees are required to submit an annual report to the CSN summarizing the main personnel initial and retraining activities relating to nuclear safety and radiation protection.

11.5 Degree of implementation of the obligations

In Spain there are no measures of legal rank that oblige the operators to maintain any previously established financial resources during plant operation in order to guarantee safety. The availability of such funds is ensured by the actions taken by the CSN in performing its functions of plant surveillance and control, and by the action of the licensees themselves in accordance with the principle of Operator Responsibility.

The system in place for the awarding and renewal of operating permits ensures the re-evaluation of safety and the incorporation of the modifications required to maintain safety throughout the lifetime of the plant.

Regulatory measures have been established for the provision of funds for plant decommissioning and radioactive waste management.

The Spanish regulations include a system for the awarding of licenses for the operations personnel of nuclear power plants. Awarding of such licenses is by a tribunal, following a training program established in the corresponding CSN guides.

Article 12. Human factors

12.1. Methods to prevent, detect and correct human errors, including the analysis of such errors, the man-machine interface, operational aspects and the feedback of experience

The current objective of activities relating to human factors is to ensure that the actions of persons involved in the operation of the installations lead in all cases to the maintenance or improvement of their safety, and that possible deficiencies detected in the past are corrected.

During the construction, start-up and licensing of the first nuclear power plants, the attention of the operators and the regulatory body centred on achieving a high degree of hardware reliability, a situation that allowed insufficient attention to be paid in the concept of certain designs to the characteristics and limitations of human beings. This situation experienced a significant turnaround as a result of the Three Mile Island (TMI) accident, as from which, in accordance with international directives, greater attention began to be paid to the impact of human actuation on overall risk.

Since that time, the ultimate objective has been encompassed in a series of specific objectives, which may be classified into three clearly differentiated blocks. These three blocks of objectives and the activities deriving therefrom are described in the following paragraphs.

The first such block centres on compliance by the nuclear power plants with the criteria established in various areas relating to human factors. The main activities carried out by the plant operators and evaluated by the CSN are as follows:

- Analyses of human reliability included in the PSA's of the Spanish nuclear power plants, in accordance with the Integrated PSA Program of the CSN. These analyses have included a detailed review of possible human errors having an impact on risk, and significant improvements in procedures and design.
- Control room design reviews. These projects have been completed by most of the plants, evaluation now being in the final stages.
- Implementation of Safety Parameter Display Systems (SPDS's) from the point of view of human factors. All the plants of US design have now implemented such systems, the last in 1997. Evaluation of these systems from the point of view of human factors is now in an intermediate stage.
- Review of Emergency Operating Procedures (EOP's) from the standpoint of human factors. The EOP's of the Trillo NPP, of German design, are being converted to a new modular format and evaluated by the CSN.
- Evaluation of operating events in which the causes attributable to human factors are an important contributor. All the plants have set up groups in charge of review of in-house and industry experience. Most use the HPES (Human Performance Enhancement System) methodology for the root cause analysis. The CSN has personnel trained in root cause analysis and an Event Review Panel which classifies the operating events at nuclear plants and defines follow-up activities.
- Evaluation from the point of view of human factors of proposals made by the Spanish plants in relation to the simulators to be used for the training of licensed operations

personnel, as well as to the design of plant licensed and non-licensed personnel training programs. The aim is to guarantee that the design of these programs be systematic and address the needs of the personnel, allowing them to successfully carry out their respective functions.

The second set of specific objectives centres on the performance of R&D projects designed to support future enhancement activities. At present, the main activities performed are as follows:

- Assessment and modeling of the impact of organization and management on the safety of nuclear power plants. The objective of this joint CSN-UNESA project is to develop preventive and corrective analysis methodologies allowing organizational factors to be incorporated in the PSA's.
- Identification and incorporation of human errors of commission in the PSA's. The aim of this joint CSN-UNESA project is to incorporate into PSA human reliability analysis human errors of commission induced by given contextual conditions additional to the random human errors traditionally considered.
- R&D activities relative to man-machine systems. Of special interest in this area is the development of methodologies allowing for adequate evaluation of the new man-machine interfaces appearing in conventional control rooms as analogue technology is being replaced by (or added to) digital systems, giving rise to what are beginning to be known as hybrid control rooms.

Performance of these R&D activities is being accomplished within a framework of consensus between the electricity utilities and the CSN, with the collaboration of other national organizations with experience of human factors, such as CIEMAT and TECNATOM, and frequently within a framework of reference of bilateral agreements with similar overseas organizations (for example, the NRC) or international projects (for example the *Halden Reactor Project*).

Finally, the aim of the third group of specific objectives is to maintain and improve technical capabilities in the field of human factors, through attendance at training courses and participation in international working groups (NEA, IAEA and EU), allowing for the exchange of experiences and consensus regarding the measures required to address similar problems.

12.2 Management and instutional issues

The institutional and management aspects which affect safety are established in the Operating Organization Manual and the administrative requirements of the Operating Technical Specifications, two official documents whose modification is subject to CSN approval. At the plants, responsibility for safety is assigned to line management, although there are groups or committees such as the Plant Safety Committee and the Owner Safety Committee which, as has been pointed out in article 10, ensure that suitable priority is given to safety matters.

In addition to normal quality assurance systems, the operators are beginning to implement safety culture and management evaluation programs, such as the Model of the European Foundation for Quality Management (EFQM).

The CSN monitors the efficiency of management and organizational activities through the results of its inspections (ESFUC program) and of operating experience.

12.3 The role of the regulatory body and the operator regarding human performance issues

The role of the regulatory body and the operator in this area is similar to that of other specialities. The CSN and the operator track the human factor-related requirements and standards issued in the country of origin of the projects and international practices, the operator being responsible for the actions required to respond to the applicable requirements, and the CSN for evaluation of such responses to ensure their suitability. It should be pointed out, however, that the standards published are limited, even following TMI, and that in certain areas only recommendations, good practices or research projects exist.

As regards organizational aspects, since 1990 the CSN has had a specific group of technicians in charge of human factors issues. Such specific groups do not exist at the Spanish nuclear power plants or utilities, although they do have a common company which has wide experience of human factors issues, and contract other activities to external organizations. In addition, the nuclear plants have specialists in other areas with training and experience in and of certain matters relating to human factors, such as analysis of human errors in operating events, the development of computerized operator support systems, task and training analysis, etc.

12.4. Degree of implementation of the obligations

The requirements applied to human factors aspects have evolved depending on the practices established in the countries of origin of the technology and at international level. In those areas in which clearly defined requirements have existed (SPDS implementation, control room design review, EOP's, PSA), these are now being implemented. In other more complex and novelty areas (human errors of commission, impact of the organization on safety), R&D projects are in place which will facilitate new improvements. The systematic review of plant and industry operating experience makes it possible to identify and correct situations in which insufficient consideration has been given to human factors in the design or operation of the installation. Nevertheless, continuous surveillance of such aspects is necessary, as is the incorporation of new improvements when required.

Article 13. Quality assurance

13.1 Quality assurance policies

The provisions of the Spanish legal system that govern quality assurance are included in the Decree on Nuclear and Radioactive Installations, of 21st July 1972, and in the Decree governing Industrial Quality and Safety, of 28th December 1995.

13.1.1 Decree governing Nuclear and Radioactive Installations

The Decree governing Nuclear and Radioactive Installations currently in force establish requirements only in relation to quality assurance at nuclear installations under construction. The requirements are as follows:

- Article seven, e): for the awarding of a preliminary authorization for a nuclear installation, the applicant is required to submit a preliminary scheme of the organization foreseen to guarantee quality during construction.
- Article fourteen, E): for the awarding of a construction permit for a nuclear installation, the applicant is required to submit a Preliminary Safety Analysis Report including the organization foreseen to guarantee quality during construction.
- Article twenty-one: the holder of a construction permit is required, during construction and erection of the installation, and prior to loading fuel or accepting nuclear substances, to put in place a control program ensuring the quality of the nuclear safety-related components and equipment during the different phases of manufacturing and incorporation into the installation.

13.1.2 Decree governing Industrial Quality and Safety

The objective of these regulations, which are applicable to all sectors of industry and not only the nuclear industry, is to adapt the regulation of industrial activity in Spain to that derived from the country's belonging to the European Union, through standardization, harmonization of the regulations and instruments of control, and the new Community approach based on the progressive replacement of administrative homologation of products with the certification performed by companies and other organizations, with supervision of their activities by the public powers.

To this end, they establish the organizational and functional requirements to be satisfied by the public and private agents constituting the infrastructure for industrial quality and safety, indicating that those agents which operate within the area of quality voluntarily as indicated in the regulations will, if they wish to voluntarily become integrated into the quality infrastructure, need to be accredited by one of the organizations defined therein.

13.2 Quality assurance programs concerning all safety-related aspects throughout the lifetime of the installations

As has been seen in section 13.1, the only obligatory quality assurance requirements are those indicated in the Decree governing Nuclear and Radioactive Installations. In order to make up for this lack of requirements, all the authorizations awarded to Spanish nuclear installations include the requirement that there be a quality assurance program applicable to the area authorized.

At present, all the Spanish nuclear installations are in operation, with the exception of Vandellós I, and their quality assurance programs are reflected in the respective Quality Assurance Manuals.

These manuals reflect the quality philosophy applicable to all activities performed during operation, which are developed in the corresponding procedures. They include the planned, systematic activities required to achieve the required quality for all the equipment and activities of the installation.

As a pattern for the performance of quality assurance activities, the CSN has issued various safety guides, the first of which has as its objective the recommendation of those standards on which the Quality Assurance programs of the Spanish nuclear installations should be based.

This guide indicates as acceptable a Spanish industry standard applicable to the nuclear sector (UNE 73-401), which basically reflects the 18 criteria of Appendix B of the US 10 CFR 50, along with the codes and standards of the international organizations of which the Spanish State is a member (IAEA Code 50-C-QA) or those recognized as being applicable by the nuclear industry, in particular those established in the country of origin of the project.

The Spanish plants have fundamentally applied the criterion of adhering to the standards of the country of origin of the project and to the aforementioned industry standard.

The guide is applicable to all nuclear safety-related activities performed for and by the Spanish Nuclear installations. It therefore includes not only those activities which are performed at the nuclear installations themselves during the different phases of site study, design, construction, start-up, operation, temporary shutdown and decommissioning, but also all those relating to such installations, such as engineering, manufacturing and inspection.

The other guidelines issued by the CSN for the performance of such activities, which are listed in Appendix 7.A, section 10, cover aspects of quality assurance in design, operation, start-up, testing, checks and inspections, audits and the supply of items and services, and recommend that performance of such activities be based on various of the IAEA series 50-SG-QA guides, recently revised by the IAEA.

The quality assurance manuals currently in force at the Spanish nuclear installations are oriented towards the basic objective of operating the plant in a safe, reliable and economic fashion, meeting all the applicable legal standards and requirements in order to guarantee to a suitable level of confidence that their operation does not imply any undue risk for public health and safety.

The manuals describe the quality criteria to be applied to achieve and maintain the necessary levels of quality during the plant operating phase, and indicate the requirements, interrelationships and responsibilities for performance of the respective quality assurance programs.

The manuals are periodically revised, with a view to keeping them updated in accordance with the experience acquired and the applicable standards in force.

Compliance with the requirements of the manuals is obligatory for the personnel of the installations, and all those carrying out activities covered by the quality assurance program are required to be familiar with the requirements and responsibilities established therein and applicable to them.

13.3 Methods used for the application and assessment of quality assurance programs

The installations are ultimately responsible for establishing and implementing the quality assurance program.

The Quality Assurance organization is clearly defined and establishes the functional responsibilities, levels of authority and lines of internal and external communications required to manage, direct and perform the quality assurance program.

In keeping with recent tendencies in this field, the Spanish installations recognize that quality assurance is an interdisciplinary function involving many components of the plant organization, as a result of which it is not considered to be the exclusive realm of the quality assurance group.

The structure of the quality assurance organizations is such that compliance with quality objectives is the responsibility of those performing the work, verification of compliance with the quality requirements established being undertaken by people who have not participated directly in the work being checked.

The structure of these organizations varies from one installation to the next, but in all cases the people responsible for quality assurance have sufficient authority and freedom to identify conditions adverse to quality, to initiate, recommend or facilitate solutions and to verify the implementation of such solutions. Likewise, they report to a level of management that guarantees the necessary authority and freedom within the general organization and provides them with sufficient independence as regards costs and time periods.

Checking and evaluation of compliance with all the aspects of the quality assurance program at each installation is accomplished through the implementation of a program of internal and external audits, for which the quality assurance organizations are responsible. The audit schedules are issued annually and approved by the corresponding hierarchy.

The audit schedules are not rigid and may undergo modification. Unforeseen audits may be included, but all those included in the annual schedule are carried out unless special circumstances justify their non performance. Prior to the performance of each audit, the points to be covered are established in writing, using checklists.

The organization responsible for the audits selects and appoints duly qualified auditors who do not have any responsibility for the activities to be audited. In the case of internal audits, the individuals responsible for selecting the auditing team do not have any direct responsibility for performance of the activities audited.

The auditors submit the results of their audits in writing to the appropriate level of management of the organizations responsible for the area audited, which applies the necessary corrective actions to deficiencies encountered during the audit.

Likewise, measures are established to control items not complying with the established requirements, and prevent them from being inadvertently used or installed.

Suitable measures are also established to allow for the tracking of corrective actions and to check that the deficiencies discovered during the audits and their root causes are corrected within the agreed on time periods.

13.4 Regulatory control activities

The Quality Assurance Manual is an official document applicable to the operation of Spanish nuclear installations which, as pointed out above, is demanded in all operating permits issued.

The initial Manual of each plant was approved by the safety authority existing at the time; at present, subsequent revisions are required to be submitted to the CSN within one month of their implementation. At other installations, such as the Juzbado Fuel Manufacturing Facility, revisions of the Manual must be approved by the Ministry of Industry and Energy.

The revision received by the CSN is evaluated in accordance with the applicable standards, and the licensee is informed as to whether or not modifications should be incorporated.

The CSN carries out monitoring and control of the quality assurance activities of the installations by means of evaluations and inspections.

Evaluations of the quality assurance manuals are performed when initially submitted, subsequent evaluation being of their revisions.

As has been pointed out above, if the manual or any of its subsequent revisions is considered not to be adequate, the plant is notified for modification.

Quality assurance inspections are carried out in accordance with the contents of the Decree governing Nuclear and Radioactive Installations in force, and cover the actions taken by the quality assurance organizations of each installation and application of the quality assurance program in the remainder of the departments and services.

At the end of each year, scheduling is prepared for the following one. These schedules establish the inspections to be performed at each installation, taking into account the results of inspections carried out in previous years and the existence or otherwise of specific projects having an associated quality plan and requiring special attention by the quality assurance organization.

In addition to these scheduled inspections, others are performed in response to events requiring checking of quality assurance activities.

Mention should be made also of control activities carried out with respect to the manufacturers and suppliers of safety-related components and services for nuclear installations.

According to the Decree governing Nuclear and Radioactive Installations, the manufacturing of apparatus, equipment or accessories destined specifically for nuclear or radioactive applications requires authorization by the Ministry of Industry and Energy, following a mandatory report by the Nuclear Safety Council.

In drawing up such mandatory reports, the Nuclear Safety Council evaluates the quality assurance programs of these manufacturers, and inspects their application to the manufacturing of components requiring authorization.

The suppliers of safety-related services do not require authorization according to the legislation in force, but the Nuclear Safety Council performs inspections of their quality assurance programs through the installation to which the services are supplied.

13.5 Degree of implementation of the obligations

In view of the requirement, established in the operating permits, that operators have a Quality Assurance Manual, of the contents thereof, the operator's organization to ensure compliance and the control performed by the CSN, as described above, Spain is considered to meet the requirements of this article.

Certain actions are currently being taken to facilitate compliance with the applicable quality assurance requirements by the installations. These include updating of the CSN guides relating to quality assurance and listed in Appendix 7.A, section 10, and tracking of new trends in this area at international level.

Likewise, new guides are being drawn up to deal with aspects not included in the present documents, which will facilitate compliance with quality assurance criteria by the installations, for example quality assurance during manufacturing.

As regards new quality assurance trends at international level, the development of gradual quality assurance requirements carried out in the United States of America (in application of Probabilistic Safety Assessment programs) is being monitored with a view to being able to evaluate and control implementation by the Spanish nuclear installations.

Article 14. Assessment and verification of safety

14.1 Licensing process and safety analysis reports for the different stages of nuclear installation projects

As has been indicated in article 7, the licensing process prior to awarding of the Provisional Operating Permit (POP) that allows the operator to perform nuclear tests includes the following stages:

- Acquisition of the preliminary or site authorization.
- Acquisition of the Construction Permit.
- Approval of the Pre-Nuclear Verification Program.

These permits, approvals and authorizations are awarded by the Ministry of Industry and Energy (MIE) following the issuing of a mandatory, binding report in relation to nuclear safety and radiation protection by the CSN.

The authorizations awarded to the second generation plants included the concept of the reference plant. This meant that the licensee identified a similar plant in the country of origin of the project and analyzed all the regulatory requirements required in that country in relation to the plant in question. Following analysis of these requirements for his plant, the operator was required to submit to the CSN a program for the implementation of the results of these studies, analyses or modifications, as appropriate. This concept of the reference plant has become habitual practice in the licensing and control of Spanish nuclear power plants.

Preliminary or site authorization

The Preliminary Authorization constitutes an official recognition of the proposed objective and the selected site, and enables the interested party to apply for authorization to construct the installation.

The documentation submitted by the applicant must specify the criteria, codes, standards and provisions applied to the different parts of the project, specifically:

Projects for installations are to be based on a proven prototype, identifying a reference plant. A minimum horizontal acceleration of the ground is defined and an operator-controlled zone and protected zone are established, the corresponding radiological criteria being indicated. Furthermore, and especially important during this phase, geological, geophysical, meteorological, hydrographic studies, etc. are carried out analyzing the characteristics of the selected site.

During this phase of the process, the Regulatory Body evaluates the site and Project organization studies and the Owner's Quality Assurance Manual. The meetings considered necessary are held with the applicant to clarify or discuss certain aspects that the Regulatory Body considers to be of interest. Deterministic methods are used to check that the most important site parameters are as indicated by the applicant, and independent calculations and checks are performed to ensure that the sites selected are compatible with the projected installation.

The evaluation performed is reflected in a report on nuclear safety and radiation protection that contains a proposal regarding the conditions to be met for the authorization requested to be awarded. This report, which is mandatory and binding, proposes a set of conditions regarding safety and radiation protection that is included as an appendix in the Authorization awarded by the MIE.

Authorization for construction

During the period established for this purpose in the Preliminary Authorization, the licensee is required to submit his application for the Construction Permit. The standards applicable in each case are first those in force in Spain, followed by the international standards and those established in the country of origin of the project (US or Germany).

The application is to be accompanied, among other documents, by a Preliminary Safety Analysis Report (PSAR), the basic contents of which have been described in article 7 and which is based on the standard format defined in US NRC Regulatory Guide 1.70.

It is the PSAR that accurately defines the design criteria and standards applicable to the different aspects of design, manufacturing, construction and erection of the installation. The structures, systems and components are classified, depending on the importance of their function in relation to nuclear safety, into safety classes, which depend on their design, manufacturing and inspection requirements.

The Regulatory Body evaluates the information submitted by the applicant, in order to issue the corresponding preliminary technical judgement regarding safety in relation to the proposed installation. Special emphasis is laid in this evaluation on checking of the quality of site data and parameters, and on all the aforementioned aspects of basic design. A very important part of this work is consideration of the information relating to the reference plant, as regards both the contents of the PSAR itself and the licensing process and documentation generated by the Regulatory Body of the country of origin of the project. An analysis is also made of the Owner's Organization and of the most important organizations intervening in the project (Main Vendor, Architect-Engineer, etc ...), as well as of their Quality Assurance Manuals, with a view to checking their capacity to undertake detailed design and construction.

The technical judgement drawn up by the CSN contains a series of conditions regarding nuclear safety and radiation protection, which are attached to the construction permit issued by the MIE.

The construction permits issued to the Spanish NPP's evolved greatly from those awarded to the first generation plants of José Cabrera and Santa María de Garoña (1960's) to those given to the third generation plants (end of the 1970's and beginning of the 1980's). As the knowledge and experience of the applicants themselves and of the Regulatory Body increased, the depth of the studies and the documents submitted and of the evaluations and inspections performed also increased, in keeping with assimilation of the technology of the country of origin. The deterministic methodology was in all cases used in awarding construction permits.

Pre-nuclear verification program

The Regulatory Body evaluates the pre-nuclear verification program submitted by the applicant. It requests the test procedures, evaluates them and inspects whatever parts it considers appropriate, issuing the corresponding inspection dossier. An assessment is made as to whether the acceptance criteria of the different tests have been met, and if this is not the case, the necessary corrective actions are requested and monitored to compliance. In this way, the entire pre-nuclear testing program is subjected to CSN evaluation and inspection.

Once the pre-nuclear testing program has been completed and approved, evaluation of the nuclear testing program begins. As in the previous case, those issues considered to be appropriate are evaluated and inspected.

Provisional Operating Permit (POP)

Once the pre-nuclear testing phase is completed, the Provisional Operating Permit (POP) is awarded, this enabling the owner of the installation to carry out nuclear tests and operate the plant in accordance with the nuclear safety and radiation protection limits and conditions incorporated into the permit as an appendix. During this initial phase, partial authorizations are issued for the performance of different tests at different levels of nuclear power and for checking that the normal and emergency systems behave as per the design.

The POP's of the different plants are similar in their structure and contain in their appendix a series of limits and conditions to be met by the installations. Certain of these conditions are for immediate compliance, while others refer to a fixed period of time. The POP's also define the revision in force of the official documents listed in Article 19 of this document, with which the operating activities must coincide (Operating Organization Manual, On-Site Emergency Plan, Operating Technical Specifications and Final Safety Analysis Report). Any modification or change to these documents must be approved prior to their entry into force by the MIE, following a report by the CSN. In addition, the POP establishes the periodic or non-periodic reports to be submitted to the CSN. All these reports are evaluated by the CSN, the result being the meetings, inspections and/or audits performed with respect to the owner of the installation whenever the CSN deems this to be necessary.

These POP's are renewed every so often. Until the end of the 1980's, these were renewed yearly or depending on the operating cycle; at present this occurs every 4-5 years, depending on the plant. Before such renewal, the licensee must demonstrate compliance with all the requirements of the set of conditions of previous POP renewals. Furthermore, the CSN carries out a detailed evaluation of both compliance with these conditions and of the status of the plant, this being reflected in the technical judgement report.

14.2 Summary of essential generic results of continuous monitoring and periodic safety assessment

Given the characteristics of the system of awarding of POP's applied in Spain since the beginning of operation of the plants, in which licenses were issued provisionally and for a fixed and relatively short period of time, the Regulatory Body has carried out direct tracking and continuous evaluation of plant operations.

The first generation plants which initiated their commercial operation at the beginning of the 1970's, carried out a safety re-evaluation program at the beginning of the eighties, similar to that performed in the USA within the framework of the US NRC's Systematic Evaluation Program (SEP). The objective was to analyze the degree of compliance with the general design criteria established in the USA, in appendix A of 10CFR50, following construction and start-up of the plants in question. In practice, this meant improvements to many of the plants' safety systems (electrical, fire-fighting and ventilation systems, revision of structures, systems and components, etc.).

In addition, the plants have made modifications in order to correct situations or problems appearing in their installations, such as replacement of the recirculation system piping at Garoña NPP, due to the appearance of intergranular stress-corrosion cracking, or the incorporation at this plant of mechanical seals in the control rod drive mechanism penetrations due to the appearance of cracking resulting from this same process. These modifications were analyzed and approved by the CSN following the necessary safety evaluations and the performance of tests.

The second generation plants, which came on line at the beginning of the nineteen eighties, had to introduce the necessary modifications that arose from the lessons learned from the events which occurred at the US TMI and Browns Ferry plants. This also implied gradual demands by the CSN for the licensees to closely monitor the operating events and experience of plants in the countries of origin of their technology, and systematic analysis of the possible consequences for their plants of such events. All these analyses are sent to the CSN and evaluated in order to determine whether the necessary corrective actions are being applied.

The third generation plants entered operation after already having incorporated into their designs the modifications required as a result of the aforementioned operating events. At Trillo NPP an operating experience and systems analysis program (OESA) has been developed as a result of the discovery of deficiencies in implementation of the design of certain components, this having meant a complete review of the safety systems in order to check compliance with the project design criteria. This program has been closely tracked by the CSN. As a result, various design modifications have been made to solve the deficiencies detected.

The Spanish nuclear power plants are subjected in practice to continuous and permanent evaluation by way of two different routes: on the one hand the awarding of provisional operating permits, currently tending to be for 10 years, and on the other the existence of resident CSN inspectors at the sites themselves (two per site). These inspectors carry out daily monitoring of plant operation and events, and track the way in which operating events are solved and the OTS's and CSN requirements are complied with. Furthermore, the resident inspectors are in permanent contact with the CSN Project Managers for each plant, keeping them updated on the day-to-day situation of each plant.

In addition to the daily review of plant safety, the CSN has required – albeit later than the regulatory bodies of other countries – that ten-year Periodic Safety Reviews be carried out. These are described below.

Periodic (ten-year) nuclear power plant safety reviews (PSR)

The nuclear power plant periodic safety reviews are carried out every ten years in accordance with the contents of CSN Safety Guide 1.10. These periodic reviews are not designed to replace the practices of analysis, control and surveillance carried out continuously at the plants, but to provide an overall assessment of the safety of each plant and of the possible improvements to be made in view of its current status.

The objectives of these evaluations are as follows:

- Ensure that the process of analysis derived from operating experience has been correctly applied, including overall review of the modifications performed as a result of generic studies.
- Analyze the overall performance of the plant over extended operating periods, including the results of equipment maintenance and surveillance requirements, with a view to checking that plant safety levels have not decreased over such periods and guarantee safe operation during the next.

- Assess plant safety with respect to the new requirements demanded by the national standards, international recommendations and requirements made in the country of origin of the project to plants of a similar design, national application of which has been established by the CSN generically or specifically.
- Update the different, continuously applied, safety evaluation and enhancement programs.

In-Service Inspection Program

One area which requires permanent attention by both the operator and the Regulatory Body is the In-Service Inspection of structures, systems and components. The plant Technical Specifications require that an In-Service Inspection program be implemented and maintained, this consisting of a set of periodic examinations and tests aimed at verifying the structural integrity and operating capability of safety-related mechanical components, systems and equipment.

The in-service inspection standard applied at Spanish nuclear power plants is Section XI of the ASME Code (USA), the scope covering the welds of mechanical systems and equipment, supports and snubbers, pumps and valves.

The inspections are performed by visual inspection, superficial non-destructive testing (NDT) (penetrant liquids and eddy currents), volumetric NDT (X-rays, ultrasonics and eddy currents) and hydrostatic leak and functional tests. These inspections are mainly carried out during refueling outages.

Once the plant refueling outage has finished, the plant is required to submit a preliminary report to the CSN, including the conclusions of the inspections performed. This report is mandatory and start-up cannot proceed without it.

Throughout the lifetime of the plant, a full inspection must be completed every ten years, to the scope established. Each ten-year interval is divided into three periods of three or four years each, and during each the same number of in-service inspection campaigns is performed as there are refueling outages.

The inspections are required to be performed in accordance with homologated procedures, and the inspectors must also be suitably homologated, depending on their responsibilities within the three levels established in the standards.

The plant owner must submit the following to the CSN:

- An In-Service Inspection Organization Manual (ISIOM), describing the organization, activities and general procedures.
- For each interval, an In-Service Inspection Manual (ISIM) including the applicable codes and standards, scope and limits of inspection, inspection schedules, technical procedures and available equipment and resources. The ISIM is a living document that must be updated as required.
- For each refueling, the foreseen in-service inspection schedule must be submitted, this including the information listed in Appendix I of CSN Safety Guide 1.5 and the final results report.

Maintenance programs

Since the very beginning of their operation, the Spanish nuclear power plants have implemented predictive, preventive and corrective maintenance programs. Predictive programs have also been introduced as a result of the experience acquired during operation.

These programs are carried out by maintenance units belonging to the operations organization. The functions and responsibilities of the maintenance organizations are included in manuals and procedures. There are initial training, qualification, retraining and requalification programs in place for the maintenance personnel.

Preventive maintenance amounts to about 70% of the total and is applied to 100% of the safety systems.

A program based mainly on the Maintenance Rule of 10CFR50.65 (USA) is currently being implemented, the aim being to monitor the behaviour or status of structures, systems and components (SSC) in relation to previously established objectives, such that SSC operation be ensured in keeping with their functions. This monitoring will not be required if correct functioning of an SSC is demonstrated through adequate preventive maintenance. Implementation of the Maintenance Rule is being carried out as a pilot experience at the Cofrentes and Vandellós II plants.

Difficulties in methodology and implementation are being jointly analyzed by the licensees and the CSN.

14.3 Regulatory control activities

The CSN is responsible for carrying out evaluations, inspections and controls of nuclear installations, in order to ensure compliance with the standards and conditions established in the aforementioned authorizations and approvals.

The documentation submitted by the operator throughout the processes of authorization and approval is evaluated and analyzed by the CSN in order to check for compliance with the necessary conditions and standards. Throughout this evaluation process, the operator may be required to provide whatever clarifications, justifications and details are considered necessary.

In revising in detail the calculations performed by the operator, the CSN may perform alternative calculations or inspections at the offices of the engineering firms which have performed these calculations.

The POP's require that the plants systematically submit to the CSN, every six months, a report on the modifications made, under way and scheduled, along with an analysis of their impact on plant safety or on the official operating documents. In view of the experience acquired over the years, the CSN is drawing up a Safety Guide on design modifications, establishing the analyses to be performed by the licensees to determine whether or not the modification affects safety, and if this is the case, establish the scope of the safety analysis to be submitted to the CSN for evaluation and/or approval.

14.3.1 Probabilistic Safety Assessment

In 1986 the CSN approved an integrated Probabilistic Safety Assessment plan which required all the Spanish plants to perform a level 1 PSA. The objective was double:

- On the one hand, the performance of PSA's for each of the Spanish plants in accordance with certain basic ideas regarding their planning. In other words, the PSA's were to be carried out step-wise in both scope and time, such that in order to achieve a future common scope at all the plants, at least the first PSA's should be updated to the scope of the last. The aim of this was to favour the use of Spanish resources and the acquisition and assimilation of technology. Consequently, in the text of the first edition the emphasis was laid especially on the performance of the PSA's.
- The second goal was PSA applications. For this reason, the applications foreseen for the PSA models once developed were already described. The applications foreseen were to be based on the high capacity of these risk analyses for discrimination of the importance or contribution to risk of different aspects of the design and operation of the installation.

The following table shows the results obtained from the PSA's, expressed in terms of Core Damage Frequency.

Core damage frequency (reactor/year)

José Cabrera NPP	3.35 E-5 *
Stª Mª de Garoña NPP	2.51 E-4
Almaraz NPP	3.78 E-5
Ascó NPP	5.51 E-5
Cofrentes NPP	2.13 E-6
Vandellós II NPP	6.38 E-5
Trillo NPP	4.34 E-5*

* Pending evaluation by the CSN

Evaluation of the level 1 PSA's of the Almaraz, Ascó and Cofrentes plants is now completed.

Performance of the level 1 PSA's meant greater knowledge of the plants by both the operator and the CSN. This performance led to certain design modifications in very specific areas.

A new integrated PSA plan to level 2 has recently been approved by the CSN, this considering off-site events, risk in other operating modes for low power and shutdown operation and risk due to sources of radioactive products other than the reactor.

14.3.2 Inspections

In order to verify that the nuclear power plants are being operated in accordance with the established conditions and standards and that the actions required in the different authorizations and approvals are being suitably implemented, the CSN applies an Inspection Program. In addition, there are two Resident Inspectors at each site.

The inspections program includes the following

- Generic scheduled inspections, usually yearly or two-yearly, such as those carried out with respect to the programs for environmental qualification, quality assurance, maintenance, in-service inspection, compliance with surveillance requirements, cycle start-up tests, compliance with fire-fighting standards, checking of the status of structures, revision of electrical and instrumentation systems, analysis of new requirements of the regulatory body of the country of origin of the project, analysis of operating experience, etc. These inspections are performed in accordance with previously prepared generic checklists.
- Specific scheduled inspections of processes for the implementation of improvements or corrective actions, such as steam generator replacements at PWR plants, design basis review programs, design modifications, scheduled repairs, systematic programs for the detection of design errors, etc.
- Non-scheduled inspections to be performed following the appearance of unforeseen problems, such as breach of the Techynical Specifications, equipment failures, events affecting nuclear safety, etc.

The inspections are performed by the technical personnel of the CSN, with the participation of personnel specializing in the disciplines included in their scope.

Along with the inspections program described above, a Program for the Systematic Evaluation of Nuclear Plant Operation (ESFUC) has been developed, this including evaluation of the performance of the operator's organization in relation to five functional areas: operation, radiological controls, maintenance and surveillance, engineering and technical support and emergency preparedness, security and fires. The evaluations are based on reports from the inspectors themselves, which assign certain qualifications to aspects relating to the functional areas considered during the inspection.

The ESFUC reports obtained during an operating cycle are used to draw up an overall report for each functional area. The results obtained allow conclusions to be drawn regarding the degree of depth of the safety culture of the operator's organization, and more efficient channeling of the Regulatory Body's control and inspection efforts towards those areas so requiring.

14.4 Degree of implementation of the obligations

The evaluation and verification of the safety of the Spanish nuclear power plants should be considered highly positive from the point of view both of the licensing and inspection systems in force, which make it possible to guarantee levels of nuclear safety similar to those of the most advanced countries in this area, and of their efficiency, since they have allowed the different problems which have appeared to be detected.

There are points which might be improved and which the CSN is determined to promote in order to work more efficiently as regards evaluations and on-going inspection. The CSN has mapped out the following courses of action in its strategic plan:

- The experience accumulated leads the CSN to consider it suitable to progressively implement a policy of awarding operating permits for periods of ten years, preceded by a systematic safety and radiation protection review of the plant. Such reviews will be performed taking into account operating experience since the beginning of plant operation, analysis of the performance of equipment, structures and systems, the impact of changes to the standards applicable to the technology of the project, the results of the probabilistic risk assessments performed and whatever requirements might be established in the national regulations during this period.
- Strengthening of on-going safety analysis and operations analysis of the nuclear power plants. Establishment of inspection policies and procedures, taking into account the results obtained during operation and the evaluation performed by the CSN of operation of the plant organization. Assimilation and application to the specific Spanish case of generic issues and requirements defined in other countries, for consideration within the continuous safety review programs.
- Strengthening of the Integrated Probabilistic Safety Assessment Program and use of results to improve plant safety.
- Implementation and development of a policy of defense against severe accidents. An essential element for the development of such a severe accidents policy is the performance of level 2 probabilistic safety assessments.
- Monitoring of the ageing of the installations and life management. The CSN should monitor in detail the programs of the plants in order to gain insight into the status of degradation of critical systems and components and equipment maintenance and replacement programs, and enhance its skill in the evaluation of the efficiency of component regeneration techniques and its knowledge of their reliability and availability for performance of their function.
- Evaluation of nuclear plant decommissioning and dismantling programs.
- Tracking of actions at international level, the adaptation of overseas experience to the Spanish situation, definition of the technical contents of the documents used as a basis for dismantling authorizations and decommissioning statements, and the establishment of criteria for the segregation of contaminated materials and wastes.
- Validation of advanced calculation methods and programs serving to support safety evaluations of nuclear plants and new types of fuels.

- The CSN should remain aware of the possible evolution of fuels and evaluate the implications of the international trend towards the use of mixed uranium and plutonium fuels in current nuclear power plants.
- The CSN should revise the inspection system, with specific attention to general criteria regarding the types of inspections to be performed, the systematic approach to their preparation and performance, the responsibilities of the inspectors and the criteria applicable during performance. Likewise, it is necessary to draw up an Inspection Technical Procedures Manual and optimize the activities of the resident inspectors at the nuclear plants.

Specific programs should be maintained, and set up where applicable, allowing better use to be made of inspections in the evaluation of operation of the installations.

Spain is considered to meet the requirements of this article.

Article 15. Radiation protection

15.1 Summary of laws, regulations and requirements referring to radiation protection applied at nuclear installations

The provisions of Spanish Law relating to radiation protection are included fundamentally in Law 15/1980, of 22nd April, establishing the CSN, the Regulations governing Protection against Ionizing Radiations, of 24th January 1992 and the Royal Decree on the protection of off-site workers with the risk of exposure to ionizing radiations due to their intervention in the controlled zone, of 21st March 1997.

15.1.1 Law establishing the Nuclear Safety Council (CSN)

This assigns to the Organization the functions of monitoring and controlling the levels of radioactivity inside and outside nuclear power plants, and their particular or cumulative impact on the areas in which such installations are located, of controlling the dose received by the operating personnel and of notifying and advising Government with regard to commitments with other countries or International Organizations in relation to nuclear safety and radiation protection.

15.1.2 Regulation governing Protection against Ionizing Radiations

This regulation establishes the basic radiation protection standards to prevent the production of non-stochastic biological effects and limit the probability of occurrence of stochastic biological effects to values considered acceptable for professionally exposed workers and the members of the public, as a result of activities implying the risk of exposure to ionizing radiations. It constitutes a translation to the Spanish regulations of the European Union's Directives 80/836/EURATOM and 84/467/EURATOM.

It establishes the principles of Justification, Optimization and Limitation as basic principles for protection, going on to establish general standards and fundamental surveillance measures for the protection of professionally exposed workers, students, members of the public and the population overall. For each of these groups it establishes permissible dose limits in accordance with the recommendations of the International Commission for Radiological Protection in its publication number 26 (ICRP-26).

In the case of professionally exposed workers, the existence of Radiation Protection Services and Technical Units is foreseen, these carrying out the protection functions commissioned to the licensees of the installations, and the requirements for worker training are set out. As regards the prevention of exposure for the workers, these are classified depending on their conditions of work, the working areas in different zones are classified depending on the annual doses that might be received in them, and the standards and measures for control to be applied in the different areas and to different categories of workers are defined. Likewise, requirements are established for dose determination and recording and for the medical surveillance of the workers.

As regards the radiation protection of the public, there is the obligation to assess those doses that might be received by the population as a result of normal operation of the installation and in the event of accidents. Performance of these assessments is required for the administrative authorization of the corresponding installation.

Standards of a general nature are established to prevent or minimize the release of radioactive substances to the environment, under both normal operation and accident conditions.

Finally, a system of inspections by the CSN is established for all activities regulated in the regulation itself, along with a system of penalties for non-compliance with the requirements established therein.

15.1.3 Royal Decree on the Occupational Protection of off-site workers with the risk of exposure to ionizing radiation due to their intervention in the controlled zone.

This constitutes the translation to the Spanish regulations of EU Directive 90/641/EURATOM.

It requires that companies which are to perform activities in the controlled zone be included on a register drawn up by the CSN, that they declare the activities performed and ensure the availability of adequate resources for compliance with the stipulations of the Royal Decree. The CSN may undertake controls and inspections of off-site companies to check for compliance with the aforementioned stipulations of the Royal Decree.

It establishes that the companies shall be obliged to comply with the Regulation governing Protection against Ionizing radiations, provide information on radiation protection to their workers, control the doses received by the latter, maintain medical surveillance and request assignment of the Individual Radiological Monitoring Document from the CSN.

The obligations established with respect to the operator of the installation are the operational aspects of radiation protection to ensure compliance with the requirements of the Regulation governing Protection against Ionizing Radiations, ensure that the external companies meet the requirements listed in the previous paragraph, ensure that for each intervention the workers have available adequate individual protection equipment and record the doses received in the Individual Radiological Monitoring Document.

Also established is the obligation that the workers collaborate with those responsible for radiation protection in the company's and the plant operating organizations.

The characteristics and contents of the Individual Radiological Monitoring Document are established.

Finally, the system of violations and penalties relating to the stipulations of the Royal Decree is established.

15.2 Application of national laws, regulations and requirements in relation to radiation protection

15.2.1 Dose limits

The dose limits currently in force in Spain for Nuclear Power Plant workers are established in the Regulation governing Protection against Ionizing Radiations, are based on the recommendations of ICRP-26 and are as follows:

- Whole body exposure

  Annual dose limit (12 consecutive months)

  50 mSv

- Partial body exposure

  Annual dose limit (12 consecutive months)

Effective dose	Equivalent dose Lens	Equivalent dose Any other organ or tissue
50 mSv	150 mSv	500 mSv

The dose limits established for the members of the public are as follows:

- Whole body exposure

  Annual dose limit (12 consecutive months)

  5 mSv

- Partial body exposure

  Annual dose limit (12 consecutive months)

Effective dose	Equivalent dose Lens	Equivalent dose Any other organ or tissue
50 mSv	15 mSv	50 mSv

15.2.2 Compliance with conditions relating to the release of radioactive substances

The requirements established in the Regulation with regard to the release to the environment of radioactive effluents are included in Titles IV (Surveillance Measures) and V (On radioactive wastes), and may be summarized as follows:

- Surveillance for the protection of the public should be based on assessment of the dose which might be received by the individual making use of the surroundings; such assessments should be based on with the risk implied by the activities and be at least yearly in frequency.
- The limits on the release of radioactive effluents should be such that the concentrations of activity of the radionuclides they contain and the doses they might cause to the public be as low as possible, and in all cases lower than the basic dose limits or than whatever lower limits might be established by the CSN.
- Installations which might give rise to radioactive wastes shall be equipped with independent storage, treatment and disposal systems, and should be subject to adequate surveillance to prevent uncontrolled releases.
- All releases of radioactive wastes to the environment shall require express administrative authorization, which shall specify the conditions for release.
- In order to prevent the basic dose limits or those established by the CSN from being reached, the corresponding administrative authorizations shall establish the limits and conditions for release of radioactive effluents.

Appendix 15.A describes the application of these principles for the Spanish nuclear power plants.

15.2.3. Measures adopted to guarantee that exposure to radiations be kept as low as reasonably achievable.

With a view to solving the problem of how far efforts should go in reducing radiation doses, the International Commission for Radiological Protection (ICRP) created the concept of OPTIMIZATION of protection, commonly known as the ALARA criterion.

The ALARA criterion is included in the aforementioned Spanish regulation. Its application in Spain as a general requirement is accomplished in compliance with the stipulations of the said regulation and of the basic standards of the European Communities and of the IAEA.

The methods used to analyze and attain an optimum level for protection vary from common sense to the most complex cost-benefit and multi-attribute analysis techniques. The process of optimization is essentially related to the source of the radiation and should first be applied in the design phase. It is in this phase that dose reductions based on quantitative analyses may most efficiently be achieved. During the operations phase, on the other hand, informal analyses predominate, based on experience, good practice and engineering judgment.

As regards compliance with the regulatory requirement that the doses received by professionally exposed individuals be kept as low as reasonably achievable, the following may be underlined:

- Rational application of this principle at nuclear power plants translates into the objective of attaining a level of exposure to radiations which is sufficiently low to guarantee adequate protection for the workers (within a range of doses far lower than the established limits), without the economic feasibility of the installations being questioned.

- One of the most widely used indicators for assessment of the degree of application of the ALARA criterion at international level is the ANNUAL COLLECTIVE DOSE PER REACTOR. The CSN regularly performs comparative analyses of the values obtained for this index in the Spanish plants with those of the USA and the OECD countries.

  The results obtained for the aforementioned index show that, overall, the situation of the Spanish plants as regards application of the ALARA criterion is in line with that existing in other countries.

  In order to ensure that this situations persists, the CSN is currently promoting greater development in the implementation of the ALARA principle. Two courses of action are followed in this respect:

  - The use of more complete and suitable indicators for effective assessment of the degree of implementation of the ALARA principle in Spanish plants.

    In this respect, attention may be brought to the publication of CSN Safety Guide 1.5, "Documentation on refuelling activities at light water reactor nuclear power plants", which allows full insight to be gained since 1991 into the collective dose associated with each of the tasks carried out during refuelling outages, the coding used for these tasks being similar to that applied in the EU.

    In this same context, the CSN actively participates in the Information System on Occupational Exposure (ISOE) promoted by NEA-OECD. This participation allows the CSN to have access to international information in relation to data on task by task collective dose and on the dose reduction techniques used at the plants in different countries.

- An in-depth review of the contents, structure and scope of the dose reduction programs implemented at the Spanish plants, based on three lines of action:

  - Extending responsibility for application of the ALARA principle (currently assigned to the Radiation Protection Services) to other units of the plant organization, in particular to the higher levels of management.
  - Strengthening the practical efficiency of application of the ALARA criterion through the existence of a specific, permanent structure for its management.
  - Homogenizing the dose reduction programs (REDOS) already implemented at the Spanish plants.

As regards the radiation protection of the members of the public and of the population in general, the Spanish legislation requires that the installations have adequate treatment and disposal systems , in order to guarantee that the doses due to radioactive releases comply with the ALARA principle and that they be lower than the limits established in the corresponding administrative authorizations.

Rigorous application of the ALARA criterion requires that complex optimization studies based on cost-benefit or equivalent techniques be performed for each installation. In practice, and in view of the difficulties involved in assigning a monetary value to the Sv-man, most countries have adopted the reverse process; in other words, they have established very low dose values that have served as a basis for the design of treatment systems.

These values are established as a small percentage of the dose limits for the public and are generally highly conservative, such that it is not expected that any specific optimization study might result in a lower dose.

The values established for the Spanish nuclear power plants come from US standards, and are lower than 10% of the basic limits. A value of around 10% of the basic limits is also used in the majority of the European Union countries.

The United States Nuclear Regulatory Commission (NRC) carried out a series of generic optimization studies for American technology light water reactors. These studies served to obtain dose values which were incorporated into the US legislation (10CFR50) as design objectives for effluent treatment systems. Consequently, all installations of this type whose treatment systems satisfy these generic values may implicitly be considered as optimized; nevertheless, higher ALARA values may be accepted as long as they be the result of a specific optimization process.

During plant operation, these dose values, originally established as a design basis for treatment systems, are applied as Limiting Conditions for Operation, and the systems are required to meet the design objectives during operation. Likewise, this phase includes definition of the surveillance instrumentation and of the release sampling and analysis programs required to verify compliance with the limiting conditions established.

15.2.4.Environmental Radiological Surveillance

As has been indicated above, the law by which the CSN was established assigns this organization the responsibility for controlling and monitoring radiation levels inside the installations. Furthermore, Spain has signed the EURATOM treaty, which establishes that each member State should have the installations required the control environmental radioactivity and regularly submit information on such controls to the European Commission.

In order to satisfy these requirements, the CSN evaluates and controls the radiological impact of the nuclear power plants. For activities subject to administrative authorization, such as nuclear power plants, awarding of this authorization implies the performance of a measuring program suited to the characteristics of each plant and of its surroundings and complying with the environmental radiological surveillance objectives described in the following paragraphs.

The objectives of environmental radiological surveillance are to detect and monitor the presence of radioactive elements in the environment, track their evolution with time, estimate the potential radiological risk to the population and determine whether any precautions need to be taken or corrective measures applied.

In the zone of influence of the plants, this surveillance is performed by means of the Environmental Radiological Surveillance (ERS) programs implemented by the licensees.

The surveillance programs applied include sampling of the main routes for the exposure of people and of other elements of the ecosystem which, although not direct routes of exposure, are good indicators of the evolution of the concentrations of activity of different isotopes in the environment.

The section of the Regulation governing Protection against Ionizing Radiations (Royal Decree 53/1992) dealing with fundamental surveillance measures for protection of the public indicates that the surveillance shall be based fundamentally on assessment of the doses which might be received as a result of operation of the plant (Art. 48). In order to obtain the necessary administrative authorizations, the applicant is required to submit suitable studies for determination of the risk of exposure to which the population might be subjected (Art. 49), and the aforementioned authorizations will specify whether or not a specific monitoring system should be available to control the doses that might be received by the public during performance of the activity (Art. 51).

When assessing the doses which might be received by the population, one is faced with the difficulty that, unlike the case for professionally exposed personnel, direct dosimetry control is not feasible for individuals belonging to the general public. This fact means that the assessment must be accomplished on the basis of estimates, using models of the behaviour of the effluents released by the plant in the different elements of the ecosystem, making it possible to quantify the radiological impact on the population using an additional set of hypotheses regarding the possible behaviour of the individual-model.

The Environmental Radiological Surveillance (ERS) programs are established to verify that the physical-mathematical models used for the calculations adequately reflect the real behaviour of the effluents released and that no uncontrolled releases of such effluents have occurred. The ERS programs are made up of the surveillance network and the sampling, analysis and measurement procedures aimed at determining any possible increase in radiation levels and the presence of radionuclides due to plant operation, the ultimate aim being to estimate the radiological impact on the population.

Appendix 15.B describes the environmental radiological surveillance programs carried out in the area of influence of the nuclear power plants and the control of these programs performed by the CSN.

15.3 Regulatory control activities

As regard the radiation protection of professionally exposed workers, in accordance with the regulations the nuclear plants are required to have a radiation protection service authorized by the CSN. The CSN is responsible for awarding the necessary licenses to those persons who are to act as Heads of the aforementioned Services.

The Spanish nuclear power plants have a document known as the Radiation Protection Manual, which includes the radiation protection standards to be adhered to at the installation. The contents of this document are established in CSN Safety Guide 7.6, "Contents of radiation protection Manuals of Nuclear and Radioactive Installations involved in the nuclear fuel cycle". Although the radiation protection Manual is not itself subject to administrative approval, the conditions attached to the nuclear plant operating permits establish the obligation to meet its requirements and to submit to the CSN whatever revisions are made to the document. The CSN evaluates the contents of the Nuclear Power Plant Radiation Protection Manuals, ensuring that their application will guarantee compliance with the stipulations of the Spanish regulations with respect to radiation protection.

As regards compliance with the dose limits established for professionally exposed workers, the radiation protection standards in force in Spain include the following requirements in relation to the Dosimetry of individuals who are exposed to the action of ionizing radiations as a result of their professional activity:

- Adequate monitoring systems should be available to determine the doses received by professionally exposed individuals.
- Individual dosimetry should be carried out by organizations expressly authorized by the Nuclear Safety Council.
- Work performed in the presence of ionizing radiations should be carried out such that the doses received by professionally exposed persons be lower than the established dose limits.

Analysis of the situation of the dosimetry applied to professionally exposed individuals in Spanish nuclear power plants may be accomplished by assessing the degree to which these regulatory requirements are met in practice.

The practice applied by the Spanish plants, with regard to the radiological surveillance systems used to determine the doses received by their personnel, is in keeping with the directives issued in this respect by the International Commission for Radiological Protection (ICRP); indeed:

- Professionally exposed workers classified as Category A are equipped with individual physical dosimeters (OFFICIAL DOSIMETRY), monthly processing of which allows insight to be gained into the doses received by them as a result of the set of activities performed during this period of time.
- In addition, for the performance of tasks inside the controlled zone, direct reading individual dosimeters are used (OPERATIONAL DOSIMETRY), which allow immediate insight to be gained as to the doses received during the performance of such tasks, this allowing for adequate task planning from the radiological standpoint.
- Apart from these individual radiological monitoring systems, there are fixed and portable area monitoring systems distributed throughout previously selected areas of the plant, which likewise make it possible to assess the doses received by the professionally exposed personnel during their presence in these areas.

This general description of the radiological surveillance systems used to determine the doses received by professionally exposed individuals is common to all the Spanish plants. The suitability of the monitoring systems used is evaluated by the CSN during the design phase of the installations. Also subject to evaluation are the aspects relating to the maintenance and operation of these systems, which are additionally verified during the periodic inspections performed by the CSN at the installations.

At all the Spanish plants, processing of the dosimeters used as the official dosimetry system is carried out by organizations specifically authorized by the CSN for this activity.

Previously, the processing of the official dosimeters of all the Spanish plants was performed by a single dosimetry laboratory; at present, all the plants have their own Dosimetry Laboratories, officially authorized by the CSN.

In view of the new situation brought about by the fact that the plants carry out their own personnel dosimetry, specific requirements have been established for authorization of their dosimetry services, with special emphasis on the mechanisms available to minimize to the extent possible any lack of objectiveness in the data obtained; thus:

- The systems authorized have a high degree of automatism, this minimizing the possibility for errors in the dose calculation process.
- The requirements established for filing of the results are especially strict, and require that the entire set of data necessary to reproduce at any given time the dose assigned to a worker (from the parameters obtained in reading the dosimeter used by this worker) be stored.
- The conditions and procedures regulating the operation of the plant dosimetry services include the need to justify and document any modification to the information initially obtained during reading of a dosimeter.
- Each dosimetry service is subject to a system of audits by the CSN, these normally being annual, during which special attention is paid to the filing of results.

The situation of the Spanish plants as regards not exceeding the regulatory dose limits may be considered satisfactory since:

- In relation to external dosimetry, there has been no case of the regulatory dose limits having been exceeded. Moreover, the results obtained show that a high percentage (more than 90%) of the professionally exposed personnel systematically present doses lower than one tenth of these limits.
- In relation to internal dosimetry, the experience acquired to date is satisfactory, since cases of internal contamination occur only very rarely. In fact, although the recording level established by the CSN (1% of the regulatory Annual Intake Limit) is much lower than what is recommended in this respect by the ICRP (10% of the said limit), this level has been exceeded only on very few occasions.

The dose values obtained by means of the official dosimetry systems at the nuclear power plants are periodically submitted to the CSN, which undertakes the management and maintenance of a national dosimetry bank. This makes it possible for the CSN to evaluate the dosimetry data and, if an anomaly is detected, establish the appropriate corrective measures. The plant owners are also obliged to notify the CSN of any event involving potential overexposure to radiations. The CSN evaluates the suitability of the actions taken by the plant radiation protection services and, if necessary, requires that additional measures be adopted and that actions required to avoid the repetition of analogous incidents be implemented.

As regards the radiation protection of the members of the public and of the population overall, the regulatory control measures are applied to the plant programs for the limitation and control of releases and the programs of environmental radiological surveillance in the area of influence of the plant.

In the first of these cases, the CSN continuously supervises compliance with the Technical Specifications on Releases, which lead to the Radioactive Effluent Control Program (RECP), performance of which is described in the Manual for Off-Site Dose Calculation during normal operation (MCOD). The contents of the RECP and MCOD are described in appendix 15.A.

In the case of the ERSP's, the CSN evaluates program proposals and the schedule for the performance of annual sampling and analysis campaigns, and the final report containing the results of such annual campaigns. In addition, the CSN carries out its own sampling and analysis, independent from that performed by the licensee, thus assessing the quality of the data contained in the results reports.

The six-monthly reports submitted by the CSN to Parliament include the following information regarding radiation protection at the Spanish nuclear power plants:

- Number of workers controlled by dosimetry during the six-month period.
- Dose resulting from external exposure accumulated during the six-month period for all the nuclear plant workers, both staff and contracted individuals, with consideration given to both normal operation and refueling.
- Controls performed with respect to the plant workers to detect possible cases of internal contamination, including the results and their evaluation.
- Activity of liquid and gaseous effluents released to the environment by the plants during each six-month period, and assessment with regard to previous six-monthly periods.
- Results of the Environmental Radiological Surveillance Programs in the area of influence of the plants for the previous annual campaign. These results are presented in terms of annual external, internal and total effective dose in the areas surrounding the plant, and their meaning is assessed in relation to those obtained during previous campaigns.

Appendix 15.C includes the information on radiation protection included in the CSN Six-Monthly Report to Parliament, for the second half of 1997.

15.4. Degree of implementation of the obligations

In view of the Radiation Protection measures taken with respect to the workers, the programs for the monitoring, limitation and control of effluents and the Environmental Radiological Surveillance Programs described before, and of application of the ALARA criterion, the Spanish plants are considered to correctly meet the obligations established in this article.

The following on-going and scheduled actions currently exist in Spain, the objective being to improve Radiation Protection at the plants:

- Modification of the radiological protection regulations to adapt them to the stipulations of Directive 96/29/EURATOM, incorporating the recommendations made by the ICRP in its publication number 60.

- Optimization of CSN control of the ERSP's performed by the plant owners, and the establishment of new warning levels in keeping with the established release limits, in terms of effective dose.
- Adaptation of the plant operating organizations in accordance with the latest approaches regarding application of the ALARA criterion (Work management).
- Implementation of the new framework for the distribution of responsibilities in relation to radiation protection among the plant operator and external companies rendering services at the plants.
- Definition of training requirements in relation to radiation protection, for the workers of outside companies.
- Implementation of the new Individual Radiological Monitoring Document, which according to the regulations is to replace the current radiological permit.

APPENDIX 15.A

Limits, surveillance and control of releases of radioactive substances at Spanish Nuclear Power Plants

In accordance with the regulatory requirements, the Spanish plants are equipped with liquid and gaseous effluent treatment systems. The design of these systems takes into account the principle of optimization, and incorporates the instrumentation required to ensure adequate monitoring and control of the effluents prior to their release off-site.

15.A.1 Authorized limits

The operating permits of the Spanish NPP's establish Operating Limits and Conditions, which are included in the Operating Technical Specifications (authorized limits).

The licensing of the Spanish nuclear power plants took place over a period of two decades, from the beginning of the 1970's to the end of the 1980's. The technological progress and evolution of limits that occurred in parallel to their entry into service gave rise to a wide diversity of both the specific formulation of the limits and the requirements applicable to the monitoring and control of radioactive effluents.

In view of the problems posed by this lack of homogeneity (difficulty in carrying out comparative studies of releases at different plants, complexity in the monitoring and evaluation of the releases by the CSN …), the need to standardize the Operating Technical Specifications in relation to radioactive effluents arose, in order to establish similar protection objectives, apply equivalent criteria to all the installations and establish a common framework facilitating monitoring and control of the releases.

Indeed, with the entry into operation of the Trillo plant, which was to be the last project in Spain of the current generation of nuclear reactors, the moment had arrived to carry out a review of the radioactive effluent limitation, monitoring and control systems of the Spanish plants. Given that the different types of limits in force were based on the dosimetry models of ICRP-2, the revision was designed in two phases:

- Standardization of release Specifications
- Adaptation of the limits to the most recent recommendations of the ICRP.

Standard specifications model

During the process of standardization, the decision was taken to adopt as a model the Radiological Effluent Technical Specifications established by the NRC for US plants.

Various factors intervened in this decision: firstly, the fact hat these specifications constitute an integral, coherent system that encompasses all aspects relating to the limitation, monitoring and control of radioactive effluents, with an important documentary base covering from basic principles to the detailed procedures by which they are developed; secondly, the fact that these Specifications had been implemented to a greater or lesser extent in the licensing of some of the more modern plants, this constituting an important additional advantage; and third the fact that this model is fully coherent with the Spanish regulatory system.

The Operating Technical Specifications relating to radioactive effluents cover the following aspects:

- The minimum instrumentation required for the monitoring and control of the effluents and their operability requirements, including surveillance testing and the determination of monitor setpoints.
- Instantaneous concentration limits for liquid effluents, including definition of the sampling and analysis program required to verify compliance.

- Instantaneous dose rate limits for gaseous effluents, and corresponding sampling and analysis program.
- Limiting Conditions for Operation for liquid and gaseous effluents, including the surveillance requirement that an estimate be made of the doses due to releases.
- Operability requirements for treatment systems, and the obligation to forecast doses for planning of effluent treatment prior to their release off site.

Table 15.A.1 summarizes the release limits established in the model used for the standardization process.

Table 15.A.1.Release limits. standard technical specifications

Instantaneous (10CFR20) (*)

Releases	Variable	Value
Gaseous	Whole body equivalent dose rate	5 mSv/y
Liquid	Concentration in non-restricted zones	10CFR20

Integrated (limiting conditions for operation) (10CFR50)

Release	Variable	Value	
		Quarterly(**)	Annual
Gaseous (Noble gases)	Dose absorbed in air		
	Beta	100 mGy	200 mGy
	Gamma	50 mGy	100 mGy
	Dose Equivalent to any organ (Iodines, particles and H-3)	75 mSv	150 mSv
Liquid	Dose Equivalent		
	Whole body	15 mSv	30 mSv
	Critical organ	50 mSv	100 mSv

(*) American standard equivalent to RPSRI

(**) A limit equivalent to half the annual value in any one quarter is established as an additional control.

Consequently, the adopted model limits the maximum value of concentration in any release (instantaneous limits) and the total release of radioactive material to the environment over prolonged periods of time (quarterly and annual limits).

The combination of both limits guarantees, with a very wide margin of safety, that no member of the public will receive significant doses as a result of the release of radioactive effluents during the normal operation of a Spanish nuclear power plant, while at the same time providing the necessary operational flexibility.

Instantaneous limits are established to facilitate continuous monitoring and control of effluents, and are applicable to all the units at a site. Exceeding these limits implies the immediate suspension of discharges and the limits also serve for calculation of the setpoints for the effluent monitors. They are expressed in derived magnitudes: for liquid effluents, maximum concentration limits are established for the discharge channel, and for gaseous effluents the limits are on dose rate at the site boundary, with consideration given to the differences between liquids and gases as regards dispersion and routes for transfer in the environment.

Given their function, different criteria might be applied to establish the instantaneous limits. In practice, the annual average concentration and dose rate values derived from the dose limits for the public are established; in other words, values which, taking into account all the exposure routes, would give rise to a total annual dose of 5 mSv for liquids, and 5 mSv for gases, in the adult individual.

The values shown in the previous table are expressed in terms of whole body and critical organ dose equivalent, established in accordance with the metabolic and dosimetric models included in ICRP-2, which at the time were the basis for the US legislation.

The Limiting Conditions for Operation apply to each unit at a site and are much more restrictive than the basic dose limits, this providing some flexibility in practical application. This flexibility means that exceeding the limits does not in itself constitute a breach of the standards, but rather non-compliance with a design objective derived from a process of optimization.

In the limit system adopted, application of the ALARA criterion is taken a step further, requiring operability of the treatment systems when the foreseen doses exceed a small fraction of the Limiting Conditions for Operation. If this requirement did not exist, effluent releases might be performed without attempts being made to ensure that the resulting doses were lower than the Limiting Conditions.

The process of standardizing the effluent specifications of the Spanish nuclear power plants had hardly begun when the NRC published a Generic Letter proposing that such specifications be re-ordered within the framework of the operating technical specifications improvement programs, such that they contain only basic aspects, with further developments transferred to other operations documents.

In the case of effluent specifications, the Radioactive Effluent Control Program (RECP) is established, in the Chapter of the Specifications relating to Procedures and Programs, and the requirement that its detailed development be included in the Off-Site Dose Calculation Manual (MCOD) is established. The contents are as follows:

- Accurate description of the different terms included in the document.
- Drawing of restricted area with no public access and of the site boundary.
- Brief description of release routes for liquid and gaseous effluents and monitoring instrumentation.
- Development of the RECP, establishing the following for each of its sections:
    - The control itself, including the conditions established in relation to the release of effluents, associated monitoring instrumentation and operability of the treatment systems, and indicating also the circumstances to which they are applicable and the actions to be taken if the conditions are not satisfied.
    - The surveillance requirements necessary to guarantee compliance with what is established in the Control.
    - The principles on which each Control is based.

- A detailed description of the methodology applied in estimating the dose to the critical individual and in the calculations of effluent monitor setpoints, including the parameters used.
- A list of the procedures developing in detail the requirements established in each Control.

The releases from all the Spanish nuclear power plants are, indeed, equivalent to those of the European and American plants using the same technology, as is shown in table 15.A.2.

Table 15.A.2. Releases of radioactive effluents (GBq/GWh)*

Gaseous effluents

Components	Spain		EU Countries		USA	
	PWR	BWR	PWR	BWR	PWR	BWR
Noble gases	2.61E+01	4.11E+01	5.42E+02	8.13E+01	3.07E+01	2.55E+02
I-131	3.09E-05	8.02E-05	3.33E-05	6.02E-05	1.76E-04	1.19E-03
Particles	2.19E-04	1.08E-04	6.08E-05	6.82E-05	7.37E-04	2.87E-03
Tritium	2.97E-01	6.57E-02	3.27E-02	7.62E-02	6.53E-01	4.59E-01

Liquid effluents

Components	Spain		EU Countries		USA	
	PWR	BWR	PWR	BWR	PWR	BWR
Fission-Activation prod	6.16E-03	2.13E-03	1.34E-01	4.47E-02	1.27E-02	1.35E-02
Tritium	2.75E+00	5.63E-02	1.26E+02	1.69E-00	3.42E-00	1.31E-01

(*) Average values 1980-1994

The doses due to releases represent 10% of the Limiting Conditions for Operation and are generally lower than 1% of the basic limits for protection of the public.

Following implementation of this model, the specifications on releases of all the Spanish plants include, in the section on Procedures and Programs, the RADIOACTIVE EFFLUENT CONTROL PROGRAM, which is developed in the OFF-SITE DOSE CALCULATION MANUAL.

Updating of model

The second phase began in 1997, on conclusion of the process of homogenization in March 1993, with entry into force of the new Specifications on Effluents and associated Manuals. This phase updates the limitation on releases, no modifications being required to the monitoring and control system, except in relation to certain parameters affected by the new limitation.

The following were proposed as objectives for this second stage:

- Clarification of the concept of the limit

  The dose values established as Limiting Conditions for Operation do not have the meaning of a limit in the regulatory sense, although they are frequently taken as such. Indeed, the term "Limit" has traditionally been applied indistinctly to values having widely varying meaning, magnitude and function in the framework of protection of the public.

This fact, and the possible legal implications inherent to the very concept of a limit and of its being exceeded, made it advisable to look again at the terminology used, the following criteria being adopted:

- The term limit is applied exclusively to the basic dose limits and values derived therefrom, which if exceeded imply immediate suspension of discharges.
- Limiting Conditions for Operation are known as “Operating Restrictions”, an expression proposed by NEA-OECD for doses lower than the restricted doses established for control of operation of the installations.

❑ Incorporation of the recommendations of ICRP-26

Although initially the aim was to incorporate the recommendations of ICRP-60, it became clear in 1993, when initiation of this phase was being considered by the CSN, that adaptation of the European Union and Spanish legislations to that document would be delayed several years.

Indeed, until the IAEA Basic Safety Standards were approved in September 1994, there had not been sufficient agreement on values for Dose Conversion Factors by age group. On the other hand, although the European Union Directive on Basic Radiation Protection Standards was approved in 1996, the maximum period established in this Directive for incorporation of the Standards into the national legislations was four years.

Nevertheless, the adaptation to ICRP-26 has been contemplated in such a way that the future incorporation of the recommendations of ICRP-60 will be possible almost immediately.

Performance of the second phase of the process of standardizing the Specifications on Effluents has meant the following:

❑ Definition of new instantaneous limits for liquid and gaseous effluents

The instantaneous limits on concentrations of liquid effluents, and dose rates for gaseous effluents, are derived from the dose limits of the Regulations governing Protection against Ionizing Radiations.

❑ Assignment of dose values based on ICRP-26 to Operating Restrictions.

These values have been defined taking into account the former Limiting Conditions for Operation and the releases from all the plants since the beginning of their operation, the following conditions being applied to the annual total effective dose (liquid and gaseous effluents):

- being lower than the value proposed at the CSN as the restricted dose for this type of installations.
- not exceeding 10% of the basic dose limit.

Following the studies performed, and taking into account the aforementioned conditions, an annual total effective dose of 0.1 mSv has been established. This value will not be modified when the recommendations of ICRP-60 are incorporated into the Spanish regulations, as has been demonstrated by a generic analysis.

With regard to the control of treatment systems, this value is distributed in the MCOD’s among both liquid and gaseous effluents, with 20% being assigned to the former and 80% to the latter.

Table 15.A.3 summarizes the new release limits.

Table 15.A.3. New limits on releases

Instantaneous limits (RPSRI)

Releases	**Variable**	**Value**
Gaseous	Effective dose rate	5 mSv/y
Liquid	Concentration in non-restricted zones	RPSRI (5 mSv/y)

Operational restrictions

(Integrated doses established by the CSN)

Releases	**Variable**	**Value**
Total	Effective dose	0.1 mSv/y
Gaseous	Effective dose	0.08 mSv/y
Liquid	Effective dose	0.02 mSv/y

The release limitation system described above has led to actual release values far lower than the authorized limits, and perfectly comparable to those at international level.

The combination of instantaneous limits and operational restrictions guarantees, with a very wide safety margin, that no member of the public will receive significant doses as a result of the release of radioactive effluents during the normal operation of nuclear power plants.

APPENDIX 15.B

Environmental Radiological Surveillance Programs in the area of influence of the Spanish Nuclear Power Plants

What follows is a description of the environmental radiological surveillance programs developed by the licensees for the area or influence of the nuclear power plants, along with a brief analysis of the results.

15.B.1 Environmental Radiological Surveillance around the nuclear power plants

The licensees of the plants are responsible for development and implementation, in accordance with the directives of the CSN. These are included in Safety Guide 4.1, ***Design and development of Environmental Radiological surveillance programs for nuclear power plants.*** Selection of the number and location of the sampling points included in the ERSP, the type of samples to be taken and the instrumentation to be used is accomplished during a phase prior to plant operation, known as the PRE-OPERATIONAL PHASE.

The objective of the PRE-OPERATIONAL PHASE of the ERSP, which lasts at least two years, is to characterize the radiological situation of the site (radiological background) before it is affected by effluent releases from the plant. This makes available reference information of great value for investigation, during the OPERATING PHASE, of whether or not there is an increase in this radiological background as a result of plant operation.

Implementation of the ERSP implies the development of procedures for sampling, instrument calibration, measuring, etc. In order to guarantee the necessary reliability of the results, a far-reaching quality assurance program is set up. Of special interest within this program are aspects relating to the quality controls applicable to sample analysis. The general approach adopted at the nuclear plants is as follows:

- Sample analysis is performed by laboratories belonging to the plant itself or other organizations, these being subjected to a system of supervision and auditing by the CSN.
- There is also an internal ERSP quality control, according to which a significant fraction (5-15%) of the samples are taken in duplicate, analysis of the second being performed by a different laboratory from the first.
- These laboratories participate in annual intercomparison campaigns promoted by the CSN.

The CSN issues guidance on the design and development of the ERSP's (Safety Guide 4-1), assess and approves the specific programs of each plant and carries out periodic inspections to verify correct application of the surveillance programs.

At present, eight ERSP's are being implemented around the respective NPP's, with more than six hundred sampling points. Around 11,000 samples are taken each year, and 12,000 analytical determinations are made. Table 15.B.1 shows the types of samples and analyses taken and performed.

Table 15.B.1 Environmental radiological surveillance program around the NPP's

Type of sample	Analyses performed
Air	Total ß activity, Sr-89, Sr-90, γ Spectrometry, I-131
Drinking water	Total ß activity, Other ß activity, Sr-89, Sr-90, Tritium, γ Spectrometry
Rain water	Sr-89, Sr-90, γ Spectrometry
Surface and groundwaters	Total ß activity, Other ß activity, Tritium, γ Spectrometry
Soils, sediments and indicator organisms	Sr-89, Sr-90 γ Spectrometry
Milk and crops	Sr-89, Sr-90, γ Spectrometry, I-131
Meat, eggs, fish, shellfish and honey	γ Spectrometry

Table 15.B.2 includes, for illustrative purposes, the average values of the results obtained from analysis of the sample of air taken during the ERSP's for 1995.

Table 15.B.2 Nuclear power plant ERSP's 1995

	Air Bq/m^3			
Plant	ß-Total			
Jose´Cabrera	4.72E-04	2.02E-04	6.00E-06	LDL
S.M. Garoña	3.84E-04	LDL	LDL	LDL
Vandellós I	6.18E-04	LDL	---	LDL
Alamraz	7.33E-04	LDL	3.02E-05	LDL
Ascó	7.89E-04	LDL	1.30E-05	LDL
Cofrentes	6.92E-04	LDL	6.00E-06	LDL
Vandellós II	5.84E-04	LDL	8.00E-06	LDL
Trillo	4.74E-04	LDL	LDL	LDL

An overall assessment of the results of the ERSP's of the nuclear power plants leads to the conclusion that no radiologically significant increases have been detected, with respect to the background for the site, in those routes of transfer having an impact on potential dose to the population. For certain indirect routes of transfer, such as sediments, increases in isotopes of artificial origin have been detected, with respect to background, this having been expected in view of their integrating nature. These routes do not, however, have any direct impact on the doses received by people.

The effective doses estimated for individuals belonging to the public in the areas of influence of the plants are similar, and of the same order of magnitude as those estimated for the average radiological background of the country.

As regards the surface and ground waters, it is in the latter that the highest values of concentration of natural isotopes are observed, in most cases reflecting the special characteristics of the site.

15.B.2 CSN Radiological Surveillance at the plants

On the environmental radiological surveillance carried out by the licensees in the area of influence of the plants, the CSN superimposes its independent control programs, which are performed either directly or through the programs commissioned to the Autonomous Communities.

Direct surveillance by the CSN is carried out at least once a year at each plant. Sampling is performed jointly by the personnel of the CSN and that of the plant in question, the samples being shared with a view to comparing the analytical results obtained. The samples are of the same type as those taken during the ERSP and are from the same points. The analytical determinations performed are the same as those carried out in the ERSP, and are accomplished at laboratories contracted by the CSN.

The control programs carried out by the CSN represent approximately 5% of those performed by the licensees.

The results of the CSN control programs are analogous to those obtained by the plant operators.

Overall assessment of all the information obtained to date from all the environmental radiological surveillance programs in the areas of influence of the Spanish plants, allow to conclude that the quality of the environment in these areas is maintained under satisfactory conditions from the radiological standpoint.

APPENDIX 15.C

Information relating to radiation protection included in the csn Six-Monthly Report to Parliament for the second half of 1997

Releases of liquid and gaseous effluents

The activity of the liquid and gaseous effluents discharged to the environment during the six-monthly period by the nuclear power plants is comparable to that of previous periods, and in all cases is lower than the limits established for each installation and for each parameter monitored and controlled.

Tables 1. and 2 show, respectively, the overall data on releases from Spanish pressurized water and boiling water reactor plants.

Table 1. Releases of effluents from PWR nuclear power plants. Second six months of 1997. Total activity discharged during the period (Bq).

	José Cabrera	Almaraz I+II	Ascó I	Ascó II	Vandellós II	Trillo
Liquids						
Total activity without tritium or dissolved gases	8.14E+07	6.00E+09	9.57E+08	5.03E+08	1.60E+10	1.94E+09
Dissolved gases	1.02E+08	4.31E+07	2.57E+06	2.65E+07	1.43E+09	----
Tritium	6.05E+11	3.08E+13	1.29E+13	2.76E+13	8.32E+12	2.88E+13
Alpha	≤LDL	≤LDL	≤LDL	≤LDL	≤LDL	≤LDL
Gaseous						
Noble gases	1.11E+13	1.31E+13	3.14E+11	8.32E+11	1.42E+11	5.33E+12
Halogens	9.45E+08	3.09E+07	<LDL	≤LDL	5.35E+07	5.37E+08
Particles (T 1/2>8d.)	2.30E+06	5.35E+06	3.67E+06	1.80E+06	2.46E+07	2.19E+06
Tritium	6.03E+10	3.82E+12	5.76E+11	9.25E+11	1.34E+11	3.61E+11
Carbon - 14	----	----	----	----	----	5.55E+10
Alpha	≤LDL	6.54E+03	≤LDL	≤LDL	≤LDL	≤LDL

LDL.- Lower detection limit

Table 2. Releases of effluents from BWR nuclear power plants. Second six months of 1997. Total activity discharged during the period (Bq).

	Sta. Mª de Garoña	Cofrentes
Liquid		
Total activity without tritium or dissolved gases.	2.83E+08	3.57E+08
Dissolved gases	<LDL	8.63E+06
Tritium	1.01E+10	4.28E+11
Alpha	2.01E+05	≤LDL
Gaseous		
Noble gases	2.05E+11	5.94E+12
Halogens	1.99E+07	1.38E+09
Particles (T 1/2>8d.)	4.90E+06	3.12E+08
Tritium	1.41E+11	6.53E+11
Alpha	2.25E+04	8.28E+04

LDL.- Lower detection limit

Summary of results of Environmental Radiological Surveillance Plans

The last report included the results of the Environmental Radiological Surveillance Plans for the year 1996, these being the latest available.

The radiological significance of the results obtained from the different ERSP's performed in the area of influence of the nuclear power plants (30 km radius) is determined by conservatively estimating the hypothetical effective doses which might be received by the population as a result of potential exposure to the radiations from the radionuclides identified in these Plans (Table 3).

Table 3. Effective annual dose in the area of influence of nuclear power plants (1996).

	J. Cabrera mSv	Almaraz mSv	Ascó mSv	Vandellós II mSv	Trillo mSv	S.M.Garoña mSv	Cofrentes mSv
External dose*	0.880	1.090	0.660	0.960	0.860	0.859	0.660
Internal dose**	0.005	0.003	0.003	0.005	0.002	0.004	0.002
Total dose	0.885	1.093	0.663	0.965	0.862	0.863	0.662

* These values correspond to the environmental dose rate caused by the natural background radiation in the area.
** Excluding the contribution made by natural radioisotopes.

Figures 4,5 shows the historic results obtained over the last five years.

Summary of personal dosimetry

External exposure

The statistical results for accumulated dose during the six months, for all the workers at all the nuclear plants are as follows:

Global operation (normal and refuelling)

- Plant personnel

  A total 2,342 workers have been controlled.

  71.01% of the controlled workers did not receive significant doses.

  99.44% of the controlled workers received doses lower than 1/10 of the annual limit.

  100% of the controlled workers received doses lower than 3/10 of the annual limit.

  If only the workers with readings higher than the background of the dosimetry system used are considered, the average individual dose for the period and for this group of workers is 0.87 mSv.

- Contracted personnel

  A total 5,517 workers have been controlled.

  42.99% of the controlled workers did not receive significant doses.

  96.50% of the controlled workers received doses lower than 1/10 of the annual limit.

  100% of the controlled workers received doses lower than 3/10 of the annual limit.

  If only the workers with readings higher than the background of the dosimetry system used are considered, the average individual dose for the period and for this group of workers is 1.54 mSv.

As a summary, the following table shows the overall six-monthly collective doses for each of the nuclear power plants:

José Cabrera	302 mSv.person	
Sta. Mª. de Garoña	135mSv.person	
Almaraz I and II	1.055 mSv.person	(*)
Ascó I and II	58 mSv.person	
Cofrentes	2.458 mSv.person	(*)
Vandellós II	887 mSv.person	(*)
Trillo	288 mSv.person	(*)

(*) Refuelling outage

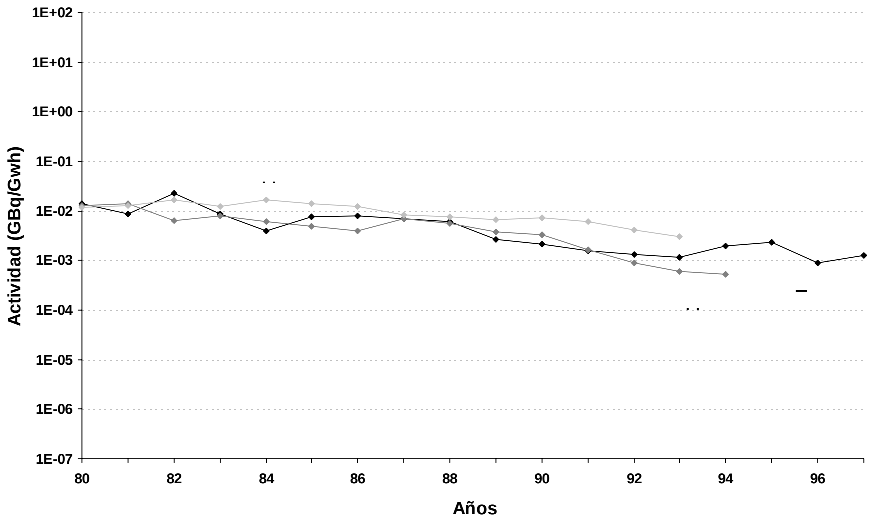
These data mean that the average collective dose per reactor throughout the six-months period is 576 mSv.person.

Figures 1.5 and 1.6 (1) show, as reference data and depending on reactor type, comparative graphs of the evolution of the parameter “collective dose per reactor and year” in Spain, the OECD countries and the USA (2).

Internal exposure

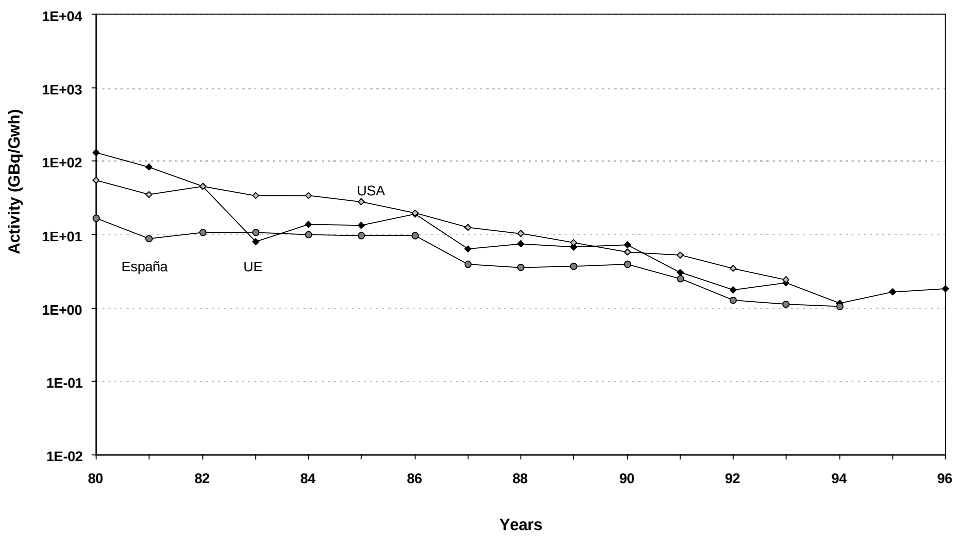
7,830 direct measurements of radioactivity in the bodies of nuclear plant personnel were carried out. In no case was internal contamination detected in excess of the recording level (1% of the annual uptake limit). Furthermore, due to an increase in the levels of concentration of tritium in the containment of the Trillo nuclear power plant, the possible internal contamination of a series of workers was performed using biolelimination techniques, internal contamination in excess of the recording level (1% of the Annual Uptake Limit) being detected in two cases; these were, however, lower than the investigation level (10% of the AUL), as a result of which they have no radiological significance.

Fig.4. PWR Plant liqued Effluents. Total Except tritium



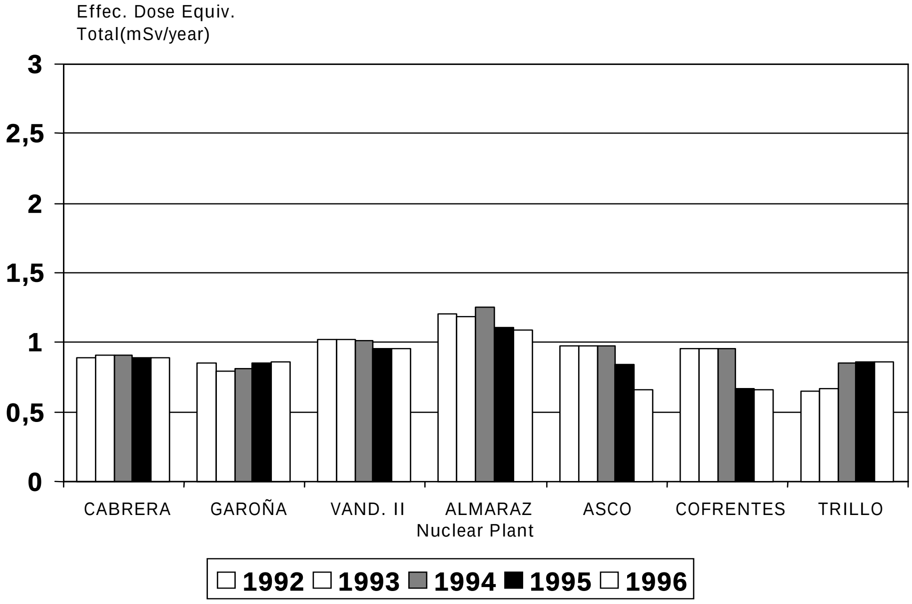
NOTE: Number of reactors considered in each case: European Union (84), USA (78), Spain (7)
The data have been revised for updating and for application of the criteria used by the EU in their procesing.

Fig.5. PWR Plant Gaseous Effluents. Noble Gases



NOTE: Number of reactors considered in each case: Europe
European Union: 84
USA: 78
Spain: 7
The data have been revised for updating and for application of the criteria used by the EU in their processing.

Fig.1.4.Effective doses for the Members of the Public Estimated from the results of NPP ERSP's (1)



(1) Includes the Natural Radioactive Background Except Internal Exposure due to Radon and its Daughters.

Fig.1.5.Collective Dose / Reactor .Year - PWR Reactors

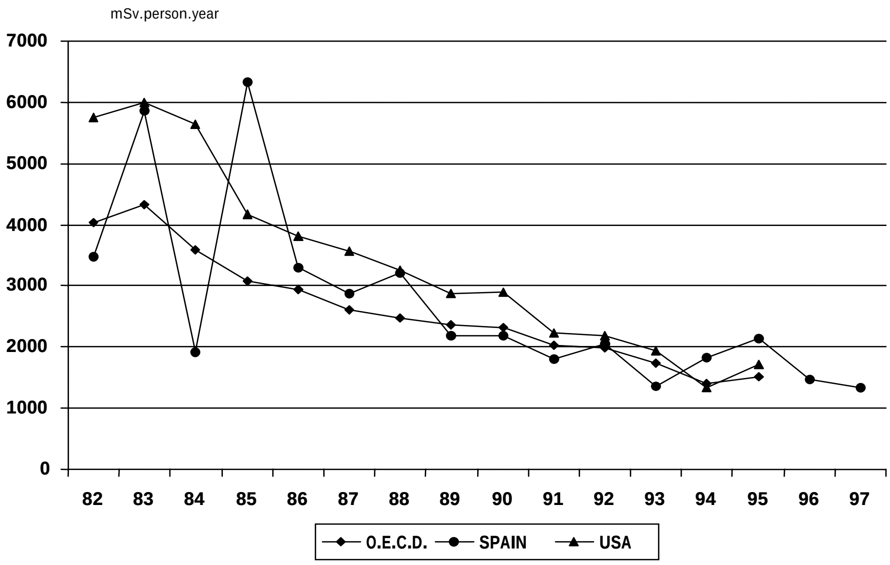


Fig.1.6.Collective Dose / Reactor .Year - BWR Reactors

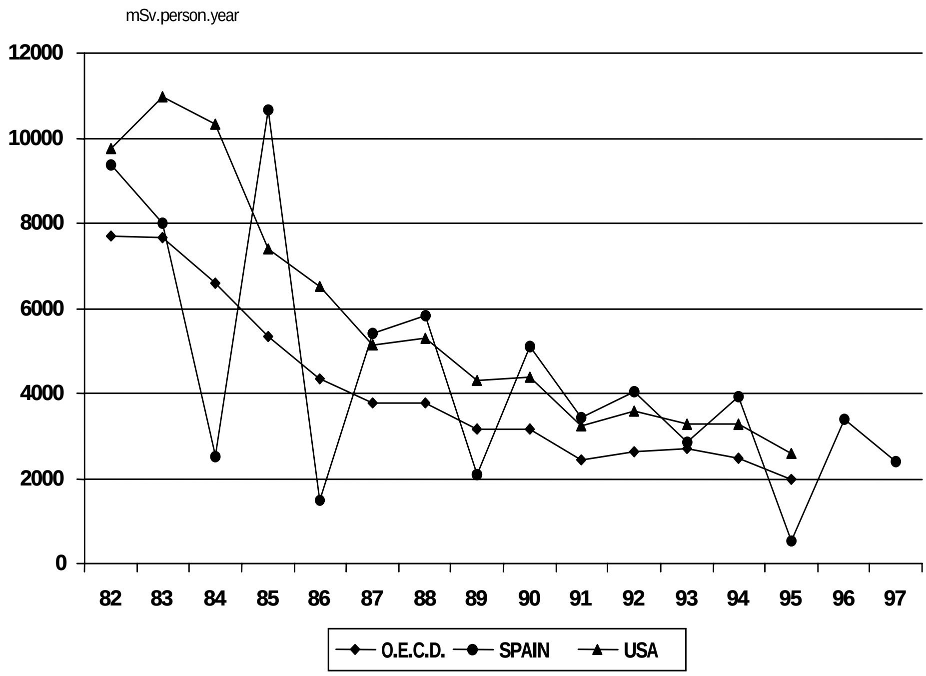


Fig.A.IV.25 NPP's overall Dosimetry (Op.Global) Second Six Months 1997

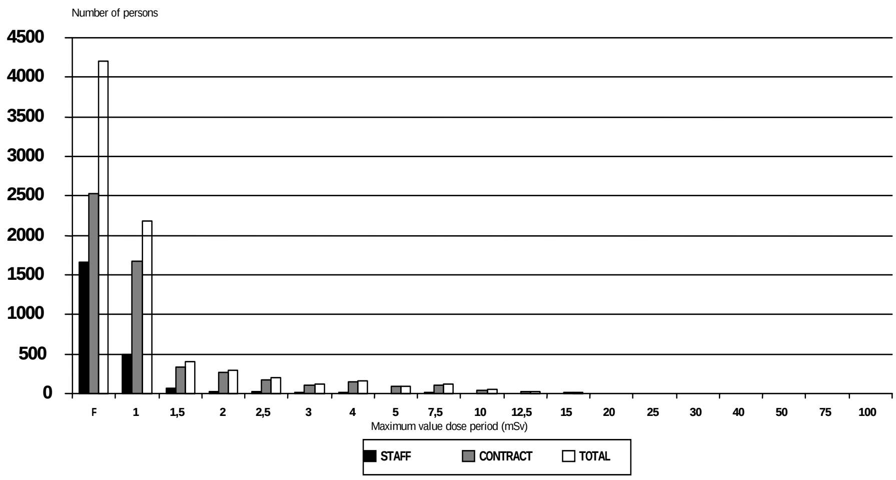


Fig.A.IV.26 Collective dose. NPP's Overall. Evolution with time

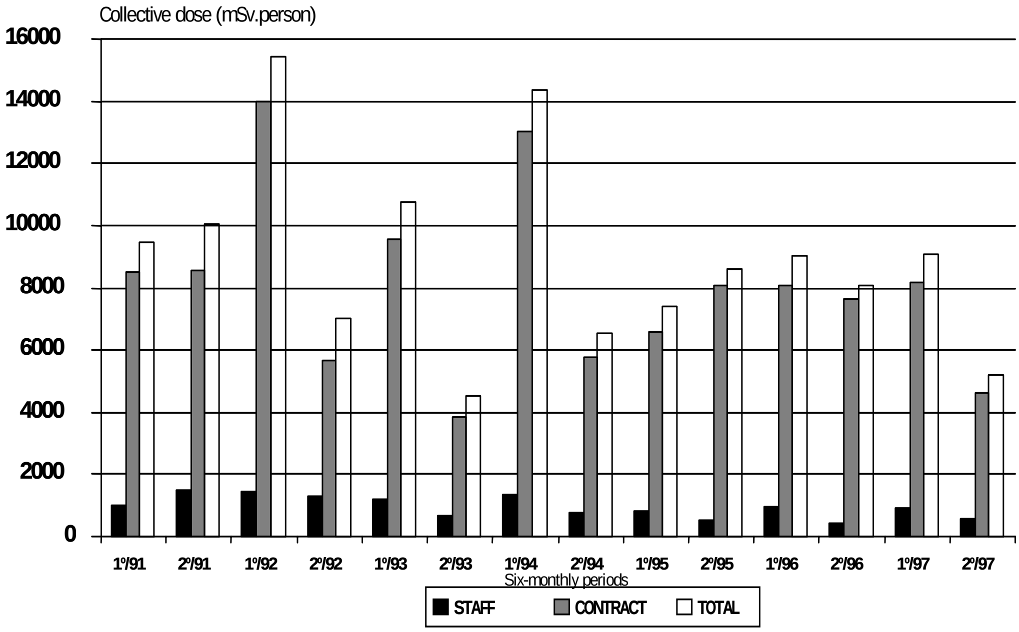
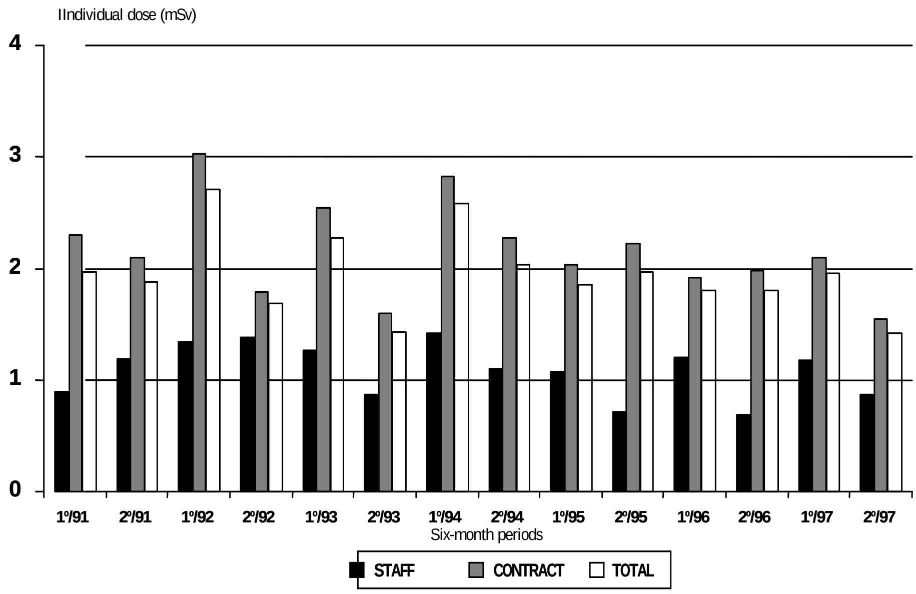


Fig.A.IV.27 Individual dose. NPP's Overall. Evolution with time



Article 16. Emergency Preparedness

16.1 Summary of laws, regulations and requirements relating to the planning and preparation for emergency conditions

In Spain, planning and preparation for emergency conditions is governed by the Basic Nuclear Emergency Plan (BNEP) and by the Regulations governing Nuclear and Radioactive Installations. The Law by which the CSN was established and the Basic Standards for Civil Protection also include general provisions regarding nuclear emergencies.

16.1.1 Basic Standards for Civil Protection

This standard was approved by Royal Decree on 24th April 1992. It determines the distribution of responsibilities for the preparation and planning for emergencies of various types among the different bodies making up the Spanish State: Government of the Nation (State level of competence), Autonomous Communities and local organizations. It also determines different types of plans, depending on the specific risks for which they are designed. Specifically, for nuclear emergencies, the responsibility of the State and planning are determined by a Basic Plan.

16.1.2 Basic Nuclear Emergency Plan (BNEP)

The Basic Nuclear Emergency Plan was approved by the Government, in response to a proposal by the Ministry of the Interior, during the Cabinet Meeting held on 3rd March 1989, in the wake of reports from the Nuclear Safety Council and the National Commission for Civil Protection, and was published by an Order from the Ministry of the Interior on 29th March 1989.

The BNEP is the basic directive for the planning of nuclear emergency response throughout the State. Its objective is to protect the population against the adverse effects of ionizing radiations which might be produced by the uncontrolled release of radioactive material as a result of a nuclear accident, and it defines the actions to be taken by the Public Authorities in providing this protection. The BNEP contains fundamentally the radiological criteria defined by the CSN for the planning of responses to nuclear emergencies.

The scope of the BNEP covers the planning of actions in the event of an emergency caused by a nuclear accident, during the first two phases: initial and intermediate. Although the BNEP includes certain protection measures typical of the recovery phase, such as transfer, development of this third phase is not included in the Plan, which refers it for subsequent development on the basis of whatever guidelines the CSN might define in this respect.

As regards its practical aspects of application, the BNEP is developed by way of the following:

- Provincial Emergency Plans.
- Nuclear Installation Site Emergency Plans.
- Municipal Emergency Plans.

and the establishment of a Central (National) Level of Response and Support, constituted by the Directorate General for Civil Protection of the Ministry of the Interior, from hereon the DGCP, and by the Nuclear Safety Council, from hereon the CSN, within their respective areas of responsibility, which is described in detail in the following paragraphs.

16.1.3 Law establishing the CSN

Law 15/1980, of 22nd April 1980, established the CSN, assigning to it, among other functions, that of collaborating with the competent authorities in the establishment of criteria to be applied in the emergency plans of nuclear installations and, following drawing up of the plans, participate in their approval.

16.1.4 Decree governing Nuclear and Radioactive Installations

This Regulation, published by Decree 2869/1972, of 21 st July 1972, requires the licensees of nuclear installations to draw up and Emergency Plan for acquisition of the commissioning license for their facilities. All the nuclear installations submit a draft Site Emergency Plan, which is approved by the Ministry of Industry and Energy following a report by the CSN, which evaluates these plans on the basis of specific national and international standards.

16.2 Application of emergency preparedness measures, including the role of the regulatory body and other organizations

16.2.1 Classification of emergency conditions

I) Emergency categories

In the nuclear power plant Site Emergency Plans, the possible accidents which might occur at such plants are classified into 4 categories.

These emergency categories are established depending on plant conditions, and take into account the maximum quantity of radioactive material that might be released off site, considering a pessimistic evolution of the initiating event. These categories are as follows, in increasing order of seriousness and decreasing order of probability:

- Category I: emergency pre-alert. No releases are expected off site.
- Category II: emergency alert. There might be releases of materials below the following values:
  - Noble gases: 3.7×10^{14} Bq.
  - Iodines: 3.7×10^{11} Bq.
- Category III: site emergency. There might be releases of materials below the following values:
  - Noble gases: 3.7×10^{16} Bq.
  - Iodines: 3.7×10^{13} Bq.

- Category IV: general emergency. Releases of material reaching and exceeding the following values might occur:
  - Noble gases: 3.7×10^{19} Bq.
  - Iodines: 3.7×10^{18} Bq.

II) Emergency Phases and Conditions

From the point of view of planning for a nuclear emergency, the BNEP establishes different phases and conditions, depending on the radiation doses which might be absorbed by the population. Two phases are established:

- ***Pre-emergency phase:*** characterized by events that do not produce abnormal off-site releases or, if such releases do occur, will give rise to an effective dose off-site of less than 5 mSv, and to a dose equivalent in the thyroid of less than 50 mSv.

  This phase contemplates Conditions 0 (absence of off-site releases) and 1, and is characterized by the absence of measures to protect the population, except for the establishment of access controls for situation 1.

- ***Emergency phase:*** characterized by events that might lead to radioactivity releases implying an unacceptable radiological risk to the population unless the appropriate protection measures are applied.

This phase contemplates conditions 2, 3 and 4 (in increasing order of seriousness), in accordance with the effective dose and thyroid dose which would be reached without the application of protection measures.

The BNEP indicates the protection measures to be considered, if appropriate, depending on the condition declared. The foreseen measures for protection include confinement, the application of radiological prophylaxis (stable sludge) and evacuation.

III) Interfaces

The BNEP establishes an interface as an instrument for the coordination of the Site Emergency Plans and the Provincial Emergency Plans. The interface serves to correlate the categories of initiating events defined in the Site Emergency Plans with the phases and conditions defined in the Provincial Emergency Plans.

Category I, II and III Events. These categories include those operating events which, even considering the worst foreseeable circumstances, would not cause the release of radioactive material expected to require the adoption of special measures to protect the public. Nevertheless, arrangements and precautions are taken in case the event evolved into a Category IV condition. These events belong to the pre-emergency phase, the correlation between the category of the event and the emergency condition being as follows:

- Category I Events: Pre-Emergency Phase. Condition 0
- Category II and III Events: Pre- Emergency Phase. Condition 1.
- Category IV Events: when there is the possibility of a release that might affect the population. This implies the application of urgent protection measures in part or all of the Emergency Measures Planning Zones, essentially in the zone of exposure due to submersion in the radioactive cloud, or Zone 1. These events correspond to the emergency phase, and may give rise to the declaration of an emergency condition 2, 3 or 4 off site.

Appendix 16.C includes a table which summarizes the characteristics of the interface between emergency phases, categories and conditions.

16.2.2. National emergency preparedness plan

The BNEP is the basic directive for planning for nuclear emergencies within the Spanish State. It is the national instrument for constitution of a Special Nationwide Emergency Plan for Nuclear Power Plants, through the integration of different levels of planning via which the following are developed:

- Site Emergency Plans
- Off-Site Emergency Plans, made up of two levels of planning:
  - Basic Level of Response: Provincial Emergency Plans including Municipal Action Plans
  - Central Level of Response and Support, constituted by the Directorate General for Civil Protection of the Ministry of the Interior and the Nuclear Safety Council, within their respective areas of responsibility.

16.2.3 Plans of the nuclear installations for emergencies on and off site, including support organizations and systems.

Site Emergency Plans

The objective of these plans is to set out the actions foreseen to be taken by the operator of a Nuclear Installation to reduce the risk of a nuclear accident or radiological emergency and, if such a condition were to occur, to limit the release of radioactive material to the environment.

In this respect, the operator of the installation is responsible for operating the plant correctly, in accordance with its technical specifications and operating procedures, under both normal and accident conditions, and for promptly and accurately notifying the Public Authorities in the event or occurrence, or imminent occurrence, of a nuclear accident or radiological emergency.

These actions are included in the Site Emergency Plan, a document which is required in the application to receive an Operating license for a Nuclear Installation, as established in the Decree governing Nuclear and Radioactive Installations currently in force.

The Site Emergency Plan is drawn up by the operator of the installation and submitted to the Ministry of Industry and Energy for consideration, and approval where appropriate. The Directorate General for Energy of the aforementioned Ministry is the National Authority which approves the Site Emergency Plans of the installations, following consideration of a mandatory and binding report by the CSN.

The minimum criteria that the Nuclear Power Plant Site Emergency Plans must satisfy, in the opinion of the CSN, are set out in CSN Safety Guide 1.3, "Nuclear Power Plant Emergency Plan". These criteria are established by the CSN, without prejudice to whatever others might be established by other State Authorities within their respective areas of competence.

Provincial Emergency Plans

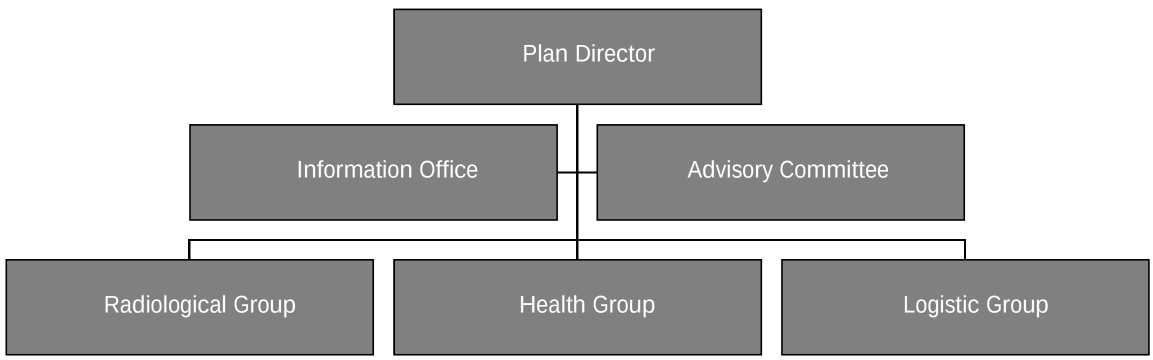
These are drawn up by the Directorate General for Civil Protection, taking into account the provisions of the BNEP, and are approved by the Government, with consideration given to the reports by the National Commission for Civil Protection and in accordance with the Nuclear Safety Council.

There are five such plans, one for each of the Spanish provinces siting nuclear power plants, and are known as: PENBU (Burgos), PENCA (Cáceres), PENGUA (Guadalajara), PENTA (Tarragona) and PENVA (Valencia).

These Provincial Plans establish for their area of application, in the same way as does the BNEP at more general level, the general planning bases and principles upon which they rest, including radiological criteria and protection measures; the structure required to efficiently coordinate and manage the actions planned, with a clear distribution of functions and responsibilities; and finally the criteria required to guarantee the operability of the Plan.

Figure shows the typical structure of the Provincial Emergency Plans, in accordance with what is established in the BNEP. Direction of each of these plans corresponds to the main representative of the Government of the Nation in the province (Delegate/Sub-Delegate of the Government). The Director of the Provincial Plan has the following essential responsibilities:

- to direct and coordinate all actions,
- to declare the emergency phase and condition,
- to decide on and order protection measures,
- to determine and coordinate public information.



The Plan Director is assisted by an Advisory Committee for better exercising of his functions.

The Information Office, which reports directly to the Director of the Plan, has the basic mission of coordinating all the general and specific information on the emergency to be transmitted to the population actually or potentially affected, through the communications media.

The working organization of the Plan Director is the so-called Operations Coordination Centre (OPCOC). The OPCOC is the Centre for Emergency Management at provincial level, where the emergency team and the Control Posts of each of the so-called Action Groups are established. These groups are as follows:

- The *Radiological Group,* whose functions are:
  - to estimate the evolution of the event,
  - to measure and analyze the levels of contamination and radiation,
  - to estimate the radiological effects,
  - to propose to the Plan Director the protection measures most appropriate for the condition.

  The Head of the Radiological Group is a Resident Inspector of the CSN at one of the installations located in the province. He is assisted by the CSN emergency organization, via the Emergency Room, known as SALEM. This Group is made up of specialist Technicians of the CSN, the Centre for Energy-Related, Environmental and Technological Research (CIEMAT), the Spanish national radioactive waste management company (ENRESA) and Civil Protection. These technicians are grouped into five operations and radiological intervention services: radiological surveillance networks, Classification and Decontamination Station teams, Access Control teams, environmental surveillance and control teams and radioactive waste management teams.

- The Health Group, whose essential functions are as follows:
  - to apply the prophylactic measures established,
  - to attend to irradiated and contaminated people,
  - to evacuate those people requiring medical transport, in collaboration with the Logistics Group,
  - medical control of evacuees.

  The Head of the Health Group is appointed by the Plan Director, on proposal by the competent organization of the Autonomous Community in which the nuclear plant is located. The Health Group is made up of five Health Operations Services:

  - Front Line Health Service, made up of local medical personnel in the affected municipal areas.
  - Classification and Decontamination Stations Service (CDS), made up of local medical staff of the municipal areas housing these installations, in collaboration with specialists from the Radiological Group. At the CDS's evacuated persons are counted and radiologically classified, and contaminated individuals are decontaminated. An evaluation is made of the need to transfer affected individuals to an irradiation treatment centre or specialist medical centre.
  - Health Service of the Basic Social Receiving Areas (BSRS), made up of local medical personnel of the municipal areas housing these installations, at which the evacuees will be attended to until such time as they return to their places of origin or are transferred to specialist centres.
  - Health Support Service, made up of other medical centres (hospitals and clinics) in the provincial area.

- Medical Services for Irradiated Persons, made up of specialist personnel and installations. Their mission is to provide specialist medical assistance to the persons transferred by the CDS, the Front Line Health Service or the Medical Service of the Nuclear Power Plant.

  In Spain there is an officially recognized level 2 centre for the treatment of irradiated persons at a Madrid hospital. In addition there are other hospitals which, despite not having undertaken the administrative process required for them to be officially recognized as level 2 facilities, have capacities which are theoretically at that level. All the country's nuclear plants have officially recognized level 1 centres.

  The national health authorities have subscribed an agreement with the Curie Institute in Paris for medical assistance in very special cases of irradiation.

- The *Logistic Group,* whose functions are as follows:
  - updating of the inventory of resources to be used in emergency conditions.
  - establishing action schedules,
  - organization of the different logistics groups,
  - coordination of actions within the Municipal Plans.

  The Head of the Logistics Group is the Senior Lieutenant Colonel Commanding the Guardia Civil in the Province. The Guardia Civil is one of the Police Forces of the Spanish State.

  This Group includes the participation of different Corps of the State Police Forces, the Spanish Army and the different service for fire-fighting, rescue and first-aid, and is organized in five operations groups: transport and supplies, public security, fire-fighting and rescue, transmissions and the municipal coordinator.

Municipal Nuclear Emergency Action Plans

These Plans are integrated in the corresponding Provincial Plans. They contemplate the actions to be taken at municipal level and the organization in charge of their implementation.

The Mayor is responsible for application of the Plan in his Municipal area. The municipal Command Post is the Municipal Centre for Operative Coordination (CECOPAL), which is set up by the Town Council.

In carrying out their missions, the Municipal Organizations are coordinated and supported by the Logistics Group of the Provincial Plan, through the Municipal Coordinator.

With regard to planning, the following types of Municipal areas are considered:

- Municipal areas belonging to Emergency Measures Planning Zone (EMPZ) I:

  These are the areas located within the area of exposure by submersion, with a radiological risk of external or internal irradiation (by inhalation). Zone I is divided into three sub-zones depending on the protection measures foreseen to protect the population during an emergency:

- sub-zone IA: no more than 3km radius around the plant
- sub-zone IB: no more than 5km radius around the plant
- sub-zone IC: no more than 10km radius around the plant

- Municipal areas belonging to Emergency Measures Planning Zone (EMPZ) II:

  These are the areas included within the zone of exposure by ingestion, with a radiological risk associated with the consumption of foodstuffs and of water contaminated by the effluents released. This zone covers a radius of 30 km around the plant.

- Municipal areas housing Classification and Decontamination Stations (CDS's) and Basic Social Receiving Areas (BSRA's).

  The Classification and Decontamination Stations and Basic Social Receiving Areas are the centres at which persons evacuated from the affected area are sheltered and treated. They are located in municipal areas at a sufficient, but not excessive, distance from the nuclear power plant. Specific Municipal Plans are defined for all such centres.

Central Level of Response and Support

The Basic Nuclear Emergency Plan is a model for response to nuclear emergencies at national level, and includes the mobilization of all the resources and capacities of the Spanish State required to provide such a response. Management of the national resources for support of the basic or provincial levels of response is accomplished through the so-called Central Level of Response and Support, integrated by the following:

- the Directorate General for Civil Protection (DGCP), a department of the Ministry of the Interior, as the organization coordinating all the support required by the different Bodies of the Central and other Administrations; and
- the Nuclear Safety Council (CSN) for all aspects relating to nuclear safety and radiation protection, also coordinating the different public and private organizations and companies whose participation is required to cover the specific functions attributed to the body.

16.2.4 CSN response to and preparedness for emergency conditions

The essential responsibilities of the CSN in relation to a nuclear accident or radiological emergency are as follows:

- Tracking of the condition, obtaining an independent assessment.
- Advising the Authorities during the emergency in relation to nuclear safety and radiation protection.
- Making proposals to the Authorities regarding classification of the seriousness of the emergency off-site and the measures to be taken to protect the popu lation.
- Informing the Authorities, public opinion and the media, in coordination with the information transmitted at local or provincial level.

In order to comply with these responsibilities, the CSN is required essentially to undertake the following functions:

- gain insight into and estimate the evolution of the initiating event,
- measure and analyze the levels of radiation and contamination ,
- estimate the radiological effects of the accident,
- determine the most suitable measures to protect the public.

In addition, the CSN appoints the Heads of the Provincial Radiological Groups, through which it directs these groups and coordinates the radiological intervention teams. As part of the Central Level of Response and Support, the CSN coordinates all the agents of the Spanish State required for performance of its functions, including the interventions assigned to the Provincial Radiological Groups.

In order to accomplish all these functions, the CSN has developed an Emergency Action Plan, which includes special organization of its human resources and the availability of the specific resources and tools required to assist in the processes to be performed by this organization. The Emergency Room (SALEM) is the location at which the CSN Emergency Organization performs its function and where the tools required for performance of its functions are located. This Room is permanently manned by technical and support personnel.

Appendix 16.A includes a description of the CSN Action Plan for emergency conditions, including the Emergency Response Organization and the available facilities and resources.

16.2.5 Measures to inform the public of emergency preparedness around the nuclear installation

The Basic Nuclear Emergency Plan establishes the need to inform the population of areas potentially affected by an accident at a nuclear power plant. The objective of this information is to ensure a suitable reaction by the affected population, through sufficient knowledge of the risks posed by the emergency and of the measures adopted to minimize such risks.

In this respect, the Directorate General for Civil Protection, as the body with overall responsibility in this area, establishes certain plans designed to inform the population of the areas involved in the planning for nuclear emergencies, these being developed through specific annual programs delivered via the Delegation/Sub-Delegations of the Government responsible for the Provincial Nuclear Emergency Plans. Drawing up of these plans is undertaken in accordance with specific procedures which, in addition, comply with what was established in the Ministerial Agreement of 21st May 1993 in relation to the information to be provided to the public on the applicable health protection and actions to be taken in the event of a radiological emergency. The aforementioned Agreement constitutes the translation to Spanish legislation of Directive 89/618/EURATOM, of 27th November 1989.

For its part, the Nuclear Safety Council collaborates closely with the Directorate General for Civil Protection in informing the population of nuclear emergency planning zones in areas such as the following: drawing up of information plans and programs, design and publishing of brochures describing the Emergency Plans, and the delivery of direct information to the population.

16.3 Preparation and training: drills and exercises

The general aspects of the preparation and training of those who might intervene in an emergency are included in the BNEP, the Provincial Emergency Plans and the Ministerial Agreement that translates to Spanish legislation the Directive of the Council of the European Union regarding public information, 89/618/EURATOM.

Activities relating to the preparation and training of those who might be required to intervene are specified in annual programs, for both the personnel of nuclear installations and those associated with the Provincial Emergency Plans. These programs include theoretical and practical courses, training exercises, and partial and general drills designed to verify the degree of preparedness of the personnel and of the support systems and equipment.

As regards the Spanish nuclear installations, all perform an annual general site emergency drill. The objective of this general emergency drill is to check the suitability of the Site Emergency Plan of each plant through performance of a set of activities, covering the majority of the aspects included in the Plan.

With a view to optimizing the scope of these drills, the Nuclear Safety Council generally requires that the events contemplated in the corresponding scenarios cover at least to emergency category III (site emergency), and include the participation of the fire-fighting, repair and evaluation of damage and rescue and first-aid brigades.

In addition, with a view to verifying specific aspects of the plant emergency response capacity and introducing a greater degree of realism in performance of the drill, the CSN establishes a series of additional, specific requirements periodically applicable to each plant and each drill, within the general annual scheduling. These specific requirements include the following: date of drill unknown to the participants, real activation of and action in the Emergency Environmental Radiological Surveillance Plan (EERSP), scaling of the seriousness of the scenario up to emergency category IV, the maximum foreseen in the Site Emergency Plans, etc.

CSN Safety Guide 1.9 "Emergency drills and exercises at nuclear power plants" establishes the criteria for the scheduling, preparation, monitoring and assessment of such drills. The CSN performs direct monitoring of the development of drills at nuclear installations through a team of inspectors who verify the general emergency response capacity of the licensees, as well as the degree of efficiency with which the different activities performed during such drills are addressed. The observations of these inspectors are made known to the licensees, in order for them to be taken into account - along with those made by the installation's own observers and controllers - in the emergency plan enhancement programs and application procedures contemplated as a result of the drills.

The CSN participates actively in the annual drills carried out by each nuclear installation, through the activation of and actuation within its emergency organizations at the SALEM. The participation of the CSN emergency organization in these drills is accomplished under maximum conditions of realism, including the application of the procedures in place for the activation and actuation of the organization's operative groups. In addition, the drills include practicing coordination between the CSN and the Provincial and National Authorities, with a view to verifying the general efficiency of the procedures established for coordination with the organizations involved.

Exercises and drills are also performed in relation to the off-site emergency plans, including the intervention of the different organizations involved. These exercises and drills are defined in annual programs for the entire State, and include from partial exercises, in which individual tasks are put into practice with the participation of specific organizations, to general drills with the full participation of all, or most, of the organizations and teams, with performance of multiple tasks defined in the plans and requiring a high degree of coordination.

Spain participates actively in the program of exercises and drills established at international level: European Union ECURIE system exercises, OECD INEX.2 program of exercises and bilateral exercises with Portugal. The CSN coordinates the Spanish participation in these exercises, activating in all cases its emergency response organization. The emergency units of Civil Protection and the Government of the Nation also participate, in coordination with the NSC. These exercises serve not only to verify the international procedures for the notification of nuclear emergencies and information exchange, but also include the implementation of national procedures for the coordination of institutions, especially those associated with tracking of the condition, decision-making and the provision of information to the media and the population at large.

16.4 Arrangements at international level, including neigbouring countries, as required

The Spanish State has signed the Convention on the Prompt Notification of Nuclear Accidents and the Convention on Mutual Assistance in the event of a Nuclear Accident or Radiological Emergency.

As regards the Convention on Prompt Notification, the CSN is the Competent National Authority, and the SALEM the National Point of Contact.

As regards the Convention on Mutual Assistance, the DGCP is the Competent National Authority and its Operations Coordination Room (SACOP) the National Point of Contact.

Furthermore, the Spanish State, as a Member of the European Union, is required to establish within its territory and with respect to other States and the Commission, the requirements emerging from the Decision of the Council 87/600/EURATOM, in relation to Community arrangements for the prompt exchange of information in the event of a nuclear accident or radiological emergency, known as the ECURIE agreements or arrangements.

The CSN is the Competent National Authority in relation to ECURIE, and the SALEM the National Point of Contact.

In addition, the Spanish and Portuguese States have signed an apply a Bilateral Agreement on the Nuclear Safety of Frontier Nuclear Installations, which includes the specific notification and information exchange actions to be taken in the event of a nuclear accident or radiological emergency occurring in, or having effects on, the respective national territories of the two countries. The CSN is the Competent National Authority for the application, maintenance and development of the aforementioned Bilateral Agreement, and the SALEM the National Point of Contact.

16.5 Degree of implementation of obligations

From what has been set out above, it may be deduced that in Spain the Planning for and Response to Nuclear Emergencies complies with the obligations of Articles 16.1 and 16.2 of the Convention, Article 16.3 referring to Contracting Parties not having any nuclear installation in their territories not being applicable.

The Spanish Integrated Emergency Plan, made up of the Central Level for Response and Support, the Provincial Emergency Plans, the Municipal Emergency Plans and suitable instruments for coordination of and interfacing between them, implies compliance with article 16.1 of the Convention, since these plans are regularly tested through the periodic performance of both partial and integrated exercises and drills.

These instruments for planning and response, along with the International and Bilateral Agreements subscribed by the Spanish State in relation to emergencies, ensure compliance with Article 16.2 of the Convention.

At present there are in Spain certain on-going and scheduled actions aimed at improving the State's general nuclear emergency response capacity. Certain of these actions relate to the following:

- Revision of the Basic Nuclear Emergency Plan to introduce the new radiological criteria defined at international level, among them the philosophy of levels of intervention based on doses avoided. Furthermore, a new structuring of the national Administration defined in Law 6/1997 regarding the Organization and Functioning of the General State Administration is foreseen.
- Improvement and updating of the resources and capacities of the Provincial Plans. The available resources are periodically reviewed and new Shortcomings Plans are published for consideration within the appropriate budget assignments.
- Incorporation of new decision-making aid systems. Incorporation of the RODOS system in the CSN's SALEM installations is currently being dealt with.
- Improvement of aspects relating to application of plans and procedures for public information.
- Establishment of generic guidelines for performance of the actions to be taken during the recovery phase. A starting point in this respect is the set of preliminary technical studies on this issue performed by the national radioactive waste management company ENRESA, among which special mention might be made of a national inventory of resources applicable during this phase of an emergency.

APPENDIX 16.A

CSN organization for emergency conditions

The Organization foreseen by the CSN for emergency conditions encompasses all the levels of authority of the Body, and draws upon the human resources used in performance of its functions as the Regulatory Body, once these have been duly prepared and trained for the performance of those functions, which are specifically assigned to them in the event of a nuclear emergency (Figure 2).

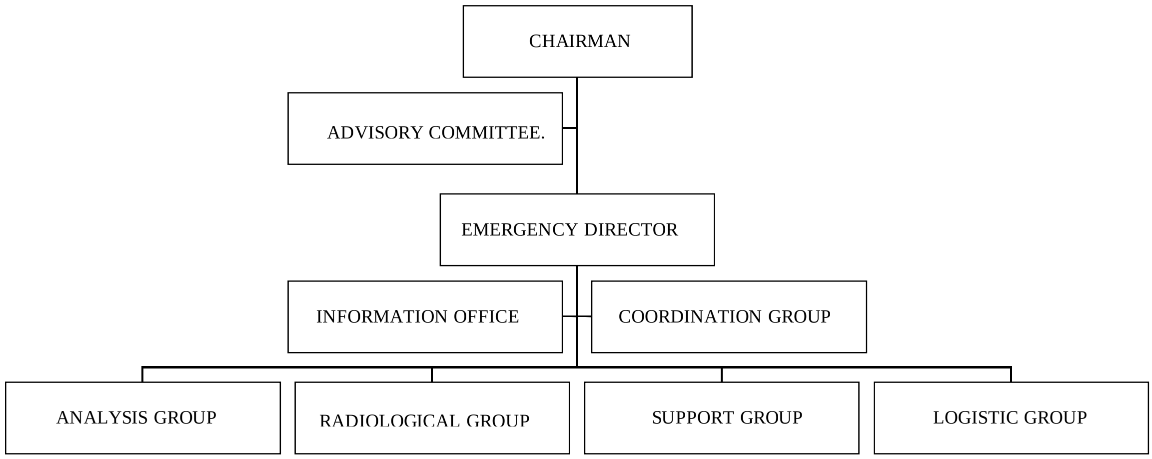


Figure 2

The Chairman of the CSN is ultimately responsible for the emergency organization, which responsibility he may delegate to the Vice-Chairman or to another member of the Board. The Chairman shall be assisted by an Advisory Committee made up of four Members of the Board and the Secretary General. This Advisory Committee will participate in all decisions made by the Chairman, to the extent possible and depending on the specific conditions that might arise during an emergency.

The Emergency Director is the Technical Director of the Body, and provides suitable coordination and management for execution of the decisions taken by the Chairman.

The CSN has a Press Office which, in the event of an emergency, would report to the Emergency Director (Information Office), with support from whatever technical personnel were considered necessary.

The Emergency Room (SALEM) is where the CN Emergency Organization mainly carries out its functions, centred on the activities of the personnel assigned to the different operational groups: management, radiological group, operational analysis group and support group.

The Radiological Group is assigned tasks relating to the tracking and evaluation of the radiological consequences of the emergency situation and makes proposals to the CSN Emergency Director regarding the protection measures to be adopted.

The Operational Analysis Group is responsible for tracking and evaluating the emergency from the point of view of the nuclear safety of the installation and, therefore, for gaining insight into the initial cause of the event, its evolution, the systems and equipment affected, the emergency operating procedures used and in general the operating status of the installation and characterization of the source term.

The Support Group is responsible for providing the support required to the different operational groups of the CSN Emergency Organization and to the Information Office, especially as regards contacts with those national and international organizations which might collaborate in the event of an emergency and with off-site plant operating support groups.

The CSN emergency organization personnel works within a stand-by system, this guaranteeing the presence of a sufficient number of people within one hour of activation. In addition, the CSN emergency centre, to be described below, is permanently manned by personnel working shifts.

Nuclear Safety Council Emergency Room (Centre) (SALEM)

In order for the different elements of the CSN Emergency Organization described above to be able to carry out the functions assigned to them in an efficient and coordinated manner, the CSN has an Emergency Centre known as SALEM. SALEM is the abbreviation of ***Sala de Emergencias***, or Emergency Room.

The SALEM is defined as the nerve centre at national level for the notification, information, tracking, analysis and evaluation of all nuclear accident or radiological emergency conditions that might occur within the Spanish national territory, or outside this territory but having actual or potential repercussions on it.

What follows is a brief description of the Centre and of the information, calculation and estimation systems available in it.

The main core of the SALEM is made up of four operations rooms of approximately the same size and located one adjacent to the others, forming a cube with glass partition walls. It is located in the basement of the headquarters of the Organization and is a restricted area of controlled access.

The most important of these rooms is known as the Emergency Management Room, and is the area in which the Emergency Director works. The three remaining rooms are the working areas for the three operational groups defined in the CSN Action Plan: radiological, support and analysis. This room also houses the Information Office.

The SALEM is backed by a communications room annexed to the Emergency Management Room and by a set of auxiliary facilities designed to allow for lengthy stays by the Emergency Organization personnel. This communications room houses telefax and telex terminals, a telephone concentrator, device for the recording of telephone conversations, photocopier, etc.

The SALEM is manned 24 hours a day, 365 days a year, by a Technical Supervisor qualified in Nuclear Safety and Radiological Protection and by a communications Officer.

The voice transmission systems installed in the SALEM are classified into three types: direct telephony (head-tail), switched (conventional) and radiotelephony. In addition to this criterion of diversification, they also meet the criterion of redundancy, inasmuch as the communications are designed with at least two different systems to provide and ensure a permanent link between the SALEM and the different nuclear groups, relevant radioactive installations, Civil Defense Operations Coordination Centres and the different national and international organizations involved in the management of nuclear emergencies.

The SALEM includes a series of surveillance, calculation and estimation systems that goes to make up a set of specialist tools used by the experts of the Emergency Organization in the performance of their functions.

Information on the electrical switchyards of the nuclear groups is received in the Emergency Management room. For each nuclear installation, the system provides a single-line diagram of its sub-stations and a set of associated electrical parameters that makes it possible to detect in real time any power reduction or non-scheduled tripping of any of the nuclear groups.

This room is also equipped with a geographic information system that includes and structures in a logical manner geographic information on the entire national territory, this being especially dense in the areas surrounding the different nuclear sites.

The Radiological Group room houses the environmental radiological surveillance networks. These networks allow the CSN to undertake its responsibilities in relation to the measurement and control of levels of radiation and contamination outside the nuclear and radioactive installations. The CSN has its own automatic network of environmental radiological surveillance stations known as REVIRA, made up of 25 stations distributed throughout Spain. Each such station contains an Automatic Radiological Station which measures radiation and the concentrations of radon, radioiodines and alpha and beta radioactivity emitters in the air, and a Meteorological Station (belonging to the National Institute of Meteorology) which measures the main meteorological parameters. The REVIRA network control centre at the SALEM receives data from the networks of automatic stations implemented by the Governments of certain of the Autonomous Communities of the Spanish State. The SALEM also houses a consultation terminal (Associated Centre) of the Radioactivity Alert Network belonging to the Directorate General for Civil Defense of the Ministry of the Interior, which is made up of 902 automatic radiation rate measurement stations distributed throughout the country.

The CSN currently possesses various calculation codes for dose estimation, this being of fundamental importance to determine the radiological risk associated with the possible release of radioactive material that might occur in the event of a nuclear emergency. Most of these codes are CSN developments adapted to the Spanish nuclear power plants: IRDAM, RASCAL and MESORAD.

In order to operate, these emergency dose estimate codes require as input a series of different meteorological parameters, for estimation or calculation of the prevailing atmospheric dispersion conditions. As a result, the CSN has a system linking the SALEM to the meteorological towers of the nuclear sites. In addition, there is a direct connection with the National Institute of Meteorology via a data transmission line, to receive the parameters required for a wide range of dose estimates and for the reception of weather forecasts.

The Operational Analysis Group room contains a system for the transmission of safety parameters, required to assist the personnel of the CSN in gaining insight into the operating situation of the plant and reliably assess its degree of safety during an emergency situation. The main function of this system is to identify abnormal operating conditions, providing a continuous indication of safety-related parameters or other variables representative of the plant operating status.

This room also has a plant real-time analysis system incorporating the MAAP code, specifically adapted to each nuclear power plant and connected to the system for the reception of safety parameters from each. This system makes it possible to evaluate and predict the evolution of severe accidents. It is also used as a training tool for the CSN personnel on severe accidents, by simulating this type of events.

In order to allow the Support Group to carry out its functions and provide technical documentation on a given installation to the other operational groups, this Group's room has an archive containing the documentation on emergency conditions at each of the nuclear groups, general and emergency operating plans and procedures, radiological surveillance plans, technical specifications, etc.

APPENDIX 16.B

Table of interfaces between emergency categories and conditions

Event Category	Maximum Activity released (Bq)	Class	Phase	Condition	Levels of Intervention		Protective Measures	
					Whole Body	Thyroid		
I	-	Pre-alert	Pre-Emergency	0	-	-	none	
II	G. 3.7×10^{14} R. 3.7×10^{11}	Emergency Alert		1	< 5 mSv	< 50 mSv.	Control of Accesses	
III	G. 3.7×10^{16} R. 3.7×10^{13}	Site Emergency						
IV	G. 1.4×10^{19} R. 6.7×10^{18}	General Emergency	Emergency	2	> 5 mSv < 25 mSv	> 50 mSv < 250 mSv	As above plus confinement, prophylaxis, personnel protection.	Zone Ic
				3	> 25 mSv < 100 mSv	> 250 mSv < 1000 mSv	As above plus CG evacuation, control of water and foodstuffs and stabling of animals.	Zone Ib
				4	> 100 mSv	> 1000 mSv	As above plus evacuation of population.	Zone Ic.

d) Safety of installations

Article 17. Siting

17.1 Description of the licensing process, including summary of national laws, regulations and requirements relating to the sites of nuclear installations

In dealing with the licensing procedure described in article 7 of the Convention, the following three stages are established: preliminary authorization, construction permit and operating permit. In all cases, there are specific conditions to be met as regards the site housing the nuclear installation.

The **preliminary authorization** constitutes official recognition of the project and formal acceptance of the proposed site, as a result of which it implies in practice a true "authorization of the site". This authorization requires the applicant to submit the following documents, among others:

- Declaration of the needs that are to be satisfied and justification of the installation and site selected.
- Characterization study of the site and the area of influence of the installation, including sufficient data on the parameters of the site that might impact nuclear safety or radiological protection, including demographic and ecological data, along with activities relating to land use planning.

The next phase of licensing is the **construction permit**, which requires the submittal of a Preliminary Safety Study, to include among other aspects, "a description of the site and surrounding area, with accurate, updated data on parameters impacting nuclear safety and radiological protection (topography, geography, geology, geotechniques, seismology, meteorology, surface hydrology and hydrogeology), including demographic and ecological data and data on the use of land and waters, along with whatever other data might contribute to better knowledge of the site, and the surveillance plans and verification of the basic parameters representative of the site". The studies to be performed constitute a refinement of the information obtained in the previous stage, with more in-depth consideration given to site characterization and definition of the design bases associated with off-site events.

The following is among the specific information to be submitted as part of the studies performed:

- Aerial photographs and satellite images
- Topographic information and maps (and bathimetric in the case of coastal locations)
- Local and regional geological information (with maps and stratigraphic information)
- Regional geophysical information (with gravimetric and magnetic anomalies)
- Local geophysical data and results of geotechnical prospecting
- Historic earthquake catalogue (and seaquakes where appropriate) and isosyst map
- Information and maps on seismic zoning

- Existing information on regional land and sub-soil
- Historic data on floods, rainfall and water course or coastline alterations.
- Data on flow regulation structures
- Regional climatological data
- Meteorological data on the basin (regional and local)
- Hydrogeological data (regional and local)
- Data on possible sources of events attributable to man
- Population distribution information and maps (demography)

Once the plant has been built, and prior to its start-up, the third phase of licensing: **the operating permit**, has to be covered. In order to obtain this permit, the applicant is required to submit the Final Safety Analysis Report, which shall "contain the information required to carry out an analysis of the installation from the point of view of nuclear safety and radiological protection, as well as an analysis and evaluation of the risks arising from operation of the installation under both normal and accident conditions". The information to be provided shall include the following:

- Complementary data obtained during construction on the site and its physical, geological, seismological, meteorological, hydrological, ecological and demographic characteristics.
- Analysis of foreseeable accidents due to malfunction of elements and apparatus, operating errors or agents external to the installation, and their consequences.

17.1.1 Criteria for the evaluation of all site-related factors affecting safety

The criteria applied in evaluating the parameters of the site, in order to determine its acceptability, are those contained in the following Spanish standards:

- Nuclear Energy Act, Law 25/1964
- Law 15/1980, establishing the Nuclear Safety Council
- Legislative Royal Decree 1302/1986, governing the evaluation of environmental impact, and Regulation for execution thereof (RD 1131/1988) .

In the case of technical aspects not contemplated in detail in the Spanish regulations, the criteria of the standards issued by international organizations to which the Spanish State has adhered are applied (IAEA standards, 50-C-S Code and Safety Guides). Finally, for each installation compliance is required also with the standards of the country of origin of the project , fundamentally 10CFR Part 100 of the USA and the US NRC standards. In the case of Trillo NPP, the criteria included in the German KTA have also been applied.

The basic objective sought in applying the evaluation criteria is to check that the site of the nuclear installation contributes to protecting the public and the environment against whatever radiological consequences might arise as a result of normal plant operation and any accidental release of radioactive effluents. In other words, the site should guarantee that the risk of exposure to radiations for the public and the environment be as low as reasonably achievable, under both normal operating and accident conditions.

The criteria used for the evaluation of the parameters of Spanish sites are basically deterministic in nature, for the evaluation both of the maximum natural events foreseeable (earthquakes, floods, etc.) and of the maximum off-site events induced by man (nearby industry, transport, etc.). Each of these maximum off-site events constitutes a design basis for the nuclear installation.

For operating Spanish nuclear plants, the site parameters influencing safety, and whose evaluation has led to consideration of the maximum off-site events and definition of the design bases, are as follows:

- Geology and Seismology: Safe Shutdown Earthquake (SSE) and operating basis earthquake (OBE).
- Geotechnology: Design of foundations, soil-structures interaction.
- Meteorology: Maximum probable precipitation (MPP), extreme temperatures, design wind.
- Surface hydrology: Maximum probable flood (MPF), site flood level.
- Hydrogeology: Groundwater levels, need to lower the water table (in the case of Almaraz NPP).
- Oceanography (only in the case of Vandellós NPP): maximum sea level, waves.
- Nearby industries and communications channels: transport and storage of explosive, toxic and hazardous substances; control room isolation conditions.

17.1.2 Criteria for the evaluation of the consequences of the nuclear installation on the surrounding environment and population

The general sequence of evaluation criteria applied to decide on the acceptance of a site, in all its aspects, has been presented in the previous section.

As regards the possible effects of a nuclear installation on its surroundings and on the surrounding population and environment, the specific criteria used for all the Spanish nuclear power plants are those specified in US 10 CFR Part 100, and developed in document TID-14844 (1962) and the standards of the US NRC. These criteria establish three zones around the installation in reference to dose limitation in the event of an accident:

- *Operator controlled zone* (or exclusion area): This is a circular area of a maximum 750 metres radius with its centre in the containment building and within which the operator has the authority to control all activities. In the hypothetical event of the maximum foreseeable release of radioactive products (maximum foreseeable accident), an individual located at any point in this zone would not receive a whole body dose higher than 25 rem during the two hours following the accident.
- *Protected zone* (or low population density area): This is an area located concentric to the previous zone and measuring a maximum 3,500 metres in radius. An individual located at any point in this area would not receive a whole body dose higher than 25 rem during the thirty days following the accident.
- *Distance to population centres*: Distance between the containment building and the *nearest* town with a population of 25,000 or more. This distance must be at least 1.33 time larger than the radius of the protected zone.

As a result of implementation of the principles of the Basic Nuclear Emergency Plan to the Spanish nuclear power plants (as from 1984), new concepts were introduced, as follows:

- *Zone of exposure by immersion*: Circular zone measuring a maximum 10 km in radius *with* its centre in the containment building. This is the geographic area in which the individual's critical path for exposure to radiations in the event of an accident is associated with remaining inside the radioactive cloud.
- *Zone of exposure by ingestion*: Circular zone measuring a maximum 30 km in radius with its centre in the containment building. This is the geographic area in which the individual's critical path for exposure to radiations in the event of an accident is associated with the contamination of foodstuffs due to the deposition of radioactive particles.

The site parameters evaluated from the point of view of the possible effects of a nuclear installation on its surroundings are as follows:

- Demography: Population distribution and demographic perspectives.
- Geography: Uses of land and water, nearby industries, communications routes and infrastructures.
- Meteorology: Coefficients of atmospheric dispersion (regional and local), deposition factors, prevailing winds.
- Hydrology: Dispersion of liquid radioactive effluents in surface and groundwaters (under normal and accident conditions).
- Ecology: Description of potentially affected ecosystems.

17.2 Implementing provisions for compliance with the aforementioned criteria

During each phase of the licensing process, the CSN reviews the documentation submitted and evaluates compliance with the established requirements. The final result of this evaluation will be the decision to award or deny the requested authorization and, if awarded, the additional conditions or requirements to which such authorization must be subjected. These additional conditions or requirements are issued along with the corresponding authorization and are legally binding.

Through these conditions, the CSN adapts the general criteria established in the standards of the country of origin of the project to the demands required by the situation of each nuclear plant, on a case by case basis. In a sense, this constitutes development of the standards specific to each installation.

Once the holder of an authorization has carried out the actions required by these conditions and has submitted the corresponding documentation, the CSN once again evaluates the acceptability of the actions performed and the actual compliance with the conditions imposed. Total or partial acceptance may be the result. If the acceptance is partial, new conditions to be applied to the holder will be drawn up, and even new limits to the authorization awarded. In extreme cases of non-compliance, the authorization awarded may even be withdrawn.

In addition to evaluation of the licensees studies and actions, the CSN may resort to *inspections and audits* to check at any time the degree of compliance with a requirement or the accuracy of the information included in the documents submitted for review by the licensee. These evaluations and inspections are complementary as regards checking and -demanding of compliance with site-related safety criteria.

17.3 Activities relating to maintenance of the continued safety acceptability of the nuclear installation, taking into account site-related factors

Given that the first Spanish nuclear power plants (José Cabrera and Sta. Mª de Garoña) were authorized prior to the detailed development of US standards, the country of origin of the projects, certain site criteria were applied in a qualitative manner. For this reason, and with the aim of applying the principle of continuous evaluation of the site parameters, when the US NRC approved the Systematic Evaluation Program (SEP) to re-evaluate the safety conditions of its operating plants, Spain applied this program to its two first plants. This program implied revising the design bases for maximum off-site events in the light of the then recently developed standards.

The basic parameters of the site, those which were a determining factor in design, require the establishment of "surveillance programs" for their continuous evaluation, through which practically continuous information on the behaviour of the site may be obtained and, in the event of occurrence of an extreme event, a check may be made to determine whether or not the corresponding design bases have been exceeded, with a view to reviewing the condition of the installation where appropriate. These surveillance programs are dynamic and specifically adapted to each site and installation; the results obtained are documented and periodic reports are submitted to the CSN for evaluation. As a result of such evaluations, the CSN may require the revision of the corresponding surveillance program to adapt its contents to the original objectives.

The Spanish nuclear power plants maintain surveillance programs for parameters relating to seismology (seismic instrumentation and transmission of the information recorded), meteorology (meteorological instrumentation and transmission of the information recorded), and hydrogeology (surveillance and data acquisition point networks). At the Ascó, Vandellós and Trillo plants surveillance programs are also kept active, to a greater or lesser extent, with respect to earth movements, the aim being to auscult differential movements as yet not stabilized, although the growth rate is decreasing.

As regards site hydrogeology, hydrogeological characterization programs were established at all the sites, these later becoming surveillance and control programs for the lifetime of the installation, in relation both the water tables and to the content of certain chemical and radiological elements, and being closely related to the Environmental Radiological Surveillance Plans. Integration of the information obtained must be accomplished at each site through the use of mathematical models for flow and transport in groundwaters.

In recent years, the standards relating to consideration of site parameters have changed significantly in certain aspects, particularly as regards the increasing use of probabilistic methodologies. This has led to the recommendation that the quantification of certain design parameters (seismology, hydrology, etc.) be performed by means of an adequate combination of deterministic (maximum foreseeable values) and probabilistic (possibility of working with uncertainties) studies, along with expert judgement. These techniques are now being applied to the Spanish sites with a view to reviewing the behaviour of the installations and improving their safety.

Along these lines, in 1986 the CSN approved an "Integrated Program for the Performance and Use of Probabilistic Safety Assessments in Spain", which is being applied sequentially to all the plants and which includes within its scope the consideration of off-site events as initiators. These probabilistic studies of off-site events are currently being performed and, given the characteristics of the Spanish sites, the events considered are earthquakes, flooding, wind, transmission lines and nearby industries. The basic objective of these studies is to analyze the performance of the installations with regard to events beyond the design basis (those having a frequency of recurrence of less than 10^{-6} being ruled out), and to detect specific vulnerabilities at each plant which might be solved at low cost, through reasonable enhancements offering a good cost-benefit ration. The methodology applied in these studies is the one described in US NRC NUREG-1407.

Among the extreme events analyzed, the one with the greatest impact on the safety of the Spanish plants is the occurrence of earthquakes. For this reason, and on request by the CSN, the operators have jointly performed a probabilistic study of the seismic danger at the seven Spanish sites and, in accordance with the alternative methodologies described in NUREG-1407, have proposed the revision of each plant according to the *"seismic margins"* method. The seismic danger study submitted having been evaluate by the CSN, using the same criteria as the US NRC for *"seismic categorization"* (classification of the sites into three groups: *reduced scope*, 0,3g and 0,5g). Each operator has been requested to provide the category of his site to be considered in applying the *"seismic margins"* method to revision of his plant. The revision process for each plant is currently on-going.

17.4 International arrangements, including those with neighbouring countries

As regards the siting of nuclear installations, and in addition to the EURATOM Treaty at European level, Spain and Portugal have signed a *Spanish-Portuguese agreement for cooperation regarding the safety of frontier nuclear installations"*. In accordance with this agreement, representatives of the two countries meet annually to exchange information of interest.

Likewise, meetings have been held between the CSN and its French counterpart DSIN to provide mutual information on the progress of their nuclear energy programs and exchange technical data and plant operating experiences, basically in relation to Vandellós I NPP, a plant of French origin which is now in the process of decommissioning and dismantling.

17.5 Degree of implementation of the obligations

The information relating to site parameters drawn up during the different stages of the licensing process, and its subsequent evaluation by the regulatory body, applying the criteria established in the Spanish standards and those established by the international organizations and the standards of the country of origin of the design, lead to the definition of design bases associated with the site parameters that reasonably guarantee the safety of Spanish nuclear power plants during the design, construction and operating phases.

Certain other phases of the lifetime of the installations are not adequately contemplated in the licensing process currently in force in Spain. For this reason, a revision of the Decree governing Nuclear and Radioactive Installations, currently in the approval process, aims to regulate also the *"authorization for modifications to the installation"* and the *"authorization for dismantling and declaration of decommissioning"*. The first requires justification of those modifications in which any factors relating to the site are involved. The second requires a safety study containing, among other things, a descriptive study of the current state of the installation, of the site and of its area of influence, along with determination of the site parameters to be considered.

As regards the site parameters monitoring programs that make continuous evaluation possible, these are in a process of enhancement and optimization. For example, as regards seismic surveillance, the implementation of free field accelerographs at all sites is being required (previously only some sites had seismographs).

Finally, the probabilistic assessment of off-site events and the revisions deriving from the installations, aim at re-evaluating the site parameters using methods capable of evaluating uncertainties, and consequently improving the safety of the plants throughout their service lifetime. Particularly important is the active process of revision of each nuclear power plant in relation to the occurrence of earthquakes by means of the *"seismic margins"* method. Efforts are currently being made to complete this currently on-going process in the shortest time possible.

Spain is considered to meet the requirements of this article.

Article 18. Design and construction

This article includes a description of the basic principles of safety, and their evolution, as used in Spain to apply for, analyze and award *construction permits* to the owners of nuclear power plants, along with the methods applied to monitor construction and guarantee compliance with the design requirements. Special reference is made to the applicable regulations and requirements, to the application of fundamental safety concepts, the prevention of accidents and the mitigation of their consequences and to the influence of design on future plant operation.

18.1 Licensing process related to construction permits. Current regulations and requirements

This section deals with the legal process established to apply for and obtain the construction permit, the process of evaluation of such applications by the Nuclear Safety Council (CSN) and the requirements established in the permit to verify that it is in accordance with the proposed design and achieves the required level of quality.

18.1.1 Process of awarding a construction permit

Article 14 has described generically the process applied in Spain to evaluate and verify the safety of a nuclear power plant. Among the most significant stages of this process is the need to hold a construction permit, as specified in the Decree governing Nuclear and Radioactive Installations, dealt with in that article.

The Preliminary safety analysis report is the most significant document to be submitted by the owner in support of his application. The format and content of this document has evolved with the three families that constitute Spain's total nuclear plants. However, even within this evolution, the aforementioned study has been based on the three following fundamental principles:

1. Consideration of the criteria and specification contained in the ministerial order by which the preliminary authorization is awarded to the plant analyzed.
2. attention to the applicable national standards and to the appropriate recommendations of the international organizations – fundamentally those of the IAEA, of which Spain is a member country, and in their absence to the standards of the country of origin of the project.
3. Accurate tracking, as regards details, of the *reference plant,* defined in the corresponding construction permit.

During the preliminary authorization phase (see art. 17), special attention is paid to the parameters defining the site and relevant to the design of the installation, especially those relating to seismicity and extreme meteorological phenomena. In this respect, the ministerial order by which the *preliminary authorization* is warded requests that *"the owner shall justify the resistance to seismic phenomena of the design"* and establishes basic parameters – maximum accelerations – for the design, these depending on the parameters of the site. The same occurs in relation to extreme meteorological parameters, especially floods, which in the case of inland sites are critical for definition of the *design of the final heat sink* and the *basic elevation* of the plant. This proved to be efficient in the case of the Cofrentes nuclear power plant, the site of which suffered a serious flood during construction, without the plant being affected. Consideration is given also to environmental impacts, which have to be formally evaluated and accepted by the Ministry of the Environment, and clauses are included establishing that *"the architectural concept of the complementary buildings shall be in harmony with the landscape of the site"*.

The ministerial orders by which the *preliminary authorization* is granted are particularly strict as regards the standards to be used during the design and construction of the plant. Quoted in first place are the national criteria, codes, standards and provisions. Naturally, these have evolved considerably during the time that elapsed between the first plant, José Cabrera, was built (construction permit awarded in 1964) and the last, Vandellós II, authorized in 1980. One way or another, and even today, the number of national references is rather low in view of the need for attention to necessary issues. For this reason, the ministerial orders make reference to the "corresponding documents issued by the international organizations to which the Spanish Government belongs". This procedure has served to incorporate into the Spanish standards some of the IAEA's NUSS series documents. Even so, it has been necessary to incorporate also documents of recognized validity in the nuclear industry, especially those established in the *country of origin of the project*. In any case, the corresponding ministerial orders require that the criteria, codes, standards and provisions used in the design be clearly reflected in the *Preliminary safety analysis report*.

The concept of the *reference plant* was introduced in Spain in the construction permit for the Santa María de Garoña plant, the second nuclear plant built in Spain, and has been used for all the other plants since then. The ministerial orders define the *reference plant* as one located at a "site of the characteristics similar to that selected for the plant (national) and whose start-up date be sufficiently prior to that foreseen for the project submitted, such that advantage might be taken of the experience acquired during the testing and operation of the reference plant proposed".

18.1.2 Evaluation of the application for authorization

The documentation received from the owner in support of his application for the *Construction Permit*, and especially the *Preliminary safety analysis report*, is subjected to rigorous evaluation by the CSN. In this respect, a practice that has been used since the very first applications is that of appointing an *Evaluation project manager*. This manager is now generally from the *Sub-Directorate General for Nuclear Power Plants* and has an Evaluation Guideline. This guideline establishes the schedule for the evaluation and defines the aspects to be evaluated by the experts of the CSN itself and those to be contracted outside. The manager issues the corresponding orders and instructions via the corresponding hierarchical channels. The *Decree governing Nuclear and Radioactive Installations* allows the CSN to request from the owner whatever additional information, clarifications, analyses and estimates it considers to be appropriate, all of which is formally added to the file referring to authorization for construction of the plant.

On completion of the evaluation process, which traditionally lasts more than a year, a report is drawn up, along with a proposal for declaration, accompanied by one or several appendices governing the activities of the owner during the construction process, regulating the construction and including specifications as to how to carry out pre-nuclear checks of the installation. They also identify the specific aspects to be taken into account to apply for the *Provisional Operating Permit* and in performing *nuclear testing*. Appendix 18.A includes a copy of the construction permit awarded to the Vandellós II nuclear power plant, the last issued.

18.1.3 Requirements of the construction permit and tracking of construction

One of the most outstanding requirements governing the construction of the installation underlines that *"the licensee shall, have at all times an organization suitable and sufficient for supervision of the project and guarantee of quality during construction"*, which has to be approved by the regulatory authority. Likewise, the licensee is obliged to submit monthly and quarterly reports to the CSN detailing the progress of the project and all matters relating to nuclear safety, as well as whatever incidents and variations were to have occurred. In addition, the Council's inspectorate makes frequent generic and specific inspections.

This requirement has proven to be of great value for verification that the construction of the Spanish nuclear power plants has been undertaken in accordance with the established requirements and with a suitable level of quality. The first generation plants were constructed within the framework of *turnkey* arrangements, as a result of which responsibility was to the main vendor. Nevertheless, the owners set up organizations to supervise the project and check quality. The second and third generation plants were built in accordance with the *administrative contracting* method, as a result of which the licensee was responsible for the correctness of the design and the quality of the works and assembly. The requirement added by the Ministry of Industry and Energy and aimed at achieving maximum possible participation by national industry increased this responsibility. In view of the above, the licensees set up their own, ample organizations, and often looked for advice from overseas, allowing them to monitor detailed design and demonstrate the quality of the processes of manufacturing, construction, assembly and pre-nuclear testing of the installation.

The pre-nuclear test program is required to include both the general tests referred to in the *Decree governing Nuclear and Radioactive Installations* and those specific to each particular case, which are described in the Ministerial Order awarding the *Construction permit*, among which those aimed at verifying the structural integrity of the pressure boundary and the containment, and the capacity of the associated engineered safeguards to satisfy the safety function assigned to them are particularly outstanding. The *pre-nuclear testing* program is required to be favourably assessed by the CSN, which also establishes those tests which are to be performed in the presence of its official inspectors. Satisfactory performance of the pre-nuclear checks and their formal acceptance by the CSN marks the end of the *Construction permit.*

18.2 The concept of inherent safety or defense in depth

The concept of *inherent safety* or *defense in depth* is incorporated into the Spanish standards and practices, not only as regards the physical integrity of the *fuel cladding, pressure boundary and containment system*, but also the *engineered safeguards* protecting the physical integrity of these barriers under both normal and accident conditions. Furthermore, special attention is paid to the administrative requirements relating to licensing, inspection and quality assurance, which attempt to ensure the correct design of the *barriers* and the correct operation of the *engineered safeguards* protecting them.

The fuel, and especially its cladding, receives considerable attention in the ministerial orders by which *construction permits* are awarded. In particular, the maximum linear power and hot channel factors are established, along with the basic requirements for the reactor protection system. Likewise, prescriptions are formulated in relation to aspects such as the control of xenon-induced power oscillations, and the design criteria for the emergency cooling system are set out, with reference to Appendix K of 10CFR Part 50 of the US NRC legislation.

The nuclear fuel is supplied by ENUSA (Empresa Nacional del Uranio, S.A.), the national supplier that manufactures fuel of different types under license from Westinghouse and General Electric. The designs and materials used in manufacturing the fuel have varied with time, in accordance with the state of the art. The performance of the fuel has been generally satisfactory, although there have been deformations, corrosion and excessive hydriding in Zircaloy-4 cladding with burnups in excess of 45 MWd/Kg; these have been replaced with *zirlo* in recent refueling outages.

The *pressure boundary*, including the reactor vessel, piping, pumps, pressurizer, steam generators and isolation valves of associated systems, is designed in accordance with the US ASME III Code (at the Trillo plant, which is of German design, the requirements of the AD Merkbläter and associated documents were applied). Also included are complete prescriptions regarding controlled and uncontrolled coolant leaks, and parts detection is required. Also established are criteria for the monitoring of the neutron flux experienced by the pressure vessel and for tracking of the displacement of the transition temperature. The *construction permit* specifies the tests to which the pressure boundary and associated engineered safeguards are to be subjected, among which the hydraulic resistance test is especially important.

The *pressure boundary* of the different reactors has performed reasonably well, although there have been certain problems of interest. After *twenty-five* years of operation, some of the blind penetrations of the José Cabrera plant's reactor vessel closure head developed through-wall fissures as result of entry into the primary circuit of ion exchange resins containing sulfonic radicles that lodged in these penetrations. The vessel head was initially repaired and subsequently replaced. At the Santa María de Garoña plant, intergranular stress-corrosion cracking soon appeared in different parts of the pressure boundary, especially in the recirculation circuit, which was replaced.

The main problems encountered in the *second generation* plants, Almaraz 1 and 2 and Ascó 1 and 2, related to the incorrect performance of the Westinghouse D-3 steam generators, as regards both the original design of the coolant distribution at the inlet nozzle, which had to be replaced, and the multiple deterioration of the Inconel-600 tubes, which finally led to the replacement of the steam generators of the four units, using tubes made of Inconel-800. At both groups of the Almaraz plant, the reactor vessel heads have been replaced in order to avoid the corrosion of the control rod drive housings observed at certain French plants.

The *containment system* also receives specific treatment among the conditions imposed by the *construction permit*. It is specified that the design should be carried out in accordance with the appropriate sections of the ASME Code (N 18.2 for PWR plants and N 212 for BWR's), or with the equivalent German standards in the case of the Trillo plant. When necessary, the fundamental requirements for the design of the different sub-compartments of the containment are also specified, and special considerations are required for correct functioning of the sump water recirculation pumps in the event of an accident.

The containments constructed in Spain include both reinforced concrete types (Almaraz I and II) and post-stressed types (Ascó 1 and 2 and Vandellós 2), all equipped with a *leak-tight skin,* as well as KWU-PWR type double containments in which the resisting element is a spherical, self-supporting steel vessel surrounded by a concrete shield, with an intermediate cavity. The José Cabrera plant presents the peculiarity of having a spherical metallic dome without shielding; this is also a heat sink to the exterior and is fitted with an external cooling spray system. The Santa María de Garoña plant is contained within a MARK-I containment, while Cofrentes, the second BWR, has a MARK-III containment.

The *construction permit* specifies the tests – both resistance and leak tests – to which the containments are to be subjected, along with the heat removal systems to be installed and the system for purification of their atmosphere and hydrogen control in the event of an accident. Also included are clauses relating to the periodic monitoring of leak rates and to the surveillance of the structural elements of the containment itself.

The containment buildings of all the Spanish plants have been re-evaluated using realistic criteria, with the objective of determining their static breaking load. In general, values of from *two to five times* the design value are obtained, this underlining the real capacity of the containments. The Spanish industry analyzed the advisability of introducing *filtered containment venting systems*, finding this to be unjustified. The owners of the BWR plants, however, considered it advisable to install wet-cell venting systems, which were approved by the authority.

18.3 Prevention of accidents and mitigation of their consequences

The preliminary authorizations issued to the Spanish nuclear power plants specify that "all the technical safeguards required to prevent accidents implying damage to the nuclear fuel or uncontrolled or abnormal releases of radioactive products and to mitigate the consequences of such accidents in the event of their occurring shall be made available". The prescription also adds that such technical safeguards should have "the capacity, redundancy and diversity required to make the installation compatible with the selected site".

The designs of the Spanish nuclear power plants have been contrasted using clearly specified deterministic methods. In particular, the *Preliminary safety study* includes a chapter on the analysis of accidents and the mitigation of their consequences, in accordance with what is established in the US NRC's Regulatory Guide 1.70, *"Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants LWR Edition"*. The first generation plants were designed and evaluated using the standards and requirements of the time, and subsequently re-evaluated via a *systematic evaluation program* (SEP); this implied a modernization and will be dealt with below. In 1986 the CSN issued the *"Integrated program for the performance and use of probabilistic safety assessments in Spain"*, initiating this type of studies in Spain. These cover the plants of the three generations, such that today the designs of all the Spanish nuclear power plants have been contrasted using both deterministic and probabilistic criteria.

The application of deterministic criteria allows us to conclude that all the design basis accidents – in essence thermal and neutron unbalances – have been foreseen, such that if they were to occur their consequences would be non-existent, or in any case very limited, as long as the protection systems and engineered safeguards satisfy the *safety functions* for which they were designed. Compliance with the *design basis criteria* which appear in Appendix A of the US NRC's 10CFR Part 50, guarantee this claim deterministically.

The probabilistic analyses performed have made it possible to identify the most severe accident sequences and quantify their expected frequency, as well as to gain insight into the importance of the different plant components, systems and structures from the point of view of safety. The level 2 PSA's , not yet completed in all cases, have allowed better knowledge to be gained of the capacities of the radioactive product retention and containment systems and determination of the corresponding source terms. These assessments have also made it possible to discover which components, systems and structures are most significant for safety, as well as the operating standards and requirements and best suited maintenance and verification practices and intervals, all of which has implied the introduction of substantial safety improvements in the operating plants.

The requirement has already been established that in the future a periodic re-evaluation – every ten years – be carried out for each of the Spanish nuclear power plants, and the assessments performed by the owners of the first generation plants -–José Cabrera and Santa María de Garoña – are expected shortly. It has been specified that such evaluations should be performed on the basis of the deterministic criteria of US NRC Regulatory Guide 1.70, mentioned above; that they reconsider the design bases and take into account the requirements established in the aforementioned *"Integrated program for the performance and use of probabilistic safety assessments in Spain"* and its revision, and in analysis of the operating experience of the plant itself.

Contrasting the design against the most modern safety requirements has revealed certain important facts that must be corrected. Among them, special attention should be brought to the deviations observed in the detailed design of certain of the safety systems of Trillo NPP, which have made it necessary to carry out a far-reaching, in-depth program aimed at systematically checking the design, construction and assembly of the plant and the results of the pre-nuclear verifications. This program, known as the OESA, revealed the existence of various minor deviations, which have been corrected.

The treatment of *design modifications* received particular emphasis in the *Decree governing Nuclear and Radioactive Installations*, where it is specified that major modifications must be approved in accordance with the same administrative requirements necessary for application for and awarding of the construction permit. The ministerial orders that govern operation also add that *"the CSN shall be informed of the modifications introduced"*, in the same terms as in US NRC 10CFR Part 50.59, establishing also that the introduction of a non-reviewed safety issue must be analyzed in detail and approved by the CSN. In addition, the CSN has developed its Safety Guide 1.11, *"Nuclear power plant design modifications"*, which is in an advanced stage of preparation.

During the first half of the 1980's, systematic evaluation programs were set up for the José Cabrera and Santa María de Garoña NPP's, with a view to analyzing the impact of the standards which had arisen subsequent to their start-up, and in particular those deriving from the general design criteria included in Appendix A of 10CFR Part 50. As a result of this analysis, numerous modifications were made to these plants, aimed mainly at improving the redundancy of the active components of the most significant safety and support systems. Special attention was given to the risk deriving from possible fires. Since then, all the plants have continued, and still continue, performance of evaluations and adaptations to the new standards, including aspects of seismic design, piping analysis, physical separation of systems and environmental qualification, among others.

18.4 Adoption of consolidated technologies

The ministerial orders by which the *preliminary authorization* was awarded to the Spanish plants includes a clause requiring that *"the project for the installation be based on a proven prototype"*. The clause goes on to add that for this purpose a *reference plant* shall be proposed, the aim and evolution of which has been dealt with above. In each case, the *reference plant* is subsequently defined in the specific *construction permit.* In certain cases *reference systems* of different plants were designated, in order to incorporate the most advanced consolidated technologies.

The José Cabrera nuclear power plant, in operation since 1968, is the only exception to this norm. It is a Westinghouse design PWR with a single recirculation loop, this making it unique world-wide. It has also been mentioned that the containment dome is not provided with a biological shield and that it has an external spray system designed to remove heat in the event of an accident. The containment has a large free volume and houses the irradiated fuel deactivation pool. It has also been pointed out that in the 1980's this plant was subjected to a systematic re-evaluation in accordance with the new design criteria and standards, this having meant the introduction of considerable improvements. More recently it has been subjected to a probabilistic risk assessment in which special attention was paid to the peculiarities of the plant.

All the operating nuclear power plants belong to the family of light water reactors with slightly enriched uranium. Two of them are of clearly defined GE-BWR design, six others being W-PWR's and Trillo being a KWU-PWR. With the exception of José Cabrera, with its single recirculation loop, the other five W-PWR plants have three loops, the design of the nuclear boiler, instrumentation and control and auxiliary equipment, including the waste treatment system, being equivalent to that of the period. The Vandellós 2 plant, the most modern in the series, includes more advanced instrumentation, especially post-accident instrumentation, larger cold shutdown margins and protection against fires, missiles and seismic phenomena, among other things. The *construction permit* for this plant, awarded at the end of 1980, incorporated the new requirements that has arisen in the wake of the TMI-2 accident.

The Trillo nuclear power plant, a KWU-PWR design, includes three recirculation loops, unlike the four-loop standard of the times. This difference made it necessary to include detailed modifications to the standard model, which are being evaluated within the framework of the aforementioned OESA program.

The 1983 *National Energy Plan* declared that irradiated nuclear fuel should be considered as a *radioactive waste* and later assigned responsibility for its management to the newly created Empresa Nacional de Residuos Radiactivos (ENRESA). The social difficulties associated with the siting and construction of *temporary storage facilities* has made it necessary to store the irradiated fuel in the deactivation pools of the nuclear plants themselves. The capacity of these pools has been increased in accordance with consolidated project criteria which have taken into account, among other factors, the following: higher thermal loads and criticality and coolant purification aspects. At the Trillo plant, whose deactivation pool, located inside the containment, has a lower storage capacity, authorization has been requested for the dry storage of the fuel on-site in dual purpose (storage and transport) casks. The design of these casks has been authorized and they are manufactured in Spain by the company Equipos Nucleares (ENSA).

18.5 Considerations regarding the influence of design on operation

Special consideration was given in the design of the Spanish nuclear power plants to aspects such as the accessibility of equipment, systems and structures, for maintenance, verification and control interventions, and to the design of the *control rooms*, both the main and remote shutdown panel.

The Ministerial Order of 29th December 1989, awarding the construction permit for the Vandellós 2 plant, includes a specific clause referring to an agreement reached by the Cabinet Meeting held on 20th April 1979 regarding the "modifications to be introduced in the Spanish nuclear power plants as a result of the TMI-2 nuclear plant accident". It is a widely-known fact that as a result of this accident concern arose for aspects such as post-accident instrumentation, the qualification of the equipment with respect to the environmental circumstances created by accidents, fire protection, emergency planning and – especially significant – the man-machine interface. With a view to considering such aspects, both the international organizations and the regulatory body of the country of origin of the affected plant issued directives and standards that were formally incorporated in the aforementioned Ministerial Order. The requirements applied to Vandellós 2 were applied also, backdated, to the other operating plants.

It was specifically required that the project include means to "track the evolution of the parameters and variables essential to prevent or mitigate the consequences of an accident that might give rise to serious damage to the core". The requirement referred also to the ability to "detect the appearance or existence of degraded core cooling conditions, and measures shall be put in place to correct such a situation". Also added were details on the new instrumentation to be incorporated and on the specific additional training to be received by the operations personnel.

As a result of these requirements, the licensees introduced significant improvements in the control rooms. One of the most outstanding was the incorporation of the so-called *operating aid systems*, which provide knowledge of the operational situation of the plant and help in decision-making with regard to the appropriate corrective measures in the event of abnormal situations, and at certain plants auxiliary control systems were added for emergency situations. Special attention was given also to improving the accessibility to components and systems of special importance in such circumstances.

18.6 Degree of implementation of the obligations

The Spanish legislation has established a formal procedure for the awarding of construction permits for nuclear power plants, including design review, surveillance of construction and verification of the suitability of performance through a program of pre-nuclear tests. The basis for authorization resides in the submittal by the owner of a preliminary safety analysis report, which is analyzed by the CSN prior to awarding of the construction permit. CSN inspections verify the suitability of the construction techniques, analyze possible deviations and monitor the performance of tests and checks, the results of which must also be favourably looked upon by the CSN. Significant modifications are subjected to the same formal process of approval and inspection, and the concept of the *non-reviewed safety issue* has been introduced.

The design of the Spanish nuclear power plants pays special attention to application of the concept of *defense in depth or inherent safety*, as regards both the design and maintenance of the physical barriers to the escape of fission and activation products and the design, maintenance and verification of the engineered safeguards that maintain the integrity of these barriers in foreseen operating situations and design basis accident circumstances.

The design pays special attention to postulated accidents and the mitigation of their consequences. The reactor protection system and safeguards associated with maintenance of fuel integrity and residual heat removal are designed with wide safety margins, in accordance with standards of recognized validity. Likewise, pressure boundaries are designed and systems and procedures are incorporated to detect loose parts and gain insight into the embrittlement status of the reactor vessel. The containment and its associated engineered safeguards also receive the necessary attention, and their mechanical strength has been re-evaluated with respect to the strictest criteria.

The Spanish nuclear power plants are based on the light water reactor (PWR and BWR) technology, of proven validity. The introduction and development in the Spanish standards of the concept of the *reference plant* guarantees the incorporation of consolidated and demonstrated technology, without preventing the introduction of consolidated innovations.

The current design allows for reliable operation and considers the importance of the human factors and man-machine interface. In particular, the concepts arising in the wake of the TMI-2 accident have been introduced and continued interest is maintained through the performance of probabilistic studies.

APPENDIX 16.B

Ministerial order authorizing the companies "Empresa Nacional Hidroelectrica del Ribagorzana, S.A.", "Hidroelectrica de Cataluña, S.A.", "Fuerzas Hidroelectricas del Segre, S.A." and "Fuerzas Eléctricas de Cataluña, S.A." to construct a nuclear unit in the Municipality of Vandellós, province of Tarragona (Vandellos II NNP)

Gentlemen:

On 27th February 1976, Official State Gazette number 62 of 12th March 1976, the Directorate General for Energy awarded a Preliminary Authorization to the companies "Empresa Nacional Hidroeléctrica del Ribagorzana, S.A.", "Hidroeléctrica de Cataluña, S.A.", "Fuerzas Eléctricas del Segre, S.A." and "Fuerzas Eléctricas de Cataluña, S.A." for the installation of a nuclear unit in Vandellós (Tarragona), and likewise awarded to the "company "Fuerzas Eléctricas de Cataluña, S.A." Authorization to install another nuclear unit in the same municipality.

In a letter dated 11th September 1976, the companies "Empresa Nacional Hidroeléctrica del Ribagorzana, S.A.", "Hidroeléctrica de Cataluña, S.A.", "Fuerzas Eléctricas del Segre, S.A." and "Fuerzas Eléctricas de Cataluña, S.A." (the Vandellós Nuclear Association), companies constituted as an association without legal standing for the construction and subsequent operation of the said installation, and whose participations are 54%, 28%, 10% and 8% respectively, requested that arrangements be initiated for the awarding to them of an Authorization to construct a nuclear unit in Vandellós, province of Tarragona (Vandellós II nuclear power plant).

In view of the Law of 29th April 1964 on Nuclear Energy, Decree 2869/1972, of 21st July, approving the Decree governing Nuclear and Radioactive Installations and Law 15/1980, of 22nd April, by which the Nuclear Safety Council was created, and without prejudice to those attributes that this last law might award to the said Nuclear Safety Council.

In view of the report by the provincial delegation of the Ministry of Industry and Energy in Tarragona and the statement issued in this respect by the Nuclear Energy Board.

This Ministry of Industry and Energy, in response to a proposal by the Directorate General for Energy sees fit to proceed as follows:

Article 1. Construction of a nuclear unit in the municipal area of Vandellós, province of Tarragona (Vandellós II nuclear power plant) is hereby authorized, as long as the limits and conditions established in the annex to the present Order are duly met.

Article 2. For the purposes foreseen in the legislation in force, the companies "Empresa Nacional Hidroeléctrica del Ribagorzana, S.A.", "Hidroeléctrica de Cataluña, S.A.", "Fuerzas Eléctricas del Segre, S.A." and "Fuerzas Eléctricas de Cataluña, S.A." (the Vandellós Nuclear Association), companies constituted as an association without legal standing for the construction and subsequent operation of the said installation, shall be considered as being the holder of the Authorization and operator responsible for operation of the Vandellós nuclear power plant.

Article 3. The nuclear installation shall be constructed in the municipal area of Vandellós (province of Tarragona), its geographical coordinates being forty degrees, fifty seven minutes, five seconds latitude North and four degrees, thirty-three minutes, twelve seconds longitude East, in reference to the meridian of Madrid. The site is as described in the preliminary safety analysis report, "Vandellós II Nuclear Power Plant chapter I volume I, September 1976", and is located between the A-7 motorway and the sea and the Lleria gorge and the area known as Malaset. The installation will be equipped with a pressurized light water nuclear boiler, the rated thermal power of which will be two thousand seven hundred and eighty-five megawatts; it will have three cooling circuits, fuel in the form of slightly enriched uranium dioxide, and the associated auxiliary and engineered safeguards systems, all designed and supplied by "Westinghouse Electric Co." Of the United States of America.

Article 4. The coverage of nuclear risk shall be in accordance with the stipulations of the Law of 29th April 1964 and the other provisions through which it is developed.

Article 5. The construction permit allows the licensee to construct and erect the nuclear installation, in accordance with the requirements of the applicable legislation in force, with the limits and conditions of this Authorization and with the limits and conditions of the preliminary authorization issued by resolution of the Directorate General for Energy on 27th February 1976. The period of construction will be eight years as from the awarding of this Authorization, which shall include pre-nuclear verification of the installation, as described in chapter IV, title II of the Decree governing Nuclear and Radioactive Installations (Decree 2869/1972, of 21st July, issued by the Ministry of Industry and Energy).

Article 6. The construction permit is awarded on the basis of the project criteria and data submitted and does not imply definitive recognition of the nuclear safety of any system or its specifications. The permit may be left without effect at any time if non-compliance with these limits and conditions were discovered, if there were any fundamental discrepancies with the criteria and data on which the awarding of this construction permit is based or if unfavourable factors relating to nuclear safety and radiological protection and not known as of the date of awarding were identified .

Article 7. The Directorate General for Energy is authorized to modify the content of the technical limits and conditions of the present Authorization or to impose new limits and conditions, as well as to require the introduction of modifications to the project and other appropriate corrective actions in view of 1)the experience acquired during the construction and operation of plants of the same type in Spain, in the country of origin of the project or in other countries contributing to the development of the project prototype; 2) the results of pending tests and the research and development programs under way and related to the project prototype, the results of the tests and checks carried out to check the safety margins of the said prototype.

Article 8. For optimum compliance with and checking of these limits and conditions, the Nuclear Energy Board may provide appropriate complementary instructions directly to the licensee.

Article 9. The present Order is understood as not having prejudice to those complementary awards and authorizations which are issued by other Ministries or Departments of the Administration.

Which I hereby communicate to you for your knowledge and the pertinent effects.

Madrid, 20th December 1980.

RT. HON. COMMISAR FOR ENERGY AND MINERAL RESOURCES AND DIRECTOR GENERAL FOR ENERGY

ANNEX: LIMITS AND CONDITIONS REGARDING NUCLEAR SAFETY AND RADIOLOGICAL PROTECTION

1. In the event that delays were to occur in initiation of construction, or interruptions in the construction or erection of the installation, the licensee shall demonstrate to the Directorate General for Energy that the nuclear safety and radiological protection are not negatively affected. At least two years before the date foreseen for the beginning of fuel loading in the reactor, the licensee shall be required to request the provisional operating permit, satisfying the requirements of article twenty-six of the aforementioned Decree and of all else that might be applicable to this Authorization.

2. For the design of the nuclear boiler and other components, systems and structures related to nuclear safety and radiological protection, Unit II of the Ascó nuclear power plant shall be adopted as the reference plant, as proposed by the licensee to the Directorate General for Energy of 29th March 1976, in compliance with the fifth condition of the preliminary Authorization, and accepted by the said organization on 21st September 1976. The project shall include those technological enhancements that experience has shown to be positive in the Westinghouse Electric Co. Plants with the most recent construction permits.

3. The design of the installation shall satisfy the technical criteria and requirements regarding nuclear safety and radiological protection identified in these conditions. Likewise, in application of article sixteen of the aforementioned Decree governing Nuclear and Radioactive Installations, and to the extent that it does not oppose the foregoing, the criteria contained in the general Project and in the Preliminary safety study submitted on applying for the Construction permit shall be in accordance with the contents of the clarifications, data, studies and additional documents submitted on request by the Nuclear Energy Board and the subsequent modifications and commitments made or accepted by the licensee. The licensee may request specific exemptions from this requirement, providing documentation justifying such request.

4. The licensee shall analyze the applicability of the design, Construction and erection of the installation and of the criteria, codes, standards and guides on nuclear safety and radiological protection published during the period of validity of this Authorization. Consideration shall be given in this respect to those issued by the national competent authorities and by the international organizations to which the Spanish State belongs and by those of the country of origin of the project. In particular, the seismic qualification of the Category I instrumentation and electrical equipment shall comply with the requirements of IEEE Standard 344-1975, "Guide for Seismic Qualification of Class I Electric Equipment for nuclear Power Generating Stations" and subsequent revisions of this document. The design, construction and erection of the installation shall adapt to the aforementioned criteria and documents. Exceptions must be favourably judged by the Nuclear Energy Board, following the appropriate technical justification by the licensee.

5. The following zones around the installation are defined:

   a) <u>Operator controlled zone</u>. The size of this zone is established initially on the basis of the data provided as the area defined by the circumference of a circle having a minimum radius of seven hundred and fifty metres, with its centre in the containment building. Inside this zone the licensee shall have power sufficient to exclude any activity or facility.

   b) <u>Protected zone</u>. The size of this zone is established initially on the basis of the data provided as the area defined by the circumference of a circle having a minimum radius of two thousand three hundred metres, with its centre in the containment building. Inside this zone the licensee shall take the protective and emergency measures required to guarantee the health and safety of the population residing therein in the event of an accident.

6. In compliance with the agreement reached by the Cabinet on 20th April 1979, in relation to the modifications to be introduced in the Spanish plants as a result of the accident at the Three Mile Island nuclear power plant, the licensee shall take into account the directives issued by the competent international Organizations, and those approved in the country of origin of the project. Meanwhile, consideration shall be given specifically to the following:

a) As regards the initial and on-going training of the future operations personnel and the minimum number of licensed operations personnel to be considered for each operations shift, as referred to in article sixty-one of the Decree governing Nuclear and Radioactive Installations, the following criteria shall be applied:

1. Each operating shift shall include at least two operators holding a Supervisor License, an individual holding the Operator License to attend to the nuclear systems and an additional individual, who shall not require a license, to attend to the non-nuclear systems.

2. A stand-by group, like the one described in the previous point, shall be available to report to the control room in a maximum thirty minutes as from the time its presence is required.

3. The initial and on-going training program for the operations personnel shall include lessons on the use of the plant systems, safety-related and otherwise, to prevent or mitigate the consequences of incidents causing serious damage to the core, on the peculiarities of the Three Mile Island accident and on the possible evolution of loss of coolant accidents at Unit II of the Vandellós nuclear power plant.

b) The design shall incorporate a system for venting and water level measurement in the head of the reactor vessel, joint operation of which shall allow non-condensable gases to be removed from the primary coolant system. These systems shall be in accordance with the requirements applied to similar plants by the corresponding authority of the country of origin of the project.

c) The design shall incorporate a position indication system (open or closed) for the pressurizer safety valves, the signals of which shall originate in a sensor linked directly to the position of the valves or in a direct indication of discharge flow in the lines associated with the said valves. This system shall be safety class and be fed by the safeguards busses.

d) A subcooling measuring device shall be incorporated, based on the difference between the temperature of the coolant and the corresponding boiling temperature at its pressure.

e) The licensee shall incorporate the following safety criteria in the design, and shall justify them to the Nuclear Energy Board prior to their application at the site:

1. It shall be possible to monitor the evolution of the parameters and variables essential for the prevention of accidents which might cause damage to the core or the mitigation of their consequences. Consideration shall be given to the incorporation of instruments with a wide margin of measurement, such as area radiation monitors in safety systems or points at which the release of effluents off-site are foreseen; core temperature measuring devices, pressure and temperature measuring devices in the primary circuit and other auxiliary systems important to safety, pressure measuring devices in containment, with a range of from seven tenths of a kilogram per square centimetre to

three times the design pressure, and containment hydrogen concentration measuring devices, ranging from zero to ten percent by volume.

2. The reactor coolant and essential buildings atmospheric sampling systems, and radiochemical analysis process, shall be capable of supplying in one hour contamination data for noble gases and isotopes of iodine and cesium, and in two hours data on the other nuclides. Consideration shall be given expressly to the possibility of handling samples heavily contaminated by radioactive products that have escaped from the core, using the hypotheses of Regulatory Guide 1.4, "Assumptions for Evaluating Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors", of the regulatory authority of the country of origin of the project and of document TID-14844, "Calculations of Distance Factors for Power and Test Reactor Sites", USAEC (1962).

3. It shall be possible to detect the appearance or existence of degraded core cooling conditions and measures shall be established to correct such a situation. In this respect, consideration shall be given to the use of specific instrumentation-

f) The design shall incorporate the following additional instrumentation:

1. Devices to measure the level of water in containment, from the bottom to the edge of the sump and from the bottom to a height equivalent to a volume of water of two thousand six hundred cubic metres.

2. Radiation measuring devices with a range of up to ten million Roentgens per hour.

3. Noble gas measuring devices in the foreseen discharge routes for gaseous radioactive wastes, with ranges for the measurements of concentrations ranging from the normal values to one hundred microcuries per cubic centimetre of xenon or equivalent.

g) The design of the electricity supply to the pressurizer heaters shall incorporate the possibility of supplying electricity to these heaters both from the off-site feed sources and from the emergency sources. The heaters required to initiate and maintain core cooling by natural coolant circulation shall be selected. The controls, signaling and interfaces of these heaters shall be classified as safety class and shall likewise receive electrical feed from the plant emergency sources.

h) The design of the shielding for areas housing equipment, components or control centres essential to prevent accidents or mitigate their consequences shall be in accordance with the following limits:

1. For zones of limited residence, fifty milisievert whole body or the equivalent to other organs, throughout the accident.

2. For zones of continuous residence, fifteen hundredths of a milisievert per hour, averaged over thirty days, fifty milisievert whole body or the equivalent to other organs throughout the accident.

7. The licensee shall undertake appropriate agreements with both national and overseas suppliers, manufacturers and engineering and service companies to guarantee the availability of the data, documents and technical reports relating to the nuclear safety and radiological protection of the installation required by the Administration, which shall guarantee the industrial property rights claimed. Devices or characteristics whose technical bases may not be fully justified shall not be incorporated into the project. The agreements shall also include filing of the project documents specified in Appendix 1 of the Safety Guide number 50-SG-QA2, "Quality Assurance Records System", of the International Atomic Energy Agency, or equivalent.

The project documents considered in the aforementioned Appendix I as being permanent throughout the lifetime of the installation shall be filed inside the national territory. Exceptions to this point shall be identified, justified and notified to the Directorate General for Energy and the Nuclear Energy Board. In such cases, the licensee shall establish formal undertakings with the organizations involved allowing for access to the said documents.

8. As regards nuclear safety and radiological protection, the licensee shall approve and supervise the performance of the quality assurance programs of those suppliers, engineering and services firms and construction, manufacturing and erection and transport companies whose services it contracts. If national, the contracted parties shall be subjected to the system of authorizations and inspections contemplated in the current Decree governing Nuclear and Radioactive Installations. If foreign, the licensee shall accredit his having established the agreements required for the inspectors of the Administration to have free access to the technical offices and manufacturing processes relating to the project.

9. The seismic resistance design of the structures, systems, equipment and components belonging to seismic category I shall be undertaken using a value of twenty percent of gravity for the maximum acceleration of the ground. This design shall also comply with the response spectra of regulatory guide 1.60, "Design Response Spectra for Design of Nuclear Power Plants" of the country of origin of the project. The licensee shall likewise have available the instrumentation required to monitor the seismicity of the site. This instrumentation shall include at least a seismograph with a minimum soil movement amplification of one hundred thousand for frequencies of one hertz. The specifications relating to the aforementioned instrumentation and its functioning shall be submitted to the Nuclear Energy Board prior to initiation of the campaign. The information obtained and its processing and interpretation, as well as the possible modifications to the aforementioned specifications, shall be submitted to the Nuclear Energy Board within the first thirty days of each calendar quarter.

10. The licensee shall increase the program of meteorological measurements currently implemented at the site in accordance with the specifications of Regulatory Guide 1.23, Revision 1, “On-site Meteorological Program”, issued by the regulatory body of the country of origin of the project. The description and justification of the model used, which shall meet the requirements of Regulatory Guides 1.111 and 1.145, “Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light Water-Cooled Reactors” and “Atmospheric Dispersion Models for Potential Accidents Consequence Assessments at Nuclear Power Plants”, respectively, of the aforementioned Regulatory Body, or equivalent, and the results of the program in question, throughout the calendar year, shall be submitted to the Nuclear Energy Board within the first quarter of the following year.

11. The structures, systems and components of the installation related to nuclear safety and radiological protection shall be of a demonstrated type. The licensee shall identify and justify any exception. The affected structures, systems and components shall be considered as prototypes and shall be subjected to whatever acceptance tests might be specified. The design, manufacturing, assembly, testing and inspection of mechanical components affecting nuclear safety shall meet requirements of recognized application, for each of the quality levels at which they are classified.

12. The containment design shall take into account the following requirements:

    a) in the pressurizer sub-compartment, the results of pressurizer spray line rupture analysis.

    b) in the reactor vessel and steam generators sub-compartment, the effects of loss of reactor coolant accidents on the supports of these components.

c) demonstration, by means of experiences using scale models, that the containment sumps will not allow for the entrainment of air to the suction side of pumps as a result of vortex formation. The test program and results shall be submitted to the Nuclear Energy Board for its favourable consideration.

13. The cooling system shall incorporate a specific system for the detection of loose parts. The elbows in the piping of this system shall be manufactured from weld-free forged parts.

14. The systems for the storage, treatment and disposal of the radioactive wastes produced shall have sufficient reliability and redundancy to guarantee their correct operation at all times. The capacity of such systems shall be such that, in the presence of the most unfavourable operating conditions, and throughout the lifetime of the installation, the primary radiological limits established in the preliminary authorization are not exceeded.

15. The gaseous radioactive waste treatment system shall incorporate the possibility of interrupting off-site releases from the venting systems when the specific activity limits authorized are exceeded.

16. The pump discharging liquid wastes from the holding tanks to the discharge canal may be placed in operation only manually and from the control room. Means shall be put in place to prevent discharges to the canal if:

a) the gamma detector in the discharge piping detects specific activities in excess of the authorized limit.

b) the gamma detector is broken down, has no electrical feed or has been removed from its place of operation.

Alarm signals shall appear in the control room whenever any of the previous situations arise, and also in the event that the entry of liquid in the discharge piping leakage collection tank is detected.

17. The licensee shall have suitable means to safely store, for at least five consecutive years, the solid radioactive wastes produced. The size of the waste packages and the composition, final state and physiochemical characteristics of the wastes, as well as the exposure rates of the packages to be removed from the installation for definitive disposal, shall comply with the established requirements. The solidification system should be designed to prevent chemical processes endangering the stability of the assembly and the leak-tightness of the package.

18. The licensee shall incorporate a system for the continuous radiological surveillance of the irradiated fuel pool, a continuous radioactivity monitor for the fuel building air and a criticality alarm system in the new fuel pool. Likewise, he shall install a detector alongside the containment personnel lock, with the indicator outside containment. The licensee shall take into account the need for accessibility in order to be able to read, maintain and calibrate the area and process monitors, and the possibility of installing the area detectors in the Radiological Protection Service office.

19. The design of the ventilation of the potentially contaminated plant buildings shall take into account twenty-five hundredths percent of defects in the fuel. The licensee shall demonstrate that the ventilation system is capable of achieving a number of control room air volume renewals equal to or greater than half a volume per hour, and that an overpressure of thirty-two hundredths of a centimetre water column may be achieved in this room.

20. The design of the installation shall guarantee the habitability of the control room in the event of a design basis accident and of actuation of the fire protection system.

21. For steam generator tube rupture and main steamline break outside containment, consideration shall be given to the increase in the leakage rate of iodine isotopes through the cladding of the fuel elements arising as a result of the power and pressure transients that occur during these accidents.

22. The design of the installation shall incorporate the industrial safety systems required for the physical protection of the installation. The reference used for this purpose shall be the program established in Guide number 7 GSN-07/78, "Criteria for the physical safety of nuclear installations", published by the Nuclear Energy Board, and in Guide INFCIRC/225 (Corrected), "Physical protection of nuclear materials" of the International Atomic Energy Agency, along with the standards applicable in the country of origin of the project or equivalent standards. Any deviation from the referenced guides shall be subject to the favourable consideration of the Directorate General for Energy.

23. The licensee shall submit to the Directorate General for Energy and to the Nuclear Energy Board, or shall meet within the dates and terms indicated in these conditions, the studies, technical information and requirements regarding nuclear safety and radiological protection specified in each case. Likewise, the licensee shall submit whatever additional studies and information might specifically be required by the Nuclear Energy Board. The criteria, requirements, specifications and conditions arising from such studies and technical information may not be incorporated in the design, construction and erection of the installation until such time as they have been favourably considered by the Nuclear Energy Board.

24. The licensee shall periodically submit the following documents to the Directorate General for Energy and the Nuclear Energy Board, in the periods indicated as from the date of this Authorization:

    a) Within the thirty days following each calendar quarter, a report containing: the status of the revisions of the Preliminary Safety Analysis Report; the progress made in the research and development program performed on safety margins, and the studies and analyses carried out in relation to compliance with the requirements of these limits and conditions; the evolution of the project and construction program; the progress made in preparing the pre-nuclear testing program; the progress made in preparation of the documents required for application for the Provisional operating permit; non-scheduled activities and events arising during construction; possible design modifications; the schedule for civil works and the manufacturing and assembly of mechanical and electrical components; the progress made in analysis of the generation, impact and damage of missiles on the turbine and secondary missiles, in accordance with Regulatory Guide 1.70, Rev. 3, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants", of the regulatory body of the country of origin of the project; the progress made in analysis of the effects on the components of systems relating to nuclear safety as a result of high and moderate energy piping breaks.

    b) Within the first fifteen days of each month, and in reference to the activities of the previous month, a report containing the following in relation to nuclear safety and radiological protection: list of bids selected and controls established with engineering and services, construction, assembly and transport companies; list of components contracted and systems to which they belong, and manufacturers thereof; foreseen initiation and end dates of the activities involved; safety classes and levels, seismic categories, codes, manufacturing and assembly procedures, inspection plans, independent inspection agencies selected and technical documentation to be included in the plant archives (for national manufacturers a copy shall be included, where appropriate, of the authorization signed by the Directorate General for Energy and referred to in Title VII of the Decree governing Nuclear and Radioactive Installations); revisions of the licensee's quality assurance manuals, procedures and inspections; list of audits performed and results thereof, including the inspection points to be attended during the following three months; list of materials, equipment and components that have entered the site, with demonstration of their having been explicitly authorized by the licensee's quality assurance personnel, and noteworthy events from the point of view of quality assurance.

c) Within the thirty days following the end of each calendar year, a report on the results obtained during the previous year, with the tracking program in place to control the behaviour of the terrain and of the structures of the installation during construction and assembly.

25. Within three months the licensee shall submit to the Nuclear Energy Board an analysis of the asymmetrical distributions of pressure that would occur in each of the compartments of the containment containing any component of the primary system in the event of a loss of coolant accident inside the compartment. This analysis shall be carried out assuming a zero initial value of relative humidity.

26. Within at most one year, the licensee shall submit the following documentation to the Nuclear Energy Board:

a) The initial and on-going training program for the plant operations personnel, specifying whether, in accordance with article sixty-six of the Decree governing Nuclear and Radioactive Installations, any agreement has been reached regarding the training of this personnel. A demonstration shall be submitted of personnel having been recruited in accordance with the recommendations of the safety guides published by the Nuclear Energy Board: Guide number 2, GSN-02/76 "Qualifications and requirements demanded of candidates for the acquisition and use of nuclear power plant operating licenses"; Guide number 4, GSN-04/77, "Guide for awarding of the post of Head of the Radiation Protection Service"; and Guide number 5, GSN-0-5/77, "Physical and psychological requirements made of candidates for acquisition and use of operator and supervisor licenses for nuclear and radioactive installations".

b) The study of flood lamination at the interface between the corrugated metal pipe and the sewer, the design and hydraulic calculation of the branch of the last section of the Malaset gorge and the water levels reached in the La Lleria gorge for flows of one hundred and fifty, one hundred and seventy and one hundred and ninety cubic metres per second.

c) Demonstration that, in spite of there being no partial length control rods, the xenon oscillations may be suitable dampened. Likewise, a statistic analysis should be submitted of the uncertainties of the hot channel factors, justifying the mix used.

d) Detailed analysis of the effects of inadvertent activation of the containment spray system, in relation to minimum internal depression. As an alternative, the licensee shall establish the external design pressure at twenty-six hundredths of a kilogram per square centimetre.

e) Analysis of the capacity of the emergency core cooling system of the authorized installation, in view of its particular characteristics, and in accordance with the final acceptance criteria of the Regulatory Body of the country of origin of the project, applying the Westinghouse model approved by that body and taking into account the process of minimization of pressure increases in containment following a loss of coolant accident.

f) Analysis of the production of hydrogen by radiolysis and metal-water reactions, in accordance with Regulatory Guide 1-7, "Control of Combustible Gas Concentrations in Containment Following a Loss of Coolant Accident", issued by the Regulatory Body of the country of origin of the design. As regards hydrogen production due to corrosion, the licensee shall submit detailed information on corrosion rates in all materials, in accordance with Branch Technical Position CSB6-2, Rev. 1 of the aforementioned Body, or equivalent.

g) The basic design of each of the liquid and gaseous radioactive waste systems, in accordance with the requirements of clause fourteen of this Authorization.

h) The criteria and hypotheses used in assessing the concentrations of contaminants in the water of the irradiated fuel pool and refueling cavity. Likewise, the models and parameters used to calculate the radioactive aerosols contained in areas normally occupied by the operations personnel.

i) Analysis of the loss of off-site power and tripping of the turbine, including the loss of normal feedwater as an additional hypothesis.

27. Within at most one year, the licensee shall submit to the Directorate General for Energy and the Nuclear Energy Board an environmental radioactivity surveillance and control program. This program shall be performed in accordance with the requirements of Guides numbers 3 and 9 on nuclear safety published by the Nuclear Energy Board: GSN-03/76, "Guide for the establishment of an environmental radiological surveillance program in the areas of influence of nuclear power plants", and GSN-09/78, "Environmental radiological surveillance program for nuclear power plants", or equivalent. The licensee shall also submit, within the first half of each calendar year, a report containing the results of this program and obtained during the previous year.

28. Within two years the licensee shall submit to the Nuclear Energy Board an analysis of the reactor coolant system pump rotor seizure accident, assuming turbine trip and the coincident loss of off-site power.

29. The safety study referred to in article twenty-six of the Decree governing Nuclear and Radioactive Installations, which the licensee will be required to submit in support of his application for the Provisional operating permit, shall include the following:

a) An analysis of the effects on the components of nuclear safety-related systems of high and moderate energy piping breaks.

b) The tests and analyses to which the elements of the Category I instrumentation and electrical equipment requiring environmental qualification have been subjected.

c) Justification, in accordance with Branch Technical Position CSB 6-4 Rev. 1 of the Regulatory Body of the country of origin of the project, that the containment high flow purging system cannot cause non-permissible leakages of radioactivity to the environment under accident conditions during shutdowns or refueling outages leading to actuation of the isolation system on high containment radiation.

d) Analysis of neutron and gamma propagation along the piping and penetrations of the reactor in the shielding design, with indication on the definitive drawings of the geometry considered and the calculation methods used. Likewise, the chemical composition and density of the concrete used shall be included, along with the quantity of reinforcing iron used per unit of volume and the arrangement of this reinforcement. Evaluation of the scattered radiation in the containment and auxiliary buildings. Incorporation of specific drawings of the shielding for filters and demineralizers, and the material used, Inclusion of the shielding calculations and data used, in accordance with the stipulations of Regulatory Guide 1-70, " Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants", issued by the Regulatory Body of the country of origin of the project.

e) Analysis of the specific data on the installation authorized, of the heat removal capacity of the containment air coolers under accident conditions. Likewise, an analysis shall be made of the effect of soiling of the surfaces of the coils on the heat removal capacity of the aforementioned coolers.

30. The emergency plan referred to in the aforementioned article twenty-six of the Decree governing Nuclear and Radioactive Installations shall contain the measures for evacuation and treatment of those persons who might be irradiated or contaminated in the event of a nuclear accident, taking into account also the presence of neighbouring nuclear power plants. The plan shall be in accordance with the contents of Guide number 6, GSN-06/1979, Nuclear power plant emergency plan", and revisions thereof, published by the Nuclear Energy Board, and the contents of document SG-06 Rev. 7, "Preparedness of the Operating Organization for Emergencies at Nuclear Power Plants", published by the International Atomic Energy Agency, or equivalents.

31. On applying for the provisional operating permit, the licensee shall submit the following, in addition to the studies and documents referred to in article twenty-six of the Decree governing Nuclear and Radioactive Installations in force:

a) A documented declaration of having met these specifications.

b) A list of all the standards applied to the different parts of the project, identifying any known deviations and, in this case, analyzing the corresponding implications.

c) The results of the basis or reference inspections of the reactor vessel and other pressure boundary components and the program contemplated for subsequent in-service inspections.

32. The licensee shall be responsible for decommissioning of the installation under safe conditions once it has ceased to operate for the proposed objective. On applying for the Provisional operating permit. The licensee shall describe the measures incorporated in the project to facilitate decommissioning of the installation. In complying with this condition, the licensee shall take into account the national standards in force, those recommended by the internal organizations to which the Spanish State belongs and those which may have been developed in the country of origin of the project in this respect.

Article 19. Operation

19.1 Laws, Regulations and Requirements relating to the operation of nuclear installations

19.1.1 Nuclear Energy Act, Law 25/1964

As regards the operation of nuclear installations, Chapter 6 of this Law establishes a set of general provisions relating to the following, for subsequent regulatory development:

- Risks during operation.
- Radiological impact on workers, the public and other living beings.
- Qualification of operations personnel.
- Personnel responsible for operation.
- Availability of installations for the storage, transport and handling of radioactive wastes.
- Medical surveillance of workers.
- Precautions to be taken in the handling of radioactive materials and wastes.
- Penalties.

19.1.2 Law 15/1980 establishing the Nuclear Safety Council

This law assigns the following functions relating to the operation of the installations to the CSN:

- The issuing of reports for the awarding and renewal of operating permits.
- Inspection and control of the installations during their operation, in order to ensure compliance with the standards and conditions established, with the capacity to suspend operation for safety reasons.
- Proposals regarding the application of penalties, including the withdrawal of licenses, permits or authorizations.
- Collaboration in the establishment of criteria for the Emergency and security Plans of the installations.
- Control and surveillance of radiation levels inside and outside the installations.
- Awarding and renewal of operations personnel licenses.

19.1.3 Decree governing Nuclear and Radioactive Installations

This establishes the process to be applied in applications for and the awarding of start-up permits for the installations, as described in article 7.

As regards the operation phase, it regulates the following aspects:

- The obligation to submit to a process of administrative authorization analogous to that applied to start-up of the installations all changes that imply modification of their operating conditions.

- The authority to carry out inspection and verification of the installations, by the Regulatory Authority, indicating the obligations of the owner to facilitate compliance.
- Power for the authorities to require of the owner whatever actions they consider necessary to ensure that the installations operate under adequate safety conditions.
- Requirements applicable to the licensed personnel of the installations and the procedure for the awarding and renewal of such licenses.
- Obligations of the operating personnel of the installations in relation to compliance with the regulations, with the conditions included in the operating permits and with the provisions of the operating documents. It provides the control room supervisor with the power to suspend operation of the installation in the event of a reduction of the safety conditions.
- The obligation of the licensee to maintain an Operations Log for the installation, including full information on operation, such as power levels, events, checks or modifications. It likewise requires that all the data measured by the plant instrumentation be recorded and filed, that periodic reports on operation be drawn up and submitted to the authorities and that events be notified.

19.1.4 Installation operating licenses

In accordance with the Decree governing Nuclear and Radioactive Installations, the start-up of nuclear installations in Spain requires the awarding of an Authorization, this being accomplished in two steps: the Provisional Operating Permit, that allows the licensee to carry out nuclear testing, and the Definitive Operating Permit, once the installation has been satisfactorily verified.

In practice, the nuclear installations currently operating in Spain do not hold the Definitive Operating Permit. They were awarded a Provisional Operating Permit for a limited period, and this has subsequently been periodically renewed or extended. Traditionally, the period for renewal of these permits was two years, but recently this has been extended with a view to establishing such renewal every ten years, coinciding with performance of the Periodic Safety Review.

In awarding the Provisional Operating Permits, and each period of extension, a series of limits and conditions has been established, these having meant that in practice these authorizations have become one of the most important mechanisms for regulation of the operation of nuclear installations in relation to nuclear safety and radiological protection.

At present, these conditions typically establish requirement in the following areas:

- Plant ownership and scope of the authorization.
- Maximum thermal power authorized for operation.
- Documents in accordance with which operation of the installation is to be performed, and revision in force: Final Safety Analysis Report, Operating Technical Specifications, Operating Organization Manual and On-Site Emergency Plan. The authorization indicates that subsequent revisions of these documents are to be approved by the Ministry of Industry and Energy following a favourable report by the CSN.
- In addition, it is required that operation of the plant be carried out in accordance with the stipulations of the Radiological Protection Manual, Normal Operation Off-Site Dose Calculation Manual and Quality Assurance Manual. These documents may be

revised by the licensee without authorization, although subsequent revisions thereof must be submitted to the CSN within one month.

- Design modifications performed, on-going and foreseen in the installation and corresponding safety analysis. In the case of modifications having an important impact on the safety or operation of the installation, authorization is required before their implementation, in accordance with the Decree governing Nuclear and Radioactive Installations.
- New requirements established by the regulatory body of the country of origin of the design of the installation and analysis of applicability.
- Analysis of plant and industry operating experience.
- Transport of fissionable materials and radioactive wastes.
- Life management activities.
- Performance of the Periodic Safety Review.
- Information for requests for renewal of the operating permit.
- Power of the CSN to issue to the licensee appropriate complementary instructions for better compliance with and verification of the plant safety conditions.

Historically, the operating permits and their renewals have incorporated additional conditions for each plant, the fundamental objectives of which have been to require the performance of safety enhancement programs in relation to specific aspects – established during the CSN evaluations – of the new standards in force in the country of origin of the project or established by international organizations or the operating experience of similar installations.

19.2 Safety analysis and commissioning program for initial operating permit for nuclear installations. CSN assessment

Following pre-nuclear testing and prior to start-up of the installation, the Provisional Operating Permit is to be issued. As indicated above, this allows the licensee to load the core and perform nuclear testing, understood as being the tests and checks that allow basic data to be obtained for assessment of the nuclear safety of the installation.

The application for the provisional operating permit submitted by the plant owner is to be accompanied by the documentation described in relation to article 7.

The Final Safety Analysis Report (FSAR) submitted by the Spanish plants for awarding of the provisional operating permit is the main document describing the installation and analyzing the risks that might arise as a result of its operation, under both normal and accident conditions. Generally speaking, this report is drafted in accordance with the revision in force at the moment of licensing of the "Standard Format and Content of the Safety Analysis Report for Nuclear Power Plants", R.G. 1.70 of the US NRC. For many years, the first generation plants (José Cabrera and Stª Mª de Garoña) have had an FSAR that did not meet this standard, and the version for Stª Mª de Garoña NPP complying with R.G. 1.70 is still pending approval. The second generation plants (Almaraz, Ascó and Cofrentes) submitted their FSAR in accordance with revision 1 or 2 of the aforementioned Guide, while the third generation plants (Vandellós II and Trillo) applied version 3, which has wider and more detailed contents.

- Except in the case of Trillo NPP, the contents of the FSAR are structured in the following chapters:
- Chapter 1: Introduction and general plant description.
- Chapter 2: Site characteristics.
- Chapter 3: Design of structures, systems and components.
- Chapter 4: Reactor.
- Chapter 5: Reactor cooling systems and connected systems.
- Chapter 6: Safeguards systems.
- Chapter 7: Instrumentation and control.
- Chapter 8. Electrical systems.
- Chapter 9: Auxiliary systems.
- Chapter 10: Steam and energy conversion systems.
- Chapter 11: Waste treatment systems.
- Chapter 12: Protection against radiations.
- Chapter 13: Operation.
- Chapter 14: Test program.
- Chapter 15: Accident analysis.
- Chapter 16: Quality specifications.
- Chapter 17: Quality Assurance.

Each of these sections includes a description of the issue or system in question, the design bases, acceptance criteria, applicable standards and analyses performed to demonstrate compliance with the acceptance criteria, including a description of the calculation methods and codes, hypotheses, input data and results obtained.

The evaluation of the FSAR carried out for the awarding of provisional operating licenses consisted of an independent review of the different chapters and systems by groups of specialists in the different areas, who drew up specific evaluation reports for each. When considered necessary, due to the lack of qualified experts or of personnel in the corresponding groups, external contracts were drawn up with support companies or organizations. In order to identify the subjects to be evaluated, assign responsibilities to the different organizational units of the CSN and establish methodologies and the work schedule, etc., an evaluation guideline was prepared at the beginning of each project.

The review performed consisted of a comparative analysis of the studies submitted by the plants and the applicable standards, with a view to checking that the designs proposed met the established requirements, that approved calculation methods and codes were used and that the acceptance criteria were met. The working method included the performance of inspections and audits with respect to the detailed design of the systems, testing of materials, manufacturing process, calculations, etc. In certain cases, independent calculations were performed by the personnel of the CSN or by contracted companies or organizations. The questions and answers issued during the evaluation and the additional information required were documented in writing so that the entire process was traceable.

As a result of this evaluation, a final report was drawn up in support of the CSN's Technical Declaration for approval of the document, including the modifications and conditions required for approval.

Subsequent revisions of the FSAR require the same authorization arrangements as the initial document.

The Operating Technical Specifications (OTS's) are another of the official documents submitted by the plants along with their application for the provisional operating license. They contain the limit values and conditions for plant operation and the safety systems required to guarantee that operation is kept within the input data and hypotheses established in the safety analysis. Likewise, they establish the actions to be taken, and the maximum periods for their performance, in the event of non-compliance with the established limits, and the surveillance requirements to be met to guarantee compliance. The format and contents of the OTS's of the Spanish plants are based on NUREG-452 and on NUREG-1213, "Standard Technical Specifications" for PWR and BWR plants, issued by the US NRC, in the revisions in force during the period of their authorization.

The evaluation of this document performed by the CSN consisted of a review by the specialist groups in each area, comparing the contents proposed for each section with the requirements of the aforementioned NUREG documents, the designs of the systems and the hypotheses and calculations of the safety analysis, such that operation of the plant within the limits analyzed in the FSAR and coherence between the two documents be guaranteed.

As a result of these evaluations, reports were issued on each of the sections, these finally being included in a single overall report serving as a support for the Technical Assessment of the CSN for approval of the document, including the additional requirements, modifications and conditions necessary for such approval.

Subsequent revisions of the FSAR are required to follow the same process of revision and approval as the initial document.

The Start-up Program submitted by the plant owners along with their application for the provisional operating permit contained the sequence of tests to be performed from loading of the fuel up to operation at 100% power, including a summary of these tests and of the organization responsible for their performance, the specific units to undertake this responsibility, and a revision of the results, the role of the Plant Nuclear Safety Committee, waiting points and actions to be taken in the event of non-compliance with the established acceptance criteria.

- The objective of the test program is to demonstrate that plant operation was as established in the design, and in particular to check that the values of the parameters and hypotheses included in the safety analyses are conservative with respect to those measured during testing. For this purpose a program is established for step-wise implementation as from loading of the core, including the following:
- Tests prior to initial criticality: hydrostatic tests, primary system flow measurements, control rod insertion time measurement, instrumentation calibration, etc.
- Initial criticality and measurement of neutronics parameters: coefficients of reactivity, critical boron concentrations, control rod worth, etc.
- Power steps at different levels (25%, 50%, 75% and 100%) at which checks and adjustments are made to the instrumentation and control systems, load steps and

certain transients for checking of the overall behaviour of the plant, such as load rejections, tripping of main pumps and others.

The CSN evaluation was performed by comparing the program submitted by the plants to the US NRC Regulatory Guide 1.68 on the start-up testing of nuclear power plants. The additional tests considered to be necessary were required and those to be performed in the presence of an official representation of the NRC were identified.

The Operating Organization Manual and the On-Site Emergency Plan are the other two official operation documents to be submitted along with the application for the provisional operating permit, and are dealt with in other sections of this report.

As a result of the evaluation process described, the CSN issued its technical assessment for approval of the application filed, along with the conditions necessary for the initiation of operation and performance of the nuclear test program. Likewise, the permit establishes that operation of the plant should be in accordance with the contents of the Final Safety Analysis Report, the Operating Technical Specifications, the Operating Organization Manual and the On-Site Emergency Plan, and establishes also the procedure for approval of the revisions of these documents.

The Ministry of Industry and Energy issued the provisional operating permit for a given period, including the nuclear safety and radiological protection conditions established by the CSN.

The test program begins with loading of the core, a large number of such tests being performed in the presence of the official representation of the CSN, which issues an Inspection Report on the tests witnessed. Certain significant milestones were established, such as initial criticality or the increase to previously defined power levels, for performance of which the CSN had to issue a favourable appreciation based on evaluation of the results of tests carried out up to that time.

19.3 Operating limits and conditions

On completion of the nuclear tests, and prior to the end of the period for which the permit was issued, the licensee is required to request renewal, including with his application a report on the results of the nuclear testing program and of operation of the installation during the period of validity of the permit. The CSN evaluates compliance by the licensee with the limits and conditions established in the permit throughout the period considered, the operating experience of the plant and the main activities or modification carried out, and issues a new technical assessment for renewal of the permit by the Ministry of Industry and Energy. The conditions established in the operating permit have been described at the beginning of the present Article.

On completion of the CSN evaluation of the licensee’s operating documents and the results of the testing and start-up program, in accordance with the conditions established for awarding of the Provisional Operating Permit, the CSN carries out a new Revision of the Official Operating Documents, incorporating the result of the testing and start-up program. The contents of these Documents, and fundamentally of the Final Safety Analysis Report and the Operating Technical Specifications, define the safety limits for operation of the installation.

19.4 Performance of operating, maintenance, inspection and testing activities in accordance with written and approved procedures

The Operating Organization Manual defines the programs, manuals and procedures to be used in performing activities in the plant, establishing the responsibilities and the processes for issuing, approval and revision. The most important programs and manuals relating to nuclear safety and radiological protection are the Quality Assurance Manual, the Radiological Protection Manual, the Off-Site Dose Calculation Manual, the In-Service Inspection Manual, the Fire Protection Manual, the Environmental Radiological Surveillance Program and the Security Plan.

The Quality Assurance Manual applicable to operation of the installations, compliance with which is mandatory, as conditioned by the operating permit, establishes that all activities affecting safety should be carried out in accordance with written and approved instructions and procedures, including those relating to plant organization, operation, periodic surveillance tests and in-service inspections, design activities, maintenance activities, safety studies and analyses, analysis of operating experience, management of services, training, radiological protection, security, protection against fires and the on-site emergency plan. This document also establishes how such procedures and all other plant documents affecting safety should be approved, modified and controlled.

Appendix 19.A briefly describes the application of these general principles to maintenance activities, testing and inspections and operation.

19.5 Procedures for event and accident response

All the Spanish plants have Emergency Operating Procedures which include the actions to be taken in the event of incidents or accidents.

The first emergency procedures used at the Spanish plants were based on identification of the event that was assumed to be occurring. Each procedure was applicable to a single scenario, which was defined on the basis of the sequence of events analyzed in the Final Safety Analysis Report. These events assumed the most unfavourable plant conditions, and credit was given only to the use of the instrumentation and safety-related systems, without consideration of the additional failure of any of these systems in development of the event.

One of the clearest teachings of the TMI-2 accident was the need to change these procedures. During that accident, the incorrect interpretation of the values observed for certain `parameters led to the mistaken diagnosis of the phenomena which were taking place, and to the implementation of actions by the operators that contributed seriously to aggravating the situation. Likewise, the failure of certain items of equipment, that did not behave as was foreseen in the design, led to reconsideration of the hypothesis of the single failure that had been assumed up until that time.

The action plan developed in the wake of that accident included the drawing up of new symptoms-based emergency operating procedures capable of covering multiple systems failures and operational errors.

The requirement to draw up new symptoms-based Emergency Operating Procedures was imposed upon the Spanish plants in the Provisional Operating Permits or in their renewals, depending on the start-up date of each.

The first generation plants were required to make certain specific improvements in their existing emergency procedures as a result of the TMI accident, and to adapt to the new EOP's following the safety re-evaluations of these plants performed in the 1980's.

The José Cabrera plant was requested to carry out a study of the feasibility of implementing the new EOP's in 1985, and to implement them in 1988. They became operable following the 1991 refueling outage. It should be pointed out that the process of drawing up the EOP's for the José Cabrera plant was especially laborious, since the systems and instrumentation of this plant are quite different from those of other Westinghouse designed plants, as a result of which the generic guidelines developed were of little application. The Stª. Mª de Garoña plant has had the new EOP's in operation since 1990.

This condition was imposed upon the second generation plants in their Provisional Operating Permits prior to their start-up. Final implementation took place in 1990 at the Almaraz and Ascó plants, and in 1986 at Cofrentes. Vandellós NPP initiated its start-up with the new EOP's already implemented.

Trillo NPP has followed the practice of the German plants, which do not have symptoms-based emergency operating procedures developed. This plant will need to track their evolution and update its operating conditions in a manner similar to whatever is required of German plants in the development of their modular Operations Manual, the aim of which is to facilitate use by the operations personnel.

19.6 Availability of engineering and technical support services

The organization, functions and responsibilities of the licensee in relation to operation of his installation are included in the Operating Organization Manual.

The owner utilities are the holders of the authorization issued to the installation, and are responsible for it as regards the legislation in force. Executive authority is represented by the Director or Manager, who is ultimately responsible within the organization for nuclear safety and radiological protection issues. Those responsible for operation of the plant and for technical engineering services, the quality assurance department and the finances and personnel departments report directly to him.

The organization of all the Spanish nuclear power plants is very similar, and includes a support organization not resident at the plant and the operations personnel itself, responsible for functions directly related to plant activities. The size of the support organization varies from one plant to another, normally depending on the engineering department, since there are some plants at which practically all engineering tasks of any magnitude are contracted and others at which this is not the case. Apart from engineering tasks, this support organization carries out activities in relation to standards analysis, licensing, the analysis of plant and industry operating experience or control of inspections performed during the manufacturing of nuclear elements.

Consequently, this support organization is normally made up of the following organizational units:

- An engineering or technical services section that coordinates with the plant and with the main engineering in relation to design modification issues. Consequently, this section develops specifications for the acquisition of equipment and services, provides support for the plant in relation to engineering issues (both electrical, mechanical and instrumentation and control), and performs general engineering analyses and studies.

- A licensing section that coordinates all plant licensing issues. For example, tracking of the conditions of the Provisional Operating Permit (POP), relations with the CSN and updating of the Operating Technical Specifications.
- An operating experience analysis group that analyzes operating data, evaluates the indicators of the plant and coordinates experience issues not relating to operation.
- A quality assurance unit, that controls compliance with the quality assurance program at the central offices, directs quality assurance at the plant and controls compliance with the quality requirements of equipment suppliers.

At some NPP's there are also sections with responsibilities in relation to the management of fuel and radioactive wastes. At those plants at which such organizational units are not defined, these responsibilities are normally assumed by Technical Services.

At the site, the Operations Manager or Plant Manager is responsible for operation of the installation and for keeping it within the conditions established in the operating permit. The organizational units of production, maintenance, radiological protection, etc. are under his charge.

At all the sites (plants) there are the sections and divisions considered necessary for the performance of the activities implicit to a Nuclear Power Plant in compliance with the standards (although in many cases there are differences as regards the size of the different sections). In this respect, activities relating to maintenance, operation, fire-fighting, management of wastes and effluents, inspection, training, etc. are covered.

The organization of the site operator also normally includes organizational units whose function is to provide technical support and engineering services for operations. Appendix 19.B describes the units that are normally to be found on site at the installations.

All the organizations of the Spanish NPP's have a highly consolidated structure (because of the number of years they have been in operation), and although there are continuously variation and new revisions of the Operating Organization Manuals, these changes relate to management needs and to optimum use of resources and do not substantially affect the general organization.

19.7 Event Reporting

CSN Safety Guide 1.6 *Reportable events at operating nuclear power plants*, describes the criteria to be applied in notifying the CSN of events. The recommendations included in this guide have normally been incorporated by the plant owners in their Operating Technical Specifications. Two types of reportable events are established: Abnormal and Other events. The classification of abnormal events is as established under the heading of the Emergency Situation in Guide 1.3 of this same guidelines set.

Appendix 19.C lists all the reportable events. Abnormal events must be reported as soon as possible, and in all cases within 30 minutes of occurrence. They include actuation of the emergency core cooling systems, fires at the plant lasting more than 10 minutes, the disappearance of radioactive material, etc. Other events must be reported either within one hour of occurrence and before operation is reinitiated, if the event has caused operation to be interrupted – for example any non-scheduled reactor trip – or within 24 hours, for example in the event of non-compliance with a Technical Specification.

All reportable events, be they abnormal or of another type, require a report to be submitted to the CSN within 30 days, including details of the time sequence of the event, initial plant conditions, detailed description of the event itself, safety evaluation, root cause, identification of human errors if they have existed, identification of failed equipment and corrective actions taken and foreseen. The Reportable Events reports are to be sent also to the other Spanish pant operators, as well as to the CSN.

19.8 Operating Experience Feedback

19.8.1 Operator activities

Each Spanish plant operator analyzes the most relevant operating events occurring at this plant, using internationally recognized root cause analysis methodologies. The operating experiences of other plants that each operator is required to analyze are described in CSN Safety Guide 1.7*, Information to be submitted by licensees to the CSN on the operation of nuclear power plants,* these being as follows:

- Events reported by other Spanish plants.
- Written recommendations from the suppliers of safety-related plant equipment.
- American design plants: requirements issued by the NRC (Nuclear Regulatory Commission) applicable to plants of similar design, for example Generic Letters o Bulletins, SOER (Significant Operating Experience Report) and SER (Significant Event Report) documents issued by INPO (Institute for Nuclear Power Operations).
- German design plants: requirements issued by the German authorities and applicable to plants of similar design in Germany, for example KTA standards and informative notes from the German Society for Nuclear Safety (GRS).
- Experience explicitly required by the CSN, for example certain of the IAEA IRS (Incident Reporting System) reports or any Spanish incident that the CSN wishes to underline in relation to any particular aspect.

In order to be able to analyze these industry operating experiences, the Spanish plants have a system for the exchange of information on reportable events and hold periodic meetings to discuss events, etc.

All the Spanish plants participate in INPO through UNESA, reporting to this organization and receiving information via the Significant Event Evaluation and Information Network (SEE-IN) Program; they also participate in WANO. Likewise, they belong to the owners groups of plants of similar technology.

19.8.2 Assessment of Operating Experience by the Regulatory Body

The CSN evaluates the impact on safety of each reportable event on learning of its occurrence. When it estimates that the event might possibly be classified above level 0 on the INES scale, it holds a telephone conference with the operator on the same day, in order to acquire complementary information and perform its classification on the basis of sound knowledge. Regardless of the INES classification, events considered to be significant or to have generic implications are analyzed and evaluated individually. A database record is filled in for each event, including in code form the result of its preliminary evaluation as regards type, cause, impact on safety, etc.

The Events Review Panel (ERP) meets monthly. This panel is made up of the representatives of the CSN technical areas most directly related to the evaluation and inspection of nuclear power plants. The ERP guarantees the systematic analysis of all events and classifies them depending on their safety impact or generic implications. In the case of events considered to be significant, the ERP ensures that the plant has, by itself, adopted the corrective actions required to address the root cause or, otherwise, activates the corresponding CSN requirement. For generic events, the ERP activates the process of sending the necessary information and recommendations to the operators of the affected plants.

The CSN has an "Operation Indicators Program" which monitors the following parameters for each plant: reactor shutdown from criticality, actuation of safety systems, significant events, safety system failures, rate of forced outages, forced outages due to equipment failures per 1,000 hours of criticality, collective exposure to radiations. This program allows the evolution of each of these parameters to be tracked, compare each plant with others, etc. It also makes it possible to compare the Spanish plants with US installations having the same technology. The root cause codes of each event are included, allowing for similar comparisons.

The CSN carries out OE inspections with respect to each plant operator, normally once every two years. These inspections include checking of whether the owner reports all events meeting the corresponding criteria, whether he performs root cause analysis of the most significant events with the necessary technical competence, that applicable industry operating experiences are suitably analyzed, that the corrective actions deriving from the OE are activated by means of adequate mechanisms and implemented within a reasonable time, and that the operator has mechanisms available for evaluation of the efficiency of his OE analysis system and the implementation of the necessary corrective measures.

The CSN participates in the IAEA and NEA operating experience exchange activities and working groups, especially in the Incident Reporting System (IRS). The IRS database, now the Advanced IRS, is installed in the CSN local network for consultation by any technician, and copies of reports and the IRS database are sent to all NPP operators. The reports considered to be of greatest interest among those received are sent to the affected CSN specialist areas; for example, in 1997, 32 of the 85 reports received were distributed. Those applicable to Spanish plants and not previously dealt with by other means are sent to these plants for analysis, the CSN being notified of the conclusions. In Spain, the CSN is responsible for drawing up the IRS report on Spanish operating experiences and for sending them to the IAEA and the NEA. During the last three years, Spain has sent 6 reports to the IRS, this representing a rate of 0.22 events per reactor/year, as compared to the recommended rate of 0.2 to 0.3 per reactor/year.

19.9 Radioactive waste management

The Spanish policy as regards the management of radioactive wastes is established in the General Radioactive Waste Plan (GRWP), approved by the Government. At present, the 4th GRWP is in force, and currently under revision.

According to this Plan:

- Low and Intermediate Level Wastes are immobilized in cement matrices and disposed of at the El Cabril Disposal Facility.
- Spent Fuel is currently stored in the pools of the nuclear power plants.

19.9.1 Low and intermediate level waste management

The first technical activities of waste management, such as waste segregation, conditioning and/or temporary storage, are carried out at the producer installations themselves, while those involved in the final stage of waste management, such as transport, re-conditioning and definitive disposal, are the responsibility of the Spanish national radioactive waste management company ENRESA.

As regards the minimization of waste production, the methods usually applied in the management of wastes and designed to minimize the volume generated are based on the following concepts:

- Application of strict control to segregation at the point of origin, with materials separated depending on their radioactive content and physiochemical nature.
- Progressive elimination of disposable materials, and their replacement with reusable materials.
- Reduction and strict control of contaminated areas, such that the sources of waste materials with radioactive contents are reduced.
- Strict segregation of contaminated and non-contaminated materials, such that the quantity of wastes entering the subsequent process of treatment is minimized.

These concepts are included in practice in the operating and waste management procedures of each installation, and are also incorporated in the acceptance criteria for those wastes which might be disposed of at the El Cabril facility.

As regards the requirements for waste conditioning, these cover the different stages involved up to the acquisition of final products satisfying the criteria for acceptance at the definitive disposal facility and for transport from the producer installation. The treatment processes relate, on the one hand, to the physiochemical and radiological characteristics of the wastes and, on the other, to the option selected for their definitive disposal.

At the Spanish nuclear power plants, compaction techniques are used to reduce the volume of compactable materials (paper, textiles and small metallic and plastic objects). These systems include specific requirements for the control of contamination and exposure to radiations, and also in reference to criteria regarding the quality of the final waste packages. Cementation techniques are used at all the Spanish plants for the conditioning of wet solid wastes.

The processes for mixing of the wastes and the cement currently implemented may be divided into two categories: mixing in the drum or previous mixing of cement and waste and later filling of the drum.

The design and operation of the waste solidification systems must incorporate process control considerations guaranteeing final products that meet the quality requirements for temporary storage at the plant and for definitive disposal.

From the regulatory point of view, the design requirements applied to the cementation plant are aimed at guaranteeing ALARA considerations in relation to personnel exposure and the physiochemical and radiological control of the solidification process.

In relation to this particular issue, the Spanish nuclear power plants apply the CSN Safety Guide 9.1, *Control of the process of solidifying low and intermediate level radioactive wastes,* through the implementation of a conditioning Process Control Program (PCP). The aim of the PCP is to reasonably guarantee that the waste solidification systems operate within the established limits and conditions, and that the products obtained are within acceptable ranges and intervals as regards certain quality requirements.

The Spanish radioactive waste management company ENRESA is required to guarantee that all the waste packages accepted at the El Cabril Disposal Facility are accompanied by the document required for such acceptance, in respect to which it applies to all the different types of waste packages generated at the Spanish nuclear power plants a methodology and a set of quality criteria previously authorized by the regulatory authorities.

19.9.2 Irradiated fuel

In Spain, the technique currently used for irradiated fuel is its storage in the pools of the nuclear power plants. The capacity of the pools has been increased in recent years by reracking, such that the fuel may be stored until the end of the lifetime of certain plants, and until approximately the year 2010 in others. In addition, a dual-purpose (storage and transport) cask has been licensed for storage of the fuel of plants whose capacity is insufficient for this timescale.

ENRESA has under way an R&D Plan whose main objective is to establish the conditions for safe, long-term management of spent fuel, on the basis of direct disposal. This Plan is coordinated with the activities performed within the framework of the European Union's General R&D Program, and with analogous plans in other countries, such as France, USA, Sweden, Switzerland, Belgium and Germany.

19.10 Degree of implementation of the obligations

The documents that the licensee draws up for submittal along with the application for the operating permit contain a full safety analysis, which is evaluated by the regulatory body prior to awarding of the permit. The Spanish regulations require the performance of a plant nuclear testing program, which is carried out under the supervision of the regulatory body, which also evaluates its results. The measures described ensure compliance with the requirements of section I) of this article.

Along with the application for the operating permit, the Spanish plants are required to submit an Operating Technical Specifications document containing the operating limits and conditions derived from the safety analysis. This document is evaluated by the CSN prior to the beginning of plant commercial operation, and checks are made to ensure that it adequately includes the results of the start-up tests. This ensures compliance with section II) of this article.

Article 13 describes the measures relative to the plants' Quality Assurance programs. This information is completed with a description of the procedures established by the plants

for the performance of activities having special importance from the point of view of safety. This ensures compliance with section III) of this article.

The operating procedures developed by the nuclear power plants to respond to foreseen events and accidents have been described. These procedures comply with the requirements of section IV) of this article.

The habitual organization of the plant operator, subject to authorization via the Operating Organization Manual, has been described. This organization contemplates for all the plants the existence of engineering and technical support services which fully comply with the requirements of section V) of this article.

The criteria applied to the notification of nuclear power plant events to the CSN have been described. Compliance with these criteria is mandatory, by virtue of their being incorporated in the Operating Technical Specifications. This meets the requirements of section VI) of this article.

The measures adopted by both the operators of the Spanish nuclear plants and by the CSN for the acquisition and analysis of information on operating experiences have been described. These programs include information from national and overseas plants, as well as that coming from international organizations and the regulatory bodies of other countries, as a result of which the requirements of section VII) of this article are duly met.

The measures adopted by the Spanish plants to minimize the production of low and intermediate level radioactive wastes and for the management of irradiated fuel have been described. These take into account the requirements applicable to subsequent conditioning and disposal, and correctly comply with the requirements of section VIII) of this article.

- The following safety update and enhancement programs relating to the operation of the Spanish nuclear power plants are currently under way or scheduled:
- Systematic implementation of periodic safety review programs every ten years and assimilation of the results within the areas included in their scope: operating experience, equipment performance, new standards and safety updating.
- Performance of the integrated program for the performance and use of probabilistic safety assessments.
- Establishment of a general policy and action measures in relation to the management of severe accidents.
- Homogenization of lifetime management programs and the establishment of safety requirements applicable to them.
- Optimization of the official operating documents, in particular the Operating Technical Specifications.
- Establishment of risk-based maintenance programs in application of US 10 CFR 50.65.
- Revision of the plants' design bases and updating of the contents of the Final Safety Analysis Report.
- Optimization of operations personnel training.
- Implementation and assimilation of the concept of the *Safety Culture*.

APPENDIX 19.A

Maintenance, inspection, testing and operating procedures

19.A.1 Maintenance

In the Safety Analysis it is assumed that the structures and systems are available for performance of their functions in the event of an accident. The ultimate guarantee of such availability is provided by the monitoring and maintenance of the plant structures, systems and components.

The impact of maintenance on the safety of an installation – maintenance being understood as all activities aimed at conserving the reliability and safety of the structures, systems and components and at restoring this availability when it becomes degraded – is important. Proof of this may be found in both the national and international analysis of operating experience and in the quantitative analysis of the impact of maintenance by probabilistic means.

The maintenance program must include all those systems whose failure might have a significant impact on plant safety. This includes systems belonging to the secondary circuit.

In general the Spanish operators have developed their maintenance programs in accordance with the guidelines offered by the nuclear industry, and in particular with those of the US "Institute of Nuclear Power Operations" (INPO).

All the plants have implemented maintenance procedures, carry out integral, computerized management of maintenance activities and have loaded historic data on their equipment, although the scope and cut-off date varies from one plant to the next.

In 1995 the Spanish plants began to adapt to the requirements of 10.CFR50.65 "Requirements for monitoring the effectiveness of maintenance at NPP", implementation being scheduled for the beginning of 1999. In this preparatory phase there are two plants, Cofrentes and Vandellós II, which are developing the procedures and applying the new standards, such that they may identify and resolve whatever difficulties might arise prior to their being generally applied to the rest of the plants.

19.A.2 In-service inspections and tests

The objective of In-Service Inspection is to verify the status of pressure-retaining systems and components of importance to plant safety under both normal operating and accident conditions, checking that the safety factors assumed in the design do not undergo changes pointing to an increase in potential risk.

With this aim mind, In-Service Inspection periodically controls the possible degree of deterioration; in other words, it serves to gain insight into the status of the components of greatest importance for plant safety through the evaluation of data taken ***in situ.***

At the Spanish plants, the ASME Code, Section XI, Division I ***Rules for the Inspection and Testing of Light Water Nuclear Power Plant Components*** is used as a detailed guide to establish the scope and content of In-Service Inspections. In addition, for certain detailed aspects, some of the NRC Regulatory Guides and other documents are used, always within the general coverage of ASME XI. At the Trillo plant, standard KTA-3204 is also used for the inspection of the vessel internals, and KTA-3201.4 for primary and secondary circuit testing.

- ***Scope of Inspections***

  The components subjected to inspection are those defined as being safety class and retaining pressure, along with their supports. These classes are established depending on the level of quality required during construction, which obviously depends in turn on the mission of the system in relation to safety or on the fluid contained, for example radioactivity to a greater or lesser degree. The inspection began with a reference intervention known as the pre-service inspection, providing knowledge of the evolution of acceptable defects.

- ***Inspection Intervals***

  Throughout the lifetime of each plant there are four intervals initially foreseen, one every 10 years. The scopes established for the examination of nuclear class components are completed during each interval, as are the pressure tests.

- ***Pump tests***

  The nuclear class pumps intervening in safe shutdown of the reactor or in the mitigation of the consequences of an accident are tested, along with those supplied with an emergency feed source.

  The inspection procedures require measurement of a set of variables: speed, differential pressure, bearing temperatures, vibration amplitude, etc. Pump tests are generally performed every three months.

- ***Valve tests***

  Functional tests are performed on nuclear class valves designed to actuate in safe shutdown of the reactor or to mitigate the consequences of an accident. Valves are also categorized depending on their function: pressure boundary or containment isolation, alignment of safety systems, pressure relief, etc. The tests to be performed, and their frequency, depend on the category of the valve; thus, there are actuation tests, leakage measurement tests, the checking of setpoints of safety and relief valves, etc. Depending on the categories, the tests are performed at frequencies ranging from three months to up to five years.

- ***Support tests and inspections***

  Supports are elements designed to transmit loads due to thermal dilation, transients and accidents from safety equipment and piping to the buildings or structures in which they are housed.

  The inspection of supports and corresponding examinations may be carried out during plant operation or during shutdowns, visual examination being the most widespread method. Setpoints are also verified and functional tests are performed on the testbench.

- ***Pressure tests***

  Depending on the class of the system, different tests are performed, these including functional tests to verify the operability of systems not operating during normal operation, in-service tests including visual inspection at operating pressure, and hydrostatic tests performed during outages at pressures above the rated operating value. The frequency of the tests depends on the function of the system in question and on the type of test, and they may be carried out during each refueling outage or every ten years.

19.A.3 Operation

The operating procedures regulate the activities to be performed for plant start-up, operation and shutdown. They include the instructions, precautions and prerequisites to be taken into account in performing these activities, as well as for the start-up or shutdown of the systems required under different plant operating conditions. Also available are the surveillance procedures for compliance

with the periodic surveillance requirements established in the Operating Technical Specifications, maintenance procedures, radiological protection procedures, etc.

Also established in procedures are the actions to be taken in the event of equipment failure or malfunction or of the generation of alarms and under emergency conditions.

APPENDIX 19.B

On-site operating organization

- Operation: this section is directly responsible for operation, through the Shift Chiefs, Control Room Supervisors and different operators, and also for guaranteeing compliance with the applicable nuclear safety standards. Among others, it is commissioned with the functions of plant start-up, shutdown and maneuvers, the use of the emergency operating procedures, etc.

  It is normally supported by the Operations Technical Office and Nuclear Engineering.

  The operations personnel (Shift Chiefs, Supervisors and Reactor Operators) hold licenses for performance of their job posts, issued by the CSN as established in the Decree governing Nuclear and Radioactive Installations.

- Maintenance: This section is responsible for corrective, preventive and predictive maintenance activities to be performed at the plant in relation to electrical, mechanical and instrumentation and control systems.

  It is normally responsible also for In-Service Inspection and fire prevention programs.

  The section is normally supported by a Maintenance Technical Office.

- Plant engineering section: The fundamental mission of this section is coordination of design modification performance and issuing of the corresponding documentation, along with the monitoring of core parameters.

- Reactor engineering section: The fundamental mission of this section is determination and monitoring of the design and operating parameters of the reactor core.

- Chemistry and radiochemistry section: This section is assigned responsibility for the chemistry of the plant systems. It is, therefore, responsible for control and supervision of all the chemical parameters of the plant and for the sampling stations.

  Support is provided to this section by the Chemistry Laboratory under its charge.

- Radiation Protection Service: This service is in charge of applying the regulatory requirements relating to protection against ionizing radiations. Its activities cover both those directly involved because of their work and the population and environment that might be indirectly involved due to their proximity to the plant. The section is managed by the Head of the Radiological Protection Service, who has under his charge the corresponding supervisors: Radiological Protection instrumentation, dosimetry, ALARA issues, etc. In relation to this latter concept, it is established that all the studies, efforts and investments required to ensure that the radiological doses received by people be maintained as low as is reasonable achievable are to be made.

- Plant Quality Assurance section: this section exercises control over the Plant Quality Assurance Plan. It is, therefore, responsible for audits, the tracking of corrective actions, inspections of operations, documentary review, etc. It normally has under its charge the Quality Assurance records Archive.

- Security section: This section develops, implements and maintains the Security Program for the installation.

- Training section: This section develops, implements and maintains the plant Personnel Training Program. It undertakes training of both licensed personnel and others.

APPENDIX 19.C

Reportable events

19.C.1 Abnormal Events

The following types of events are included in this class, certain examples being included in brackets:

- Automatic required initiation of the emergency core cooling systems.
- Evolving events which might affect the safety barriers and whose control is not guaranteed at a given time (indication of the occurrence of core damage; leakage or abnormal coolant temperature or pressure transients, including in all cases non-compliance with the technical specifications).
- Unexpected plant response (Exceeding of safety limits, loss of safety system redundancy during a transient, possible affecting its evolution; exceeding of technical specification instantaneous release limits; safety system relief/safety valve sticking open at a pressure lower than the closure value; inadvertent criticality).
- Degradation of a safety function during operation or shutdown (station blackout; rapid, uncontrolled secondary depressurization (PWR); low water level or flow in the final heat sink when still appreciably higher than the design minimum; loss of containment integrity or of emergency core cooling function redundancy, in both cases requiring shutdown based on the technical specifications).
- Site event whose control is not guaranteed at a given moment and which does not yet affect the safety-related systems but does constitute a threat to plant safety (fire in the plant lasting more than 10 minutes as from detection, flooding close to the location of safety systems or the release of toxic or explosive substances inside the plant).
- Natural or off-site event constituting a threat to plant safety (damage to dams, intensity of winds or rainfall in excess of that having a return period of 1 in 10 years, uncontrolled fire close to the plant, emission of hazardous toxic substances such that the concentrations expected at the site exceed the authorized limits, or explosions close to or at the site itself, earthquake detected by the plant seismic surveillance instrumentation, aircraft drop onto the site or abnormal air traffic).
- Threat to security (attempted intrusion or sabotage, intentional degradation of the security Plan, blocking of accesses, believable bomb threats).
- Disappearance of radioactive material.
- Significant loss of the capacity to communicate with the outside.

19.C.2 Other reportable events

The following are considered to constitute Other Reportable Events. Some examples are given in brackets:

- Non-scheduled shutdown or reduction in plant power, or these events required by the “ACTION” section of the technical specifications.
- Non-scheduled actuation of the reactor trip system with correct performance by the safety systems and operations personnel.
- Occurrence of an event requiring the development of special procedures to cover safety-related activities.
- Any non-scheduled or uncontrolled release of radioactive material.

- Any event in which a person has actually or potentially received a dose from external irradiation and/or internal contamination which in principle would exceed, in a single exposure, the dose limits established by the Spanish legislation.
- Non-compliance with a technical specifications limit condition or surveillance requirement.
- Exceeding the value of a limiting condition for operation variable.
- Discovery of deficiencies in design, construction, assembly, operation or maintenance methods when it has been determined that this might prevent compliance with a safety function by the structures or systems required for the following:
  - Safe plant shutdown.
  - Residual heat removal.
  - Control of emissions of radioactive material.
  - Mitigation of the consequences of an accident.
- Discovery of deficiencies in the performance of the plant personnel or in the operating procedures when it has been defined that this might prevent compliance with the safety functions defined in the previous point.
- Any automatic or manual actuation of safety systems, with the exception of the tests or mode changes required by the technical specifications.
- Any plant internal event or condition implying a potential impact on plant safety or reducing the capacity of the operations personnel to operate the plant in a safe manner (fires, common mode equipment failures, release of toxic or radioactive substances, flooding, turmoil, strikes, etc.).
- Any off-site natural phenomenon or condition implying a potential impact on plant safety or reducing the capacity of the operations personnel to operate the plant in a safe manner (release of toxic, explosive or hazardous materials, explosions, flooding, earthquakes, etc., not included in the category of abnormal reportable events).
- Any other event not included in the previous points and which might, in the opinion of the operator, be important to plant safety.
- Any other event not included in the previous points and which might, in the opinion of the operator have significant public repercussions (environmental variations, irradiation or contamination of persons, occupational accidents).

ANNEX

Acronyms and Abbreviations used

10CFR	US Code of Federal Regulations, part 10.
SRBA	Social Receiving Base Areas.
OESA	Operating Experience and Systems Analysis.
ALARA	As low as reasonably achievable.
PSA	Probabilistic Safety Assessment.
ASME	American Society of Mechanical Engineers.
ATWS	Anticipated transient without scram.
Bq	Becquerel.
BWR	Boiling water reactor.
D.F.	Disposal Facility.
NPP	Nuclear Power Plant
CECOP	Provincial Operations Coordination Centre.
CECOPAL	Municipal Coordinations Centre.
CEDEX	Centre for Public Works Studies and Experimentation.
CIEMAT	Centre for Energy-Related, Environmental and Technological Research.
CSN	Nuclear Safety Council.
PSC	Plant Safety Committee.
OSC	Owner’s Safety Committee.
DGCD	Directorate General for Civil Defense.
CDS	Classification and Decontamination Station.
ECURIE	European Community program for the urgent exchange of radiological information.
USA	United States of America.
FSAR	Final Safety Analysis Report.
NDT	Non-Destructive Testing.
ENRESA	Empresa Nacional de Residuos Radiactivos.
ENUSA	Empresa Nacional del Uranio.
OE	Operating Experience.
EPRI	Electrical Power Research Institute (USA).
PSAR	Preliminary Safety Analysis Report.
SSC	Structures, Systems and Components.
ESFUC	Systematic Evaluation of Nuclear Power Plant Operation.

OTS	Operating Technical Specifications.
Gbq	Gigabecquerels.
GRS	Reactor safety company (Germany).
SG	Safety Guide.
GWh	Gigawatt hour.
HPES	Human Performance Enhancement System.
R&D	Research and Development.
IAEA	International Atomic Energy Agency.
ICRP	International Commission for Radiological Protection.
INES	International Nuclear Event Scale.
INEX	International nuclear emergency exercise.
INPO	Institute of Nuclear Power Operations.
INRA	International Association of Nuclear Regulators.
IPE	Individualized plant evaluation.
IPEEE	Individualized plant external event evaluation.
IPSN	Institute for Protection and Nuclear Safety (France)
IRS	Incident Reporting System.
HRPS	Head of Radiological Protection Service.
KTA	Nuclear Technical Standards (Germany).
KWU	Kraftwerk Unión A.G.
LBB	Leak before break.
LDL	Lower detection limit.
LOCA	Loss of coolant accident.
ODCM	Off-site Dose Calculation Manual.
mGy	Miligray.
MIE	Ministry of Industry and Energy.
ISIM	In-Service Inspection Manual.
ISIOM	In-Service Inspection Organization Manual.
mSv	Milisievert.
mSv/y	Milisievert/year.
MW	Megawatt.
NEA/OECD	Nuclear Energy Agency/Organization for Economic Cooperation and Development.
NRC	Nuclear Regulatory Commission (USA).

NUREG	NRC publication.
PCP	Process Control Plan.
POP	Provisional Operating Permit.
GRWP	General Radioactive Waste Plan.
BNEP	Basic Nuclear Emergency Plan.
EOP	Emergency Operating Procedure.
ERP	Event Review Panel.
RECP	Radioactive Effluent Control Program.
ERSP	Environmental Radiological Surveillance Plan.
EERSP	Emergency Environmental Radiological Surveillance Plan.
PWR	Pressurized Water Reactor.
R.G.	Regulatory Guide (USA).
REDOS	Dose reduction program.
DNRI	Decree governing Nuclear and Radioactive Installations.
PSR	Periodic Safety Review.
DPIR	Decree governing Protection against Ionizing Radiations.
SACOP	Operations coordination room.
SAL	Manufacturer’s letter of recommendation (Westinghouse).
SALEM	Emergency Room.
SAMG	Severe Accident Management Guideline.
SBO	Station Blackout.
SEE-IN	Significant event information and evaluation network.
SEP	Systematic Evaluation Program.
SER	Significant Event Report.
SIL	Manufacturer’s informative letter (General Electric).
SOER	Significant Operating Event Report.
SPDS	Safety Parameter Display System.
TMI	Three Mile Island.
EU	European Union.
UNESA	Unidad Eléctrica, S.A.
US DOE	US Department of Energy.
WANO	Word Association of Nuclear Operators.
EMPZ	Emergency Measures Planning Zone.