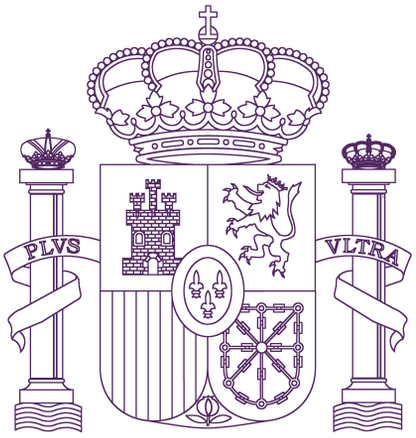


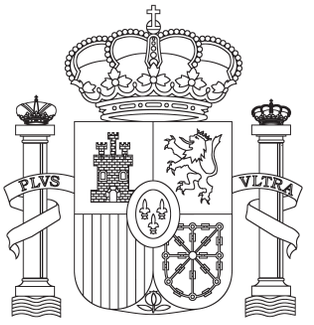

# SPAIN

# National Report

# for the Second Convention

# on Nuclear Safety Extraordinary Meeting

## (Vienna from 27th to 31st August 2012)

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# for the Second Convention

# on Nuclear Safety Extraordinary Meeting

## (Vienna from 27th to 31st August 2012)

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# Índex

# Introduction

## Presentation of the Report

The present document constitutes the Spanish National Report for the extraordinary meeting of the Convention on Nuclear Safety to be held in Vienna during the month of August 2012. The holding of this extraordinary meeting was agreed to by the Contracting Parties as a conclusion to the fifth review meeting of the said Convention on Nuclear Safety, held in Vienna from April 4th to 14th 2011.

In compliance with the instructions issued by the Secretariat of the IAEA, this national report for the extraordinary meeting must be submitted by May 13th 2012. As a result, its contents cover the data and events occurring between the accident at the Fukushima nuclear power plant in March 2011 to March 2012 (inclusive).

## Drawing up of the Report

The report has been drawn up by the Nuclear Safety Council (Consejo de Seguridad Nuclear, CSN), the organisation solely responsible for nuclear safety and radiological protection in Spain, independent from the Government and reporting exclusively to Parliament. In compliance with the commitments adopted during the second review meeting, the licensees of the Spanish nuclear power plants have contributed to the preparation of the report, coordinated by the Spanish Electricity Industry Association (Unesa), along with the Ministry of Industry, Energy and Tourism (Minetur).

The report has been drawn up adhering to the structure agreed to by the General Committee of the fifth review meeting of the Convention on Nuclear Safety. On October 31st 2011, the Secretariat of the IAEA sent an informative e-mail to the national contacts for the Convention on Nuclear Safety, followed on January 18th 2012 by an addendum, including the instructions to be adhered to regarding the content and format of the national report for the aforementioned extraordinary meeting.

In accordance with the provisions of the aforementioned documents, the structure of the national report will be in line with a series of specific subject matters. It will not coincide with the structure of the text of the Convention on Nuclear Safety established in reference document INFCIRC/499 of July 5th 1994, and will not, therefore, adhere to the directives set out in INFCIRC/572/Rev 3 "Guidelines regarding national reports under the Convention on Nuclear Safety", approved during the extraordinary meeting of the Contracting Parties in September 2009.

The subject areas that make up the structure of the national report for the extraordinary meeting of the Convention on Nuclear Safety are as follows:

- Topic 1: External events
- Topic 2: Design aspects
- Topic 3: Severe accident management (in the reactor)
- Topic 4: National organisations
- Topic 5: Emergency preparedness & response and post-accident management (off-site)
- Topic 6: International cooperation.

# General framework for actions carried out in spain following the accident at Fukushima nuclear power plant

As a result of the accident at the Fukushima nuclear power plant, the Spanish plants implemented a set of analysis and reviews to ensure that all the measures in place to respond to events within and beyond the design basis were operable, in accordance with the recommendations of WANO (World Association of Nuclear Operators). On March 25th, the CSN sent a letter to the licensees of the nuclear power plants requesting information on the results of the actions already adopted by them and the performance of measures complementary to those initially implemented.

On May 25th, the CSN approved and sent to all the nuclear power plants a series of Complementary Technical Instructions (CTI's) additional to their Operating Permits, requiring the performance of the stress tests agreed to in the context of the European Union (see Appendix 1). The results report was to include a detailed proposal on the foreseen measures and their scheduling.

These tests consist essentially of a complementary safety analysis including a reassessment of the safety margins of the nuclear power plants in the light of the events that took place at the Fukushima plant in Japan on March 11th 2011.

In keeping with the requirements, the licensees were to analyse for each site the current capacities of the facility to respond to the following events:

- external events: earthquakes, flooding and other natural events.
- Loss of safety functions as a result of loss of the different sources of power supply and of the ultimate heat sink.
- Management of severe accidents affecting the reactor core and of accidents entailing loss of inventory and/or spent fuel pool cooling.

In the event of there being any other type of spent fuel storage facility on the site, the robustness of this installation with respect to the aforementioned external events and loss of functions was also to be assessed.

With a view to harmonising the analyses to be carried out by the Spanish plants to the extent possible and to establishing the content of the reports to be drawn up, several coordination meetings were held between the CSN and the licensees during the months of June and July 2011, along with meetings among the licensees, to address technical aspects relating to the scope of the necessary analyses and the method to be used to perform them. In addition, two joint meetings were held with the plant licensees and the operator of the Spanish electricity grid, Red Eléctrica Española (REE), to review the actions and protocols relating to the reliability of the grid and the capacity to recover the power supply in the scenarios foreseen in the stress tests.

In compliance with the terms established by ENSREG, on September 15th 2011 the CSN drew up an initial report assessing the preliminary analyses *(Progress Reports)* submitted by the licensees on August 15th. Finally, on December 30th 2011, the CSN sent to the European Commission the *Final report assessing the reports on the stress tests submitted by the licensees of the nuclear power plants.*

## I.a. Description of the stress tests

In an initial phase the "Stress Tests" consist of a "targeted" reassessment of the safety margins of the nuclear power plants in the light of the events that took place at Fukushima: extreme natural phenomena that might threaten the Safety functions of the plants and lead to a severe accident situation.

This reassessment consisted of the following:

- An evaluation of the response of a nuclear power plant to a series of extreme situations, and
- Verification of the preventive and mitigating measures selected in accordance with the philosophy of "defence in depth: initiating events, consequent losses of safety functions and severe accident management".

In such extreme situations, a deterministic approach is used in which the sequential loss of the existing lines of defence is assumed, regardless of the probability of occurrence of such loss. Specifically, it should be remembered that the loss of safety functions and the existence of severe accident situations may occur only when numerous design features have failed. Furthermore, it should be assumed that the measures available to adequately manage these situations are lost successively.

This reassessment considers the response of the plant and the effectiveness of the preventive measures, underlining any potential weaknesses and "cliff edge" or limit situations identified in the analyses. These limit situations correspond to those that might induce a significant change in the sequence of events and, where appropriate, in the measures in place to prevent extreme conditions from being reached and might correspond, for example, to exceeding a point at which significant flooding of plant areas above the height of the existing walls or dykes or the depletion of the batteries in the event of total loss of alternating current power might commence. The objective is to assess the robustness of the philosophy of defence in depth and the suitability of the accident management measures applied, as well as to identify the potential for the implementation of technical and organisational safety improvements, such as procedures, human resources, the emergency response organisation or the use of off-site resources.

Given their nature, the Stress Tests should tend to focus on the measures that might be adopted following loss of the safety functions in place to respond to accidents already considered in the design. The adequate operability of these systems has already been verified in connection with the licensing conditions of the plants. Hypotheses relating to their operation should be reassessed as part of the Stress Tests and presented as already existing measures. Finally, it is important to recognise that all the measures adopted to protect the reactor or the integrity of the spent fuel pools constitute an essential part of "defence in depth" and that it is always better to prevent accidents from occurring than to manage their consequences.

## I.b. Process applied by the licensees

The analyses performed by the licensees are being carried out in accordance with the following plan:

- Verification of compliance by the facility with the design basis in areas covered by the scope of the stress tests, assessing the suitability of this design basis in the light of currently available technical know-how.
- Evaluation of the response of each facility to a series of extreme situations beyond the design basis, in an attempt to assess the available safety margins, identify those cliff edge situations that might unleash extreme accident sequences and analyse the expected performance of the facility.
- Verify the existence of adequate preventive and mitigating measures and, where necessary, propose the incorporation of improvements appropriate for the situations identified.

For each of the events proposed an analysis has been performed of the current capacities of each plant to respond, as regards both design and organisation, and an attempt made to identify the autonomy (timeframes available) to address the loss of safety functions and the

resources required to prevent a serious accident from having unacceptable consequences for the population.

These assessments are being undertaken by adhering to the philosophy of *defence in depth* proposed in the ENSREG document, adopting a deterministic approach in which the sequential loss of the existing lines of defence is assumed, regardless of its probability of occurrence.

The ultimate objective set out by the licensees in their reports is to confirm the degree of robustness of the plants in response to the situations proposed and the suitability of the existing accident management measures, and finally to identify the potential applicable improvements as regards both equipment (fixed and portable) and organisational issues: procedures, human resources, the emergency response organisation and the use of off-site resources.

## I.c. Process adhered to by the regulatory body

The CSN has published a specific assessment guideline detailing the methodology to be applied, the organisational units responsible for each part of the process, the interactions between them and the foreseen schedule. In addition, and in view of the limitations on available time, weekly coordination meetings have been held to discuss the preliminary conclusions obtained by the different organisational units.

The CSN evaluation has consisted of reviewing the documentation submitted by the licensees, focussing on the following aspects:

- Verification that the analyses submitted by the licensees completely covers the scope required by the CSN CTI's establishing the need to perform the stress tests, a differentiation being made between those areas in which the licensee has completed the studies foreseen and describes the corresponding improvement actions and those others that are pending or in the performance phase. Also identified are those areas that are not mentioned in the licensees' reports 'and that must be analysed, the aim being to guarantee that the analyses of the stress tests performed at the Spanish plants are complete and, to the extent reasonably possible, homogeneous.
- Verification that the analyses have been performed in a coherent and systematic manner, with a view to identifying and establishing the importance of potential weaknesses or opportunities for improvement.
- Evaluation of the hypotheses and analytical methods used by the licensees in their reports, checking that these coincide with the scope and contents mapped out for the stress tests.
- Verification that the licensees' reports have contemplated the possible cliff edge situations for all the aspects analysed. As regards this verification, the situations considered to be applicable are those that, despite their very low probability of occurrence, cannot be ruled out as being impossible.
- Verification that, for all the aspects studied and in accordance with the results of the analyses, the reports analyse the advisability or need to reinforce the existing capacities, both design-related and organisational, checking that a reasoned justification for the conclusions drawn in this respect is provided.
- Evaluation of the feasibility and reliability of the recovery and mitigation actions referred to in the licensees' reports. This means that, where applicable, the performance of specific tests and the drawing up of the corresponding written procedures have been verified.

The information submitted has been contrasted with the licensing documentation and other information available at the CSN, as well as with the results of inspections performed previously.

In addition to the evaluation, the CSN has held a series of technical meetings with the licensees and has carried out a total 24 inspections (four at each of the operating nuclear power plants), during which various aspects of the contents of the final reports of the licensees were checked, among them the capacity of the plants to respond to the following:

- Earthquakes (determination of seismic margins).
- Potential on-site flooding caused by earthquakes.
- Loss of off-site power events.
- Events entailing loss of heat sink.
- Severe accidents in the reactor.
- Accidents in spent fuel pools.

The CSN has not been able to complete the review of certain detailed aspects in the time available within the programme of stress tests, for which reason the organisation has continued to work on these issues and to carry out the checks that it has considered to be necessary. Likewise, the licensees will have to carry out certain complementary studies and design the proposed modifications in detail. In addition, the new information acquired on what happened at Fukushima may give rise to new safety improvements to be implemented at the nuclear power plants.

The general conclusions of the CSN analysis are set out below:

1. The CSN has verified that the reports submitted by the licensees have been drawn up in accordance with the stress test specifications prepared by WENRA/ENSREG and that they provide an adequate response to the corresponding Complementary Technical Instructions (CTI's) issued by the CSN.
2. The CSN evaluation has not identified any aspect that might imply a relevant weakness as regards the safety of these facilities and that might require the urgent adoption of measures, or even their immediate shutdown.
3. The licensees' reports conclude that the design and licensing bases established for each facility are currently being met. The CSN has not now performed a detailed evaluation of each and every one of the analyses relating to this issue since the verification of these aspects is part of its continuous supervision and control programme.
4. The scope of the descriptions, analyses and proposals submitted by the licensees is considered adequate. However, in the paragraph dedicated to external events, design aspects and severe accidents management (on reactor) specific aspects have been identified that the licensees should complete, adopting the pertinent measures where appropriate.

On March 14th 2012 the CSN approved, and subsequently sent to each licensee, a Complementary Technical Instruction setting out the conclusions drawn and including the proposals for improvement, other aspects identified in the CSN evaluations and additional analyses and other improvements considered by the CSN to be necessary. Also included have been the associated periods for implementation and, in addition, the requirement that a detailed schedule of the process of implementation of the improvements be identified within 6 months, this to include both the proposals committed to in the final stress test report presented by each plant and those additionally requested by the CSN.

All the modifications to be incorporated at the facility, including the use of portable equipment, shall be accompanied by the development (or adaptation) of the corresponding operating procedures, which shall be verified and validated by the licensees prior to their formal implementation. Furthermore, the personnel assigned to the operation of the new equipment shall receive initial and on-going training on its use. Each licensee shall check that the new equipment is designed to maintain its capacity under the conditions associated with the events

it is required to respond to. The portable equipment shall be stored in areas or buildings to which access is guaranteed for the personnel in charge of the management of emergencies on the site and that cannot be affected by the events in question. The licensees shall set up a specific periodic surveillance and testing programme for this equipment. The evaluations of the stress tests presented by the licensees have been addressed internally by the CSN without the need for external technical support, although there has been occasional collaboration from the operator of the Spanish electricity grid, Red Eléctrica de España (REE), and the Centre for Public Works Studies and Experimentation (Cedex), a public organisation of recognised solvency reporting to the Ministry of Public Works, for the evaluation of issues relating to off-site flooding. In this last case, the advisory services provided have focussed on the analyses submitted by the licensees of the resistance capacity of the dams located upstream in the river basins in which the facilities are located and their consequences in terms of flooding in the areas surrounding the sites.

# Topic 1: External events

## 1. Brief description of the analyses performed

The reports submitted by the licensees in response to the CTI of May 25th 2011 cover the verification of the following three aspects:

- The provisions included in the plant design basis and compliance by the latter with the design requirements.
- The strong points of the plant beyond the design basis. For this purpose the robustness (available design margins, diversity, redundancy, structural protection, physical separation, etc.) of the safety-significant structures, systems and components (SSC) and the effectiveness of the concept of "defence in depth" have been evaluated.

  As regards the robustness of the installations and available measures, one of the focal points of the review has been the identification of possible "cliff edge situations" that might lead to a significant change in the sequence of events and, where appropriate, of the measures already in place to prevent extreme conditions from arising.
- The possibility of implementing modifications that might improve the current level of defence in depth in terms of improving the resistance of the components or of strengthening independence with respect to the other levels of defence.

Furthermore, with a view to providing a context for these stress tests, the licensees analysed the status of the existing protection measures in place to prevent the extreme situations considered within the scope of these tests. Where necessary, this analysis was completed with the results of the specific plant walkdowns performed.

## 2. Activities performed by the licensees

### 2.a. Brief description of actions performed or planned

#### 2.a.1. Earthquakes

All the plants have revised their structures, systems and components design bases with regard to earthquakes. The conclusions drawn by the licensees indicate that these design bases are adequately fulfilled. In addition, the licensees have reviewed the data on the earthquakes that have occurred in the vicinity of the plants from the cut-off date considered in the studies for definition of the design basis earthquake to the first six months of 2011, and have concluded that, using the methodology applied in the initial studies, the values initially adopted continue to be valid, these being between 0.1g and 0.2g.

The licensees' reports include an analysis of the possible indirect effects induced by an earthquake inside the facility; in this respect, consideration has been given to explosions and fires, as well as to on-site flooding caused by pipe breaks.

As part of the IPEEE *(Individual Plant Examinations for External Events)* analyses performed in the 1990's, the licensees checked whether in the case of two initiating events induced by an earthquake (loss of off-site power and small LOCA) it was possible to assign a seismic margin equal to or greater than 0.3g to the SSC's on two different paths required to reach and maintain

safe shutdown (for 72 hours), including the functions of long-term emergency core cooling and containment isolation. Otherwise, the licensees proposed additional measures to meet this objective.

Within the stress test programme, the scope of the seismic margin analyses has been extended to include the SSC's necessary to guarantee spent fuel pool integrity and cooling. Also, among the measures aimed at guaranteeing greater plant robustness in response to seismic events, the licensees have reviewed or proposed the review of the margins of the equipment used respond to Station Blackout (SBO) and severe accident situations. In all these cases the licensees have verified the possibility of assigning a seismic margin equal to or greater than 0.3g to these SSC's or, otherwise, have scheduled the additional measures necessary for compliance.

Another aspect analysed by the licensees has been the possible loss of water from the spent fuel pool, or from the heat sink tanks where applicable, as a result of the movement of the water caused by an earthquake (sloshing), the conclusion being that for the earthquake intensity considered, both the design basis earthquake (DBE) and the seismic margin of 0.3g, this effect would not be relevant in any case.

In those cases in which the plant is located in a river basin with dams upstream of the site, the licensees have performed an analysis of the structural resistance of these dams in order to verify their capacity to withstand an earthquake of the same intensity as the plant design basis earthquake. An analysis has also been performed to determine the capacity of these dams to withstand larger earthquakes, and the seismic margins available for each dam have been quantified.

Complementary to the above, the licensees have analysed the consequences for the site of rupturing of these dams. In this respect they have evaluated the propagation of the flood that might be caused by such rupturing to the site of the nuclear power plant, with a view to determining the maximum credible level of flooding at the plant for this cause and the time that the peak maximum flow would take to arrive.

In the case of tsunami, the only Spanish plant that is located on the coast has a very high level of protection, since its safety systems are located at more than 20 metres above sea level.

### 2.a.2. Flooding

All the plants have reviewed their design bases with respect to floods caused by natural external events. The conclusions drawn by the licensees indicate that these bases are adequately met. In addition, the licensees have assessed the extent to which these bases coincide with the current understanding of these phenomena, the conclusion being that the magnitude of the design basis flooding (DBF) chosen continues to be valid.

In addition to the analyses of floods caused by the rupturing of dams addressed in the previous section, the review studies also contemplate flooding as a result of other causes, such as intense local rainfall, the overflowing or rivers and ravines, tsunamis, waves and increasing sea levels and groundwaters. These analyses study the maximum event expected and also the existing safety margins, establishing various proposals for improvement applicable in each case.

### 2.a.3. Other natural events

The analyses performed by the licensees are based on a preliminary probabilistic screening process in which use was made of the results available from the IPEEE's to attempt to determine what external events other than earthquakes and flooding might have an impact on safety at each site. Consideration was given to the following external events, among others: strong winds, electrical storms, hail, snowfall, extreme temperatures (high and low), ice, drought and forest fires.

For each of these events the licensees have reviewed the original design basis and have checked that the plant structures and components in outdoor areas are adequately designed. In addition, attempts have been made to verify the existence of safety margins beyond the design basis for the events considered to be credible at each site, and various reinforcement measures have been established for implementation.

## 2.b. Presentation of foreseen actions and schedule for implementation

The activities planned by the licensees of the Spanish nuclear power plants are presented below (they refer to initiatives undertaken by the industry and committed to by more than one plant), along with the term for implementation[1]:

### 2.b.1. Earthquakes

- Analysis of SSC seismic margins and definition of feasible actions improving their seismic performance, with a view to having available a margin of around 0.3 g (short term).
- Design modifications to improve the seismic resistance of the plant SSC's to around 0.3 g, implementing the necessary modifications on SSC's with lower values or undertaking their replacement (short/medium term).

### 2.b.2. Flooding

- Analysis of the site using current models of the natural features of the terrain (ravines, slopes, terraces, etc.) in order to define potential improvement actions (short term).
- Analysis of the site drains network, in order to identify possible improvement actions (short term).
- Resolution of vulnerabilities already encountered and implementation of improvements identified in the study of flooding on site, aimed at reinforcing the leaktightness of doors and buildings and the capacity of drains and overflows (short/medium term).

### 2.b.3. Other natural events

- Specific reassessment of external natural events (hail, extreme temperatures and lightning strikes) and subsequent implementation of improvement actions (short/medium term).

## 2.c. Results of licensees' actions, including proposed activities

Summarised below are examples of the generic improvement actions identified by the licensees and the evaluations performed and completed by the CSN:

- Verifications and reviews of the measures in place to respond to off-site events, in accordance with the recommendations of the World Association of Nuclear Operators (WANO).
- Review of the design basis earthquake.
- Analysis of beyond design basis SSC seismic margins to 0.3g.
- Analysis of the licensing basis against on-site flooding caused by earthquakes.
- Other effects induced by earthquakes and caused by nearby industrial facilities.
- Analysis of the design basis regarding off-site flooding.

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1 — Short term: performance prior to the end of 2012.
— Medium term: performance between 2013 and 2014.
— Long term: performance between 2015 and 2016 (the term may exceptionally be extended if duly justified).

- Analysis of safety margins with respect to flooding precursor events beyond the design basis.
- Analysis of the consequences of dam rupture.
- Specific reassessment of external natural events (hail, extreme temperatures and lightning strikes).

# 3. Activities performed by the regulator

## 3.a. Brief description of activities performed

### 3.a.1. Earthquakes

As regards the safety margins with respect to the occurrence of earthquakes, the work was based on the fact that seismic IPEEE analyses were already available in Spain for all the operating plants. The IPEEE analyses are oriented towards the identification of plant vulnerabilities to beyond design basis off-site events. In accordance with the seismic margin methodologies applied (EPRI and USNRC), the objective has been to determine the so-called "high confidence low probability of failure" (HCLPF) plant seismic capacity. For this purpose, in the initial analyses the CSN established a Review Level Earthquake (RLE) corresponding to a maximum horizontal acceleration of the ground of 0.3g (considered to be an adequate review margin for all the plants regardless of their seismic design basis), compliance with this value not being required.

Taking into account the progress made in recent years in site seismic characterisation methods and in view of the international experience gleaned, the CSN is considering the initiation of a programme to update seismic hazard in accordance with the most recent IAEA standards.

The scope contemplated by the CSN for the analyses was as follows:

- Fires and explosions: identification of the design basis of the facility regarding protection against fires or explosions caused by an earthquake; identification of stores for combustible or explosive material at the plant, with an analysis of their seismic capacity and definition of feasible actions to improve their seismic performance where possible. In those cases in which an adequate seismic margin cannot be justified, a check is made to ensure that the potential effects cannot affect the capacity to reach and maintain the safe shutdown of the plant and that they do not cause unacceptable off-site radiological consequences.
- On-site flooding: identification of the design basis of the facility regarding compliance with protection against on-site flooding resulting from an earthquake. Analysis of non-Seismic Category I sources of flooding (both tanks and piping), identifying flooding barriers against ruptures and analysing their performance in the event of an earthquake. Use of probabilistic safety assessment (PSA) for flooding in order to identify ruptures likely to generate initiating events and affect mitigation systems, with a view to identifying flooding sources and barriers against them and to including them in the seismic margin review walkdowns.
- Identification of possible flooding scenarios caused by the failure of structures or components that, while being seismic category I, contain or channel large masses of water that might cause effects not previously analysed and affect other buildings (for example galleries containing cooling system pipes taking suction from pools) and evaluation from the seismic point of view of the existing protective barriers against such flooding.

### 3.a.2. Flooding

The CSN analysis required the evaluation of the NPP design bases, with the following scope:

- Maximum flood against which the plant was designed.

- Arrangements to protect the plant against the design basis flood (DBF).
- Plant compliance with the current licensing basis.

In addition, consideration was to be given to the assessment of the available margins, including the level of flooding that the plant could withstand without suffering severe fuel damage.

### 3.a.3. Other natural events

The technical scope of the stress tests included the addressing of extreme natural events other than earthquakes and flooding and with a magnitude higher than that considered previously as part of the credible initiating events on the site.

## 3.b. Schedule of regulator's activities

On December 30th 2011, the CSN submitted to the European Commission the *Final report on the stress tests performed at the Spanish nuclear power plants,* in which it evaluated the results presented by the licensees and the proposals for improvement to be carried out.

In addition, on March 14th 2012, the CSN sent a complementary technical instruction (CTI) to each nuclear power plant licensee with the conclusions drawn from the evaluation of the stress tests, including proposals for improvement, other aspects identified in the CSN's evaluation and the additional analyses or other improvements that the CSN considers necessary, along with the associated terms for implementation.

As the established terms (short/medium/long) unfold, the CSN will supervise and evaluate the measures proposed and actions for improvement.

## 3.c. Regulator's conclusions regarding the results of the licensees' actions

1. The CSN has evaluated the final reports submitted by the licensees of the Spanish nuclear power plants within the framework of the programme of stress tests performed at European level, including the performance of 24 inspections aimed at verifying certain aspects of the issues reviewed. The conclusions drawn from the evaluation performed by this organisation with respect to extreme off-site events are set out below, along with the periods for completion of the studies or additional measures to be implemented where appropriate. The design basis earthquake for each facility has been reviewed on the basis of data on the earthquakes that have occurred from the cut-off date considered in the original design to the first half of 2011, using the methodology applied in the initial studies for the licensing of the facilities. As a result of this review, it is concluded that the value of the design basis earthquake adopted continues to be valid in all cases.
2. In view of the progress that has been made in the site seismic characterisation studies, the CSN is considering addressing a programme for the updating of these studies, in accordance with the most recent IAEA standards.
3. Analysis of seismic margins beyond the design basis:
   - The licensees have based their analyses on the availability of previous seismic margin studies, required by the CSN, with a reference earthquake corresponding to a maximum horizontal acceleration of the ground of 0.3 g, this being considered an adequate margin for review for all the Spanish plants, regardless of their seismic Design Basis (which in the case of the Spanish plants is between 0.1g and 0.2g). The scope of these studies centred on the resistance capacity of the structures, systems and components necessary to reach safe shutdown and maintain the integrity of the Containment Building, and included a comparison of this resistance with the reference earthquake of 0.3g, without the requirement that they all achieve this value.

- In the current review of these studies, carried out within the context of the stress tests, the licensees propose the implementation of the improvement actions necessary to reach this objective. The CSN has required that the analyses be completed in the short term and that all the necessary modifications be implemented in the medium term.
- Also within this context, the licensees have extended the scope of the seismic margin analyses to include the structures, systems and components in place to respond to a complete loss of power supply, in order to mitigate the consequences of severe accidents and maintain the "confinement" function of both the Containment Building and the Spent Fuel Pool, along with the corresponding cooling. The CSN has required that these analyses be completed in the short term.
- With a view to achieving this seismic margin objective, the licensees have submitted proposals for the reinforcement of certain structures and components that presented lower margins, the CSN having required that this be carried out in the short term.
- Revision of the seismic IPEEE report to include the results of the new analyses and actions performed. This revision is to be completed within six months of the implementation of the design modifications required to achieve the seismic margin objective mapped out (0.3 g).

Following performance of the evaluation, the CSN considers that in general the licensees' analyses and proposals are adequate; nevertheless, there are certain aspects that are still in the review phase.

4. As regards the licensing bases against on-site flooding caused by earthquakes, the CSN has identified a certain scattering of the reference standards used by the different plants, for which reason it will require the licensees to modify these bases in order to fit in with the most updated international standards, which explicitly contemplate the consideration of earthquakes in the design analyses for protection against the consequences of rupturing.
5. The licensees have analysed other effects induced by earthquakes, such as the fires, explosions and on-site flooding that might occur at the plants, along with those caused by nearby industrial facilities. Barriers and protective actions are identified in all cases, although in certain cases the studies of on-site flooding should be completed and the corresponding measures adopted.

   As regards the aforementioned equipment and structures, consideration should be given to the following: the barriers against the effects of flooding (drains, drains non-return valves, etc.) and the instrumentation for its detection, as well as the tripping of non-seismically qualified pumps belonging to systems whose rupturing as a result of an earthquake might cause flooding.

   - In relation to the indirect effects that might be induced by an earthquake, the plants should analyse the circumferential rupturing of piping that is not Seismic Category 1 (SC-1), bearing in mind that for the mitigation of the consequences of possible flooding credit may be given only to the available barriers (protection instrumentation and alarms, drains, check valves, etc.) that are also SC-1. The analysis should be completed before December 31st 2012 and the measures deriving therefrom incorporated in the medium term, except for those whose scope or complexity justifies their being extended to the long term.
   - Extension of the scope of the analysis of SC-1 piping seismic margins and analysis of the response to earthquakes of non SC-1 piping, in order to take into account those that might cause an initiating event and the loss of mitigation systems and that have not already been included in the analyses performed. The analysis should be completed before December 31st 2012 and the measures deriving therefrom incorporated in the medium term.
   - Analysis of rupture scenarios implying major releases of fluid at the facility, with a view to determining whether an adequate detection capacity and barriers are available to

address such scenarios. The analysis should be completed before December 31st 2012 and the measures deriving therefrom incorporated in the medium term.

6. The licensees have checked the suitability of the design basis with respect to off-site flooding, including the hydrological and meteorological data recorded at each site throughout the entire operating period, and have concluded that the levels of flooding adopted as the design basis continue to be valid.

   - They have also analysed the safety margins with respect to events that might give rise to levels of flooding beyond the design basis. The most critical events correspond to the potential rupturing of upstream dams. In all cases these dams have been determined to withstand earthquakes larger than those adopted as the seismic design basis for each site and the seismic margins have been quantified. In addition, the licensees have analysed the consequences of dam rupturing, concluding that the levels of flooding that would be reached at the plants affected by such events would remain below the elevation of the base level terrace.

   - The evaluation performed by the CSN, which has received technical support by Cedex, concludes that the analyses presented are considered valid and make a justified estimate of margins beyond the design basis for aspects relating to dam rupturing. Nevertheless, the approaches adopted in the analyses submitted differ from those adopted in the emergency plans of the dams, for which reason the actions required for these approaches to be adequately brought into line should be carried out. As a result of these actions, the licensees should revise the studies performed and contemplate the measures deriving therefrom in the short term.

   - The CSN has also required specific measures for each plant relating to the drainage capacity of dams and the rainwater network, and analysis of the local rising of the water table, the channelling of ravines, the surveillance of groundwaters, the sealing of building penetrations, etc. The periods for performance vary between the short and medium term depending on the facility and on the specific measures.

   The CSN considers the rest of the reinforcement measures relating to off-site flooding proposed in the licensees' reports to be adequate.

7. As regards other natural external events, the licensees have carried out a specific reassessment of this type of situations. In this respect they have used a preliminary screening process based on a probabilistic methodology, ruling out those events that have a probability of occurrence of less than once every hundred thousand years and determining the safety margins existing beyond the design basis. In addition they have increased the scope of the events considered to include those that were previously ruled out during screening but that are credible at each site. Finally, they have considered various reinforcement measures for implementation.

The CSN has required the licensees to adequately complete the analyses performed regarding the potential impacts on safety of certain possible combinations of natural events that might be considered credible at their sites, such as wet snowfall coinciding with strong winds, or wind and hail, or to justify such phenomena not being credible at the site. This is to be performed in the short term. For certain facilities the CSN has concluded that it is necessary for the licensees to complete the actions foreseen in the studies on the extreme temperatures that might be reached at the site and to increase protection against lightning; this is to be completed in the short or medium term depending on the facility.

Furthermore, in 2010 the CSN undertook a specific study on the climatology of tornados in areas close to nuclear facilities, this study not yet having been completed. The CSN will require the licensees to carry out the studies considered to be appropriate in each case depending on the results obtained from this currently on-going study.

Topic 1: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c.

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 1 – External Events | | | | | | |
| Revision of design basis earthquake | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Site seismic characterisation studies, in accordance with new IAEA standards | Pending regulator's conclusions | N/A | N/A | Under consideration | Pending | No |
| Analysis of SSC seismic margins beyond the design basis up to 0.3g | Analysis performed | N/A | N/A | Evaluated | N/A | Yes |
| | Derived design modifications | Short/med. term | Yes | Pending evaluation of request for authorisation by licensee, if necessary | Medium term | No |
| Extension of scope of SSC seismic margins in response to postulated accidents in Containment Building and Spent Fuel Pool | Planned | Short/med. term | Yes | Pending licensees' proposals | Short term | No |
| Revision of seismic IPEEE report to include the results of new analyses and actions performed. | Planned | 6 months after implementation of MDs to achieve seismic margin objective (0.3 g) | No | Required by CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| Analysis of licensing bases against on-site flooding due to earthquakes | Performed | N/A | Yes | Evaluated | N/A | Yes |

Topic 1: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 1 – External Events | | | | | | |
| In relation to indirect effects induced by earthquakes, analysis of circumferential rupturing of non-Seismic Category 1 (SC-1) pipes | Planned | Prior to 31/12/12 and measures derived in medium term | No | Required by CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| In relation to indirect effects induced by earthquakes, extension of the scope of seismic margin analysis in SC-1 piping and analysis of the response to seismic events of non SC-1 piping, in order to take into account those that might cause an initiating event and the loss of mitigation systems and that have not been included in previous analyses. | Planned | Prior to 31/12/12 and measures derived in medium term | No | Required by CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| In relation to indirect effects induced by earthquakes, analysis of rupture scenarios implying major releases of fluid at the facility, in order to determine the existence of an adequate detection capacity and barriers to address such scenarios. | Planned | Prior to 31/12/12 and measures derived in medium term | No | Required by CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |

Topic 1: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 1 – External Events | | | | | | |
| Other effects induced by earthquakes and those caused by nearby industrial facilities | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of off-site flooding design basis | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of safety margins to flooding precursor events beyond the design basis | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of the site using current models of the natural features of the terrain (ravines, slopes, terraces, etc.) | Definition of potential improvement actions planned | Short term | No | Required by CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| Resolution of vulnerabilities encountered and implementation of improvements identified in study of flooding | Reinforcement of leaktightness of doors and buildings and capacity of drains and overflows planned | Short/med. term | No | Required by CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| Analysis of consequences of dam rupture | Performed | N/A | Yes | Evaluated | N/A | Yes |

Topic 1: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 1 – External Events | | | | | | |
| Revision of dam rupturing scenarios with those contained in the dam emergency plan for harmonisation and suggested measures for improvement | Planned | Short term | No | Required by CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| Specific reassessment of natural external events (hail, extreme temperatures and lightning strikes) | Performed | Consideration of reinforcement measures to be implemented | Yes | Completed | Analysis completed with other possible combinations | Yes |
| Completion of analyses of certain possible combinations of credible natural events, such as wet snowfall coinciding with strong winds, or wind and hail, or justification of these phenomena not being credible at the site. | Planned | Short term | No | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| Conclusions of stress test report evaluations | On-going | In accordance with terms of CTI | On-going | CSN CTI issued on March 14th | Completed | Yes |

# Topic 2: Design aspects

## 1. Brief description of analyses performed

The reports submitted by the plants in response to the CTI issued on May 25th 2011 contain a detailed summary of the alternating current power supply systems, including the distribution networks and on and off-site sources. They also describe in detail the sequences that might occur in the event of a successive loss of off-site power (LOOP) and of the emergency and auxiliary sources of alternating current on site, or station blackout (SBO), the times available for action to be taken and the action procedures applicable. In all cases an analysis of battery depletion is also included.

The licensees' reports also analyse scenarios of successive loss of the different heat sinks and their possible consequences, along with the simultaneous loss of power supply.

In addition, the licensees identify the normal and alternative means available for the cooling of and the supply of water to the spent fuel pools (SFP) and the strategies in place to address their loss, as well as aspects relating to the loss of radiological shielding that a drop in the water level in the pools would imply.

### 1.a. Loss of power supply

For the design of the electrical systems of American design plants, the CSN originally considered the criteria contained in the USNRC standards to be applicable. Among these, and as regards the de4sign of these systems, mention may be made of General Design Criterion number 17 (*Electric power systems*), Regulatory Guide 1.9 (*Application and Testing of Safety-Related Diesel Generators in Nuclear Power Plants*) and IEEE Std 387, *Standard Criteria for Diesel-Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations,* Regulatory Guide 1.32 (*Criteria for power systems for Nuclear Power Plants*) and IEEE Std 308, Criteria for Class 1E *Power Systems for Nuclear Power Generating Stations.* For Station Blackout (SBO), the contents of 10CFR50.63 (*Loss of all alternating current power*) and of Regulatory Guide 1.155 (*Station Blackout*) were applied.

### 1.b. Loss of off-site power (LOOP)

The loss of off-site power is an event that is contemplated in the design basis of the Spanish nuclear power plants. The additional loss of the safeguards diesel generators is also contemplated in the design basis of the five Spanish nuclear power plants of American design, since this event was included as an extension of the initial design basis during the process of compliance with the regulations on Station Blackout (SBO) required of the plants by the CSN. As in Germany, in the case of the Trillo plant the SBO event was addressed within the general framework of requirements to reduce the vulnerability of this type of plants to severe accidents.

As regards the resistance capacity of the exterior feed lines, the criteria are equally applicable to all the supply networks of the Spanish plants, in accordance with the information provided by Red Eléctrica de España (REE), the grid operator. The objective of the hypotheses currently applicable in Spain in the design of pylons, cables and all types of accessories for overhead high voltage lines is to avoid failures under adverse weather conditions (wind, ice), but not in the event of earthquakes; nevertheless, the design relating to loads caused by wind

and ice do provide a significant mechanical resistance. In summary, these hypotheses are as follows:

- Loads due to 120 km/h winds (in accordance with 1968 regulation).
- Loads due to 140 km/h winds (in accordance with 2008 regulation).
- Loads caused by sleeves of ice.
- Combined wind and ice loads (in accordance with 2008regulation).

The extraordinary meteorological phenomena recorded to date in Spain have had little effect on the transmission network. Furthermore, the existence in the country of an important grid mesh configuration and rigorous operating criteria significantly reduces the risk of loss of power supply in the event of failure of any of the network components.

As regards the reliability of the grid and of the lines supplying electricity to the plants, a process was initiated in Spain for application of the NRC's Generic Letter 2006-02, (*Grid reliability and the impact on plant risk and the operability of offsite power*), a mixed working group being set up in 2006 between the CSN, REE and Unesa (the association of the Spanish electricity utilities). The work performed by this group led to an action plan having the dual objective of establishing a protocol for communication on the status of the grid at all times and of updating the dynamic grid stability analyses performed for each plant in the 1990's, within the framework of the so-called Escenred Project.

As a result of the Escenred Project updating work, the analyses of the stability of the grid and of interactions with each plant have been revised, using updated models of the plant components and the forecasts regarding the topology and distribution of generation for 2011. Severe contingencies were simulated (nearby three-phase short-circuiting, with the failure of protections or grid outages and losses of generation) and REE and the engineering departments of each plant jointly analysed the performance of the grid and off-site feeds, taking into account the settings of the protections for the internal systems of the plant. In the analyses performed at each plant, special emphasis was laid on the performance of the preferential off-site feed sources. The work of this group is expected to be completed in the near future.

For the response to a situation of zero voltage on the grid, REE has procedures for recovery of the service that give priority to providing electrical feed to the nuclear power plants. The replacement of the electrical feeds to the switchyards of the nuclear plants would be achieved preferentially from autonomous start-up hydroelectric stations located in the vicinity of each of the nuclear facilities.

## 1.c. Station blackout (SBO)

The standards in force in Spain for SBO at plants of American design contemplate a period of time known as the coping duration, which may be 2, 4, 8 or 16 hours, which is established on the basis of three parameters: susceptibility to loss of off-site power (due to atmospheric characteristics and the characteristics of the grid and switchyard), the degree of redundancy of the on-site emergency sources of a.c. power (diesel generators) and the level of reliability of these diesel generators. In establishing this period, consideration was originally given to the suitability of the plant response, taking into account the following aspects: the availability of condensate water, the capacity of the batteries, the availability of compressed air, loss of ventilation, containment integrity and the capacity to maintain primary system inventory. All the above was to be considered after having selected one of the two following basic options:

- Option 1, independence from alternating current: i.e., by means of systems whose operation does not require an alternating current power supply.

- Option 2, availability of an alternative source of a.c. power (generally known as the SBO diesel generator) for the feed of certain systems.

In the case of the Trillo plant, whose Nuclear steam supply system (NSSS) was supplied by the German company Siemens-KWU, the design includes four safeguards diesel generators and four emergency diesel generators, and is developed in compliance with the applicable KTA standards and with the improvements defined by the German RSK to reduce the vulnerability of the plants to severe accidents; the capacity to "bleed and feed" the secondary system is currently available and the capacity to "bleed and feed" the primary is in the design phase, with implementationscheduled for the year 2013.

# 2. Activities performed by the licensees

## 2.a. Brief description of actions performed or planned

In addition to what is required by the CSN in its CTI's, the reports of the licensees analyse the scenarios that would occur in the event of depletion of the batteries and complete loss of d.c. power, detailing the manual actions that might be performed and the improvements proposed to reinforce the capacities to respond to this situation.

The licensees have analysed the available electrical feeds and the existing interconnections with the external grid, concluding that they provide a high degree of robustness and reliability. The procedures of the operator of the grid assign priority to providing feed for the nuclear power plants, with preferential feed from nearby hydroelectric stations.

In the event of loss of off-site power, the plants have feed for the safeguards systems by means of emergency diesel generators, which meet the requirements established by the standards in terms of redundancy and physical separation. The autonomy of these diesel generators is 7 days.

The aforementioned characteristics are part of the plant design basis and have been evaluated and inspected within the framework of the CSN's habitual supervision processes, for which reason they are considered to be acceptable.

For a situation of prolonged station blackout (loss of on and off-site power), the licensees set out the sequence of events and safety functions required, specifying the limit situations and the times in which degradation of the core or the loss of containment integrity would occur, considering only the equipment currently existing at the plant.

The licensees have analysed the loss of d.c. power beyond the scope set out in the stress tests, which only required this loss to be valued after the autonomy of the batteries had elapsed. In this respect the loss of d.c. power has been analysed from the very first moment without any credit given to the autonomy of the batteries, assessing the possibilities of maintaining the plant in a stable condition by means of local manual actions. In those cases in which their feasibility has been demonstrated, these manual actions constitute a strength of the plants, although they are not expected to be used, both because the event assumed is highly improbable and because portable electrical generators would be available.

As regards loss of heat sink, the licensees' reports first identify the different sinks in place at the facilities and their most relevant design characteristics. The reports then go on to analyse the successive loss of these heat sinks and possible consequences, including the systems in place to maintain the plant in a safe condition and the times available to implement applicable actions.

The analyses carried out by the licensees conclude that these scenarios are included in the envelope of the station blackout (loss of on and off-site power) scenario, for which reason the improvements proposed for that event also cover this eventuality.

All the licensees analyse in their reports the simultaneous loss of power and heat sink. The general conclusion drawn by the licensees is that this situation is included in the envelope of the complete loss of power scenarios, as a result of which the improvement actions for potential limit situations are the same as those described for these scenarios.

The spent fuel pool (SFP) cooling systems and the strategies in place to address their loss have been analysed, as well as aspects relating to the loss of radiological shielding that would be implied by the drop in pool water level.

The licensees identify the normal and alternative means available for the cooling of and supply of water to the spent fuel pools. They also submit an analysis of the times available to boiling and to different levels of water being reached (up to uncovering of the fuel assemblies) in the event of total loss of cooling and for different thermal loads in the SFP. Also analysed has been the problem of the possible return to criticality of the fuel, if the pools contain borated water and replacement had to be carried out using non-borated water.

## 2.b. Presentation of foreseen actions and schedule for implementation

The activities planned by the licensees of the Spanish nuclear power plants are presented below (they refer to initiatives undertaken by the industry and committed to by more than one plant), along with the term for implementation[2].

In their reports, all the licensees propose additional measures to improve the robustness of the plants for loss of power scenarios, the objective being to have available a complete autonomy to address this type of events for at least 24 hours with the equipment existing on the site, and 72 hours using only light equipment brought in from outside. Also relevant are the measures proposed to improve the capacity to recover the off-site power supply from nearby hydroelectric stations and to reinforce the on-site supply using autonomous equipment.

A noteworthy aspect is the inclusion of measures to reinforce the supply of d.c. power to the controls and instrumentation required to maintain the plant safety conditions in this situation. Additional measures are proposed to extend the time to depletion of the batteries and address situations including their total loss at instant zero.The licensees point out that the corresponding action procedures will be developed in association with these improvements and that the personnel will be suitably trained to perform them.

The following improvement proposals are applicable to all the facilities:

- Improvement of the protocols for dedicated electrical supply to the site from nearby hydroelectric stations and performance of periodic tests in this respect (short/medium term).
- Availability on the site of autonomous electrical generators (long term).
- Analysis, and where appropriate to develop procedures and testing, of the capacity to feed the primary/secondary via the turbine-driven pumps (if included in the design of the plant), even in the event of d.c. power not being available for their control (short term).
- Availability on site of autonomous motor-driven pumps for the injection of water to the primary and/or secondary and to be able to provide the make-up of water or fuel to critical tanks (short/medium term).
- Additional portable instrumentation for performance of the necessary manual control manoeuvres in the event of total loss of the batteries (medium term).

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2 — Short term: performance prior to the end of 2012.
— Medium term: performance between 2013 and 2014.
— Long term: performance between 2015 and 2016 (the term may exceptionally be extended if duly justified).

- Improvements to the communications systems (external and internal) to respond to events implying loss of the corresponding electrical feed systems (short term).
- Improvements to the lighting systems to address prolonged loss of electrical feed events (short/medium term).
- Design modifications required to provide connection points for autonomous electrical and mechanical equipment (short/medium term).
- Measures to reinforce the supply of d.c. power to the controls and instrumentation required to maintain the plant safety conditions in this situation (short/medium term).

In the reports submitted the licensees propose improvements to strengthen the response of the plants to scenarios of prolonged loss of safety functions in combination with external events:

- Alternative fixed and mobile resources to supply water to the spent fuel pool (short/medium term).
- Improvements to the spent fuel pool water level and temperature measuring instrumentation (medium term).

### 2.c. Results of licensees' actions, including proposed activities

Summarised below are examples of the generic improvement actions identified by the licensees and in the evaluations performed by the CSN, these now being completed:

- Analysis of the loss of off-site power scenario (LOOP).
- Analysis of the loss of off-site power and of the on-site back-up sources, or station blackout scenario (SBO).
- Analysis of main ultimate heat sink (UHS), and of the alternative heat sink where appropriate.
- Analysis of loss of main UHS with SBO.
- Accident management measures available to address loss of the fuel storage facility cooling function.
- Scenarios in the event of battery depletion and complete loss of d.c. power, detailing manual actions.
- Analysis of available electrical feeds and existing interconnections with the exterior grid.
- Analysis of loss of d.c. power beyond the scope foreseen in the stress tests detailing manual actions.
- Aspects relating to the loss of radiological shielding that would be implied by the drop in water level in the spent fuel pools.
- Means available for cooling of and the supply of water to the spent fuel pools.
- Analysis of times available to boiling and to reaching different water levels (uncovering of fuel assemblies).

## 3. Activities performed by the regulator

### 3.a. Brief description of activities performed

In keeping with the CTI issued to all the licensees on May 25th 2011, the CSN required the performance of the stress tests agreed to within the context of the European Union, with the scope to be addressed by the licensee for the following situations:

a) *Loss of off-site power (LOOP):*

- Describe the way in which this situation is taken into account in the design.

- Indicate for how long the on-site back-up power sources are capable of operating without any type of external support.
- Indicate what actions are required and contemplated to extend the operation of the on-site power supply equipment.
- Identify the possible measures to be adopted to increase the robustness of the plant.

b) *Loss of off-site power and of the on-site back-up power supplies or station blackout (SBO),* considering two situations (LOOP + Loss of "normal" back-up sources, and this same scenario coinciding with the loss of any other back-up source). For each of these situations:

- Provide information on the capacity of the batteries and their duration and on the measures foreseen in the design for these situations.
- Indicate for how long the plant might withstand an SBO without any external support until serious damage to the fuel became inevitable.
- Indicate what external actions are foreseen to prevent fuel damage.
- Identify the possible "cliff edge situations" that might occur, indicating the additional measures that might be incorporated to increase the robustness of the plant.

c) *Loss of main ultimate heat sink (UHS), considering two situations (Loss of primary ultimate heat sink (UHS) and, where appropriate, of the alternative heat sink). For each of these situations:*

- Indicate for how long the plant might withstand the situation without assistance from outside.
- Provide information on the provisions incorporated in the design for these situations.
- Indicate the external actions contemplated to prevent fuel damage.
- Identify the possible "cliff edge situations" that might occur, indicating the additional measures that might be incorporated to increase the robustness of the plant.

d) *Loss of main UHS with SBO,* indicating the provisions identified for the loss of main UHS scenario.

e) Describe the accident management measures currently available to address the successive stages of a loss of fuel storage facility cooling function scenario.

## 3.b. Schedule of regulator's activities

On December 30th 2011, the CSN submitted to the European Commission the *Final report on the stress tests performed at the Spanish nuclear power plants,* in which it evaluated the results presented by the licensees and the proposals for improvement to be carried out.

In addition, in March 2012, the CSN sent a complementary technical instruction (CTI) to each nuclear power plant licensee with the conclusions drawn from the evaluation of the stress tests, including proposals for improvement, other aspects identified in the CSN's evaluation and the additional analyses or other improvements that the CSN considers necessary, along with the associated terms for implementation.

As the established terms (short/medium/long) unfold, the CSN will supervise and evaluate the measures proposed and actions for improvement.

## 3.c. Regulator's conclusions regarding the results of the licensees' actions

The CSN has evaluated the final reports submitted by the licensees of the Spanish nuclear power plants within the framework of the programme of stress tests performed at European level, including the performance of 24 inspections aimed at verifying certain aspects of the issues reviewed. The conclusions drawn from the evaluation performed by this organisation

with respect to extreme external events are set out below, along with the periods for completion of the studies or additional measures to be implemented where appropriate:

- **Loss of safety functions (power and ultimate heat sink)**

  The CSN has required the affected licensees to implement actions relating to the procedures and tests for power supply from nearby hydroelectric stations in the period proposed (short/medium term).

  The CSN has required the licensees to implement the actions foreseen to increase the capacity to respond to situations of prolonged loss of alternating current electrical supply in the terms proposed, including measures relating to new fixed or mobile equipment for the replacement of inventory to the refuelling water storage tank (RWST) and auxiliary feedwater (AFW) tank and the injection of water to the primary circuit and steam generators, and to ensure the availability of the instrumentation readings required under these circumstances and the availability of the communications and lighting systems.

  Furthermore, in the short term the licensees should complete, by means of whatever tests and justifications might be necessary, the demonstration of the feasibility of the actions contemplated for maintenance of the safety functions under conditions of total loss of all power sources, including the batteries, by locally and manually operating the necessary equipment (turbine-driven pump, valves). The instrumentation and the communication and lighting resources required for this situation shall be analysed and detailed. In addition and to the extent feasible, the licensee shall set up a periodic testing programme for the local manual operation of this equipment.

  The licensees shall analyse in the short term the temperature conditions reached in the auxiliary feedwater turbine-driven pump room in the event of prolonged loss of the on and off-site power supplies.

  In the case of affected licensees, the CSN requires the implementation of actions relating to the tracking of possible improvements to the reactor coolant system pump seals within the period proposed (medium term).

  Before June 2012, the licensees must carry out and submit to the CSN the planned analyses of the possible implementation of an alternative electricity supply for the control room emergency filtering units and heating batteries, for situations of prolonged loss of electrical feed.

- **Accidents that might occur during group shutdown**

  As regards those accidents that might be initiated in plant shutdown situations, the CSN evaluation has identified the need for the general analysis of a potential additional improvement to address situations in which a complete loss of electrical supply might occur under such conditions. In this respect, the licensees are required to analyse, prior to December 31st 2013, the containment sealing capacity in cases in which its integrity is not established at the onset of the accident, identifying the possible additional measures required to attempt to guarantee the recovery of this integrity.

- **Accidents with loss of spent fuel pool inventory and/or cooling**

  The CSN also considers that in order to respond to accidents involving the prolonged loss of the UHS and of power, the SFP temperature and level instrumentation should have an adequate range and a seismic category and level of environmental qualification in keeping with the importance of its function. There should also be an indication in locations that are accessible under severe accident conditions (both for the reactor and for the pool itself),

and in addition there should be portable instrumentation available for cases of loss of all electrical power sources. The analyses should be completed in the short term and the implementation of the improvements might be accomplished in the medium term.

As regards other improvement measures to be implemented, the CSN has required all the licensees to carry out the actions planned to increase their capacities to respond to accidents affecting the spent fuel pool within the periods proposed, these relating to additional measures for alternative make-up (based on autonomous equipment) and pool spraying. The spray system should be designed to provide make-up water to the pool and reduce whatever fission product emissions might occur.

Topic 2: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c.

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 2 – Design issues | | | | | | |
| Analysis of loss of off-site power (LOOP) scenario. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of loss of off-site power and of on-site back-up power sources scenario, station blackout (SBO). | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of loss of main ultimate heat sink (UHS) and of alternative heat sink, where appropriate. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of loss of main ultimate heat sink (UHS) with SBO. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Accident management measures available to address loss of fuel storage facility cooling function. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Battery depletion and complete loss of d.c. power scenarios, detailing manual actions. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of available electrical feeds and existing interconnections with external grid. | Performed | N/A | Yes | Evaluated | N/A | Yes |

Topic 2: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 2 – Design issues | | | | | | |
| Analysis of loss of d.c. power beyond the scope contemplated in the stress tests, detailing manual actions. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Aspects relating to the loss of radiological shielding that would be implied by a drop in spent fuel pool water level. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Means available for spent fuel pool cooling and water make-up. | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Analysis of times available to boiling and to different levels of water being reached (uncovery of fuel assemblies). | Performed | N/A | Yes | Evaluated | N/A | Yes |
| Improvement of protocols for dedicated electrical feed from hydroelectric stations close to the site and performance of corresponding periodic tests. | On-going | Short/med. term | Yes | CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| For affected licensees, implementation of actions relating to tracking of possible improvements to reactor coolant system pump seals (medium term). | Planned | Medium term | No | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |

Topic 2: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 2 – Design issues | | | | | | |
| Analyses mapped out of the possible implementation of an alternative electricity supply for the control room emergency filtering units and heating batteries. | On-going | June 2012 | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Analysis of capacity to provide feed for primary/secondary via turbine-driven pumps (if included in plant design), even if d.c. feed not available for their control. | On-going | Short term | No | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No (pending activity by licensee) |
| Availability on site of autonomous motor-driven pumps for the injection of water to the primary and/or secondary and for make-up of water or fuel to critical tanks. | On-going | Short/med. term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Availability of additional portable instrumentation for performance of the necessary manual control actions in the event of total loss of batteries. | Planned | Medium term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Improvements to communications systems (on and off-site) to address events involving the loss of the corresponding electrical feed systems. | On-going | Short term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |

Topic 2: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 2 – Design issues | | | | | | |
| Improvements to lighting systems to address prolonged loss of electrical feed events. | On-going | Short/med. term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Design modifications required to make available connections for the autonomous electrical and mechanical equipment. | On-going | Short/med. term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Measures to ensure d.c. feed for the controls and instrumentation required to maintain plant safety conditions. | On-going | Short/med. term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No (pending activity by licensee) |
| Availability of alternative fixed and mobile resources for water make-up to the spent fuel pool. | On-going | Short/med. term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Improvements to spent fuel pool water level and temperature measuring instrumentation. | Planned | Medium term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |

# Topic 3: Severe accident management (in the reactor)

## 1. Brief description of analyses performed

The Complementary Technical Instruction (CTI) issued to all the licensees of nuclear power plants on May 25th 2011 required them to undertake the following actions:

- Describe the accident management measures currently available for the different stages of a loss of core cooling function scenario.
- Describe the accident management measures and plant design characteristics for protection of the containment integrity function following the occurrence of fuel damage.
- Describe the accident management measures currently available to respond to the different stages of a loss of spent fuel storage pool cooling function scenario.
- Verify the organisational aspects and material resources available, in accordance with the provisions of the respective NPP On-Site Emergency Plans (OEP).

## 2. Activities performed by the licensees

### 2.a. Brief description of activities performed or planned

The licensees' reports present the different operating procedures currently available at each plant to respond to accident situations, specifically the Emergency Operating Procedures (EOP's) and the Severe Accident Management Guidelines (SAMG's). The fundamental objective of the EOP's is to attempt to avoid damage to the core, while the SAMG's aim to mitigate its consequences, including the maintenance of containment integrity and the prevention and/or mitigation of fission product releases off site.

The implementation of the SAMG's at the Spanish plants of American design, for both pressurised water reactors (PWR) and boiling water reactors (BWR), was by way of a process that was parallel in time, such that all the plants have had SAMG's since the year 2001. This implementation was carried out in accordance with the practices of the country of origin of the project (USA), applying the criterion of using only equipment already available at the plants.

In the specific case of Trillo NPP, the only Spanish plant of German design, the implementation of the emergency operating procedures was also accomplished in accordance with the practices of the country of origin of the technology. This has meant that the scope of these manuals focuses more on reinforcing strategies aimed at preventing core damage than on mitigating its consequences.

In relation to the control of hydrogen in containment, the licensees point out that in order to implement a hydrogen management approach covering the ranges of concentrations that might be expected in the event of a severe accident and improve the robustness of the plant, they will install passive autocatalytic recombiners (PAR) in those areas of the containment that might pose a risk of hydrogen accumulation. The Trillo plant already has such equipment and the primary containment at the Garoña plant is "inertised" with nitrogen during power operation, for which reason this type of equipment will be installed in the secondary containment.

Certain licensees have also analysed the possibility of hydrogen accumulating in other buildings annexed to the containment, and others indicate that they will do this in the short term.

As regards the prevention of overpressure conditions in containment, the licensees of the PWR plants indicate that they are going to install a filtered vent as an additional improvement to protect containment. The implementation of the filtered vent provides adequate protection against the risk of failure of the containment building as a result of overpressure and, in addition, reduces the radiological limitations implied by the non-filtered vent.

In the case of the BWR plants, there is a "hard" venting system that, if operated from the wet well, implies the scrubbing of fission products as they pass through the suppression pool (from the drywell or the relief and safety valves). The licensees have also verified that the current systems have a seismic margin of 0.3g and propose to incorporate the modifications necessary to improve operability under SBO conditions. Furthermore, they propose actions for the study or implementation of a filtering system on the existing containment vent line.

As regards the reduction/mitigation of fission product releases off site, and in addition to the filtered containment vent, the licensees are analysing the strategy of spraying the containment, or any other building, from the outside.

With regard to the analysis of severe accidents that might be initiated with the plant in the shutdown condition, the licensees point out in their reports that they will carry out such analyses as part of their Probabilistic Safety Assessment (PSA) updating programme.

In relation to the planning of accident management, each licensee has reviewed the response capacity of his plant to emergency situations, as regards both material and human resources, and has also reviewed the content of the corresponding OEP in order to take into account the lessons learned from Fukushima

The licensees have set up a joint working group to analyse the human resources required to strengthen their emergency response organisations. Consideration will be given to the following aspects:

- The feasibility of addressing the functions required in scenarios such as those postulated in the stress tests.
- Potential interferences resulting from the duplication of the functions of the personnel.
- The personnel required to carry out the new prevention and mitigation strategies.
- The performance of benchmarking activities to analyse the suitability of the current organisation.
- The necessary changes to the plant documentation (OEP), procedures, etc.) and.
- The appropriate means of transport for the effective incorporation of the personnel.

The licensees have decided to reinforce the centres currently available for the management of emergencies with a new on-site Alternative Emergency Management Centre (AEMC) designed to withstand external events and equipped with measures to protect against radiations, the aim being to facilitate emergency operations in extreme situations such as those analysed. For this purpose a working group has been set up, including the licensees of all the Spanish nuclear power plants.

The licensees also propose to establish an Emergency Support Centre (ESC), common to all the plants, with back-up equipment located at a centralised storage facility ready to be deployed and operated by an intervention unit capable of acting at the sites within 24 hours.

The plants already had a procedure in place for mutual assistance in the event of an emergency situation; the licensees point out that this procedure will be revised and updated to adapt it to the new needs for support and the exchange of human and material resources arising as a result of these analyses. They also report that the members of World Association of Nuclear

Operators (WANO) have decided to promote an integrated world-wide emergency response strategy.

As regards the capacity of people and auxiliary equipment to access the site, all the licensees have analysed this issue —albeit with varying scopes— for the most limiting cases (severe earthquake and flooding), establishing the itineraries that would remain available under such circumstances.

In relation to the availability of voice and data communications media on and off site, the licensees point out that an exhaustive analysis will be carried out, taking into account criteria such as redundancy, independence and autonomy, with a view to ensuring the availability of the communications systems in the postulated scenarios. The conclusions of this analysis will be coordinated by the plants in order to jointly define and implement the improvements identified.

The licensees have carried out an estimate of the doses to the personnel in the control room and Technical Support Centre (TSC) in the scenarios analysed, with a view to identifying the protection measures required to guarantee that the doses received do not exceed the emergency intervention levels.

As regards the monitoring and control of the doses to the workers and of radioactive emissions, the licensees have assessed the available resources and have concluded that in general the human and material resources available to them are adequate, although they consider it appropriate to analyse possible improvements to strengthen the response to severe accident scenarios.

With regard to those radiological conditions that might affect the recovery actions carried out at the plant, the licensees have submitted analyses and propose non-uniform reference dose levels for the personnel of the emergency response organisation.

The licensees have analysed and identified situations in which the radiological conditions might prevent the performance of local manual actions. However, there are differences as regards the approach and degree of development of the analyses performed by the different plants.

Finally, in relation to loss of pool cooling accidents, the licensees have calculated the dose rates at the edge of the pool on the basis of the water level above the fuel assemblies, in order to determine the loss of shielding capacity and its repercussion on accessibility for the performance of recovery actions.

## 2.b. Presentation of foreseen actions and schedule for implementation

The activities planned by the licensees of the Spanish nuclear power plants are presented below (they refer to initiatives undertaken by the industry and committed to by more than one plant), along with the term for implementation[3].

As regards the control of hydrogen in containment, the licensees who so require will install passive autocatalytic recombiners (PAR) in those areas of containment that might pose a risk of hydrogen accumulation (long term).

In relation to the prevention of overpressure conditions in containment, the licensees plan to install a filtered vent (long term) to protect the containment.

The licensees also propose several different actions, specific to each facility, to improve the habitability of the control room during a severe accident, to increase the availability of the

3 — Short term: performance prior to the end of 2012.
— Medium term: performance between 2013 and 2014.
— Long term: performance between 2015 and 2016 (the term may exceptionally be extended if duly justified).

instrumentation in the event of prolonged SBO and to propose alternative paths, based on portable equipment and connections to systems, to inject water into the vessel, the containment and the steam generators (PWR).

As regards the management of accidents and radiological protection issues, the licensees have presented the following specific improvement actions:

- Human resources necessary to strengthen the emergency response organisations. Implementation of the actions deriving from the joint analysis (medium term).
- New on-site Alternative Emergency Management Centre (AEMC), designed to withstand external events and equipped with measures for protection against radiations:
  - Definition of characteristics (short term).
  - Completion of the construction or modification of existing structures (long term).
- Emergency Support Centre (ESC), common to all the plants (medium term).
- Availability of on and off-site communications media:
  - Analysis (short term)
  - Implementation of improvements (long term)
- Joint analysis of possible improvements to reinforce the response to severe accident scenarios, in relation to the monitoring and control of workers' doses and radioactive emissions (short term).

### 2.c. Results of licensees' actions, including proposed activities

Presented below are examples of the generic improvement actions identified by the licensees and in the evaluations performed by the CSN; also included are other actions that have been completed but some of which may require additional actions as a result of the evaluation performed:

- Installation of various methods for the injection of water to the reactor vessel, the steam generators or containment (medium/long term).
- Installation of PAR's at plants not already fitted with such devices (long term).
- Installation of filtered containment vents (long term).
- Measures to prevent core damage sequences with high pressure in the reactor (medium term).
- Measures to strengthen the capacity to implement containment flooding strategies (short term).
- Analysis of possible difficulties in accessing the sites in extreme situations caused by earthquakes or flooding, with identification of available routes and resources and of the reinforcements of structures or equipment when necessary.
- Analysis and proposals regarding reference dose levels for the personnel of the emergency response organisation.
- Estimate of doses to the personnel in the control room and Technical Support Centre (TSC) in the scenarios analysed.

## 3. Activities performed by the regulator

### 3.a. Brief description of activities performed

On May 25th 2011, the CSN issued a CTI requiring the performance of the stress tests agreed to within the context of the European Union, with the scope indicated at the beginning of this section. In addition, consideration was to be given to organisational aspects and to the

material resources available according to the respective On Site Emergency Plans (OEP's), as well as to the management and forecast limitations of both possible radioactive emissions and possible doses to the workers.

Both the EOP's and the SAMG's have been the subject of specific CSN requirements in the past, as a result of which they were already part of the Spanish regulatory system. Among these requirements are those relating to the initial and on-going training of the personnel required to intervene in the event of an emergency, as established in Council Instruction IS-12 (*Requirements relating to the qualification and training of in-house and external non-licensed personnel in the area of nuclear power plants)*. The development and maintenance of these procedures and guidelines are currently included within the scope of this organisation's systematic supervision processes.

## 3.b. Schedule of regulator's activities

On December 30th 2011, the CSN submitted its *Final report on the stress tests performed at the Spanish nuclear power plants* to the European Commission, evaluating the results presented by the licensees and the proposals regarding the improvements to be carried out.

In addition, on March 14th 2012, the CSN issued a complementary technical instruction (CTI) to each nuclear power plant licensee with the conclusions drawn from the evaluation of the stress tests, including proposals for improvement, other aspects identified in the CSN's evaluation and the additional analyses or other improvements that the CSN considered to be necessary. Also included were the associated periods for implementation.

As the established periods (short/medium/long) elapse, the CSN will supervise and evaluate the measures proposed and actions for improvement.

## 3.c. Regulator's conclusions regarding the results of the licensees' actions

The CSN has evaluated the final reports submitted by the licensees of the Spanish nuclear power plants within the programme of stress tests performed at European level, including the performance of 24 inspections to verify certain aspects of the issues reviewed. The following conclusions have been drawn from the evaluation performed by this organisation with respect to extreme external events, indicating where appropriate the periods established for the completion of studies or the additional measures to be implemented.

The CSN evaluation has established the need to implement a filtered containment venting arrangement in all the operating nuclear power plants. The CSN has required all the licensees to submit an analysis of existing alternative technologies for the filtered containment vent system and the solution finally adopted, before December 31st 2013. Implementation will be undertaken in the long term. The licensees currently have strategies to respond to severe accidents in the reactor. These strategies are included in severe accident management manuals or guidelines, although in certain cases the licensee proposes to extend their scope. The CSN had previously evaluated the existing guidelines and considered them acceptable, also considering the improvements proposed by the licensees, included in the previous section, to be adequate.

The CSN evaluation concludes that the improvements proposed are adequate and that they will strengthen the capacity of the plants to respond to severe accidents and mitigate their consequences.

As regards the radiological conditions in the event of a severe accident, the licensees have estimated doses in the control room during a scenario of prolonged loss of power supply and the need to vent containment, with a view to identifying the measures required to guarantee the protection of the personnel in the said control room. In this context, the CSN considered the proposal made by certain licensees to implement or study the advisability of providing electrical feed to the control room emergency filtering units in the event of

prolonged SBO to be positive, and in the CTI issued on March 14th required the rest of the licensees to implement this activity and to resolve any uncertainties regarding the guaranteed habitability of the control room during SBO.

The CSN has required the implementation, within the proposed periods, of the actions foreseen by the licensees to increase their capacity to ensure alternative injection to the primary system and reactor cavity. In the definition of the applicable strategies, consideration should be given to the problems associated with the quality and chemistry of the water that would be injected from alternative sources to the reactor or to containment, including refilling of the RWST, with special emphasis on aspects relating to reactor subcriticality and containment pH.

The CSN evaluation considers the contents of the licensees' reports to be acceptable as regards the control of hydrogen in containment and, therefore, considers it necessary to implement a containment hydrogen control system based on passive autocatalytic recombiners (PAR's). Before December 31st 2013, the licensees are to submit an engineering study specifying the number and location of these PAR's in the containment. Implementation will be completed in the long term.

The CSN has required the licensees to perform the additional analyses indicated below:

1. Analysis of the leaktightness of containment penetrations and isolation valves under the pressure, temperature and radiation conditions to be expected in the event of a severe accident (period for completion: medium term).
2. Analysis of the possibility of increasing robustness to core damage sequences with high primary pressure, coinciding with an earthquake and total loss of power sources (including d.c. power) by means of pressuriser relief valve actuation (period for completion: June 30th 2013).
3. Detailed analysis of the effect of water injection to containment on equipment and instruments of relevance in severe accident management strategies, taking into account the possible flooding levels that might be reached through the application of current and future severe accident management strategies (period for completion: short term).
4. Analysis and identification of the critical instrumentation required for accident management, including severe accidents. In addition to the process instrumentation, this analysis should take into account the feasibility of using the post-accident sampling system (period for completion: short term).
5. Analysis of the capacity of the equipment identified in the previous point to provide reliable information under the ambient conditions to be expected in the event of a severe accident (period for completion: medium term).
6. Analysis of severe accidents initiating with the plant in the shutdown condition. The objective of this analysis is to identify measures and propose a plan for their implementation, from the point of view of both physical and procedural modifications, to improve the management of severe accidents in these situations (period for completion: medium term).

The CSN has also required the licensees to revise their PSA performance schedules in order to have available the results of level 2 analyses in other operating modes in the medium term.

As regards the procedures and means available for the monitoring and control of workers' doses and radioactive emissions, and although these are in general adequate, possible improvements are to be analysed in a coordinated manner by all the plants with a view to reinforcing the response to severe accident scenarios. The CSN analysis considers that the analysis should contemplate the following:

- The availability of the radiation monitors and of the post-accident sampling system in prolonged station blackout (SBO) scenarios and their correct operation under severe accident conditions, and

- Analysis of alternatives to the lack of fixed RP instrumentation for monitoring of the radiological conditions in the plant.

In addition, the CSN considers that it would be advisable for those licensees who have not already done so to extend the radiological surveillance capacity at the site by means of a continuously operating network with the automatic reception of data in the control room, TSC and CSN emergency response room.

As regards the radiological implications for the workers in the event of a severe accident and the identification of situations that would prevent the performance of work for radiological reasons, the CSN has established the scope of the analyses to be performed and has required that, as a result of the above, specific action guidelines be drawn up in association with the SAMG's to contemplate radiological protection issues according to the foreseen doses and radiological conditions. These actions should be completed in the medium term.

In relation to accidents involving loss of pool cooling, the CSN has required that the radiological protection issues to be considered in the local manual actions foreseen in the event accidents involving loss of pool cooling be incorporated in procedures, that the conditions (water level or time) compromising the manual interventions be identified and that specific actions be contemplated to reduce doses in the foreseen local manual actions.

Furthermore, and as regards the radiological conditions that might affect plant recovery actions, the CSN has issued specific requirements harmonising the different reference dose levels for the personnel of the emergency response organisation, in order to make the necessary individual protection of the workers compatible with the feasibility of carrying out critical mitigation actions. These dose levels should be incorporated in the procedures corresponding to the site emergency plans (OEP's) before September 15$^{th}$ 2012 and in the proposal for review of the OEP's that will be submitted for approval before April 30$^{th}$ 2013.

All the nuclear power plant licensees have in place an organisation and measures for the management of beyond design basis accidents at each facility. Nevertheless, they have issued proposals to attempt to increase the robustness of the different relevant aspects identified in relation to their response to emergencies. The CSN evaluation considers the proposals for improvement relating to the construction of an Alternative Emergency Management Centre (AEMC) on each site, the analysis of additional resources and equipment (including on and off-site communications resources) and the reinforcement of the emergency response organisations to be adequate.

In relation to the AEMC, the CSN considers that provisional measures should be implemented in the medium term in order to make available improved capacities prior to the date for the complete implementation of this modification, which is scheduled for the end of 2015, even though these improved capacities be partial. As regards the ESC, a detailed specification must be submitted in the short term indicating the resources available, their management and the training of the personnel, as well as the integration of the ESC in the SEP's. The ESC must be operable in the medium term. Finally, the CSN evaluation concludes that each licensee should submit in the medium term a report containing the plans for the improvement and strengthening of the emergency response organisation, taking into account the following considerations:

- Plants with more than one group on the site should consider the simultaneous occurrence of an accident affecting both groups.
- The feasibility of performing the local actions proposed by the licensees and based on the use of portable equipment should be studied in detail, taking into account among other aspects the accessibility of the locations at which the actions are to be carried out, in view of the ambient and radiological conditions, the times available for such actions and the availability of adequate human resources. If this feasibility were not demonstrated, the licensee should opt for the implementation of fixed equipment.

- The feasibility of assigning more than one function to a specific post in the emergency response organisation should be reviewed.

These improvements should be implemented in the medium term.

The improvements associated with the communications systems in emergency situations, deriving from the analysis mapped out for the short term, including those contemplated to strengthen the response to situations of prolonged loss of electrical feed, should be implemented before the end of 2015, although provisional compensatory measures should be put into place in the medium term.

The CSN considers the analyses presented with respect to possible difficulties, for both people and auxiliary equipment, in accessing the site in extreme situations caused by earthquakes or flooding to be adequate, although in certain cases additional measures have been required, for implementation in the medium term.

Topic 3: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c.

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 3 – Severe accidents | | | | | | |
| Installation of different methods for the injection of water to the reactor vessel, the steam generators or containment. | Planned | Med./long term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Preparation of an engineering study specifying the number and location of PAR's in containment. | On-going | Before December 31st 2013 | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Installation of PAR's in plants not already equipped with these devices. | Planned | Long term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Analysis of existing alternative technologies for the filtered containment vent system and solution finally adopted. | On-going | Before December 31st 2013 | No | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Installation of filtered containment vent | Planned | Long term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |

Topic 3: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 3 – Severe accidents | | | | | | |
| Analysis of leaktightness of containment penetrations and isolation valves under the pressure, temperature and radiation conditions to be expected in the event of a severe accident. | Planned | Medium term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Analysis of the possibility of increasing robustness in relation to core damage sequences with high primary pressure, coinciding with an earthquake and complete loss of power sources (including d.c. sources) through actuation of the pressuriser relief valves. | On-going | June 30th 2013 | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Detailed analysis of the effects of water injection to containment on equipment and instruments of relevance in severe accident management strategies, taking into account possible flooding levels. | On-going | Short term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Analysis and identification of critical instrumentation required for the management of accidents, including severe accidents. | On-going | Short term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |

Topic 3: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 3 – Severe accidents | | | | | | |
| Analysis of severe accidents initiating with the plant in the shutdown condition. | Planned | Medium term | Yes | Required by CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | Yes |
| Review of planning foreseen for PSA performance in order to have available level 2 analyses for other operating modes. | Planned | Medium term | Yes | Required by CTI issued on March 14th | Evaluation/authorisation of improvement measures and actions, within established terms. | Yes |
| Development of the human resources required to strengthen the emergency response organisations. Implementation of actions deriving from joint analysis | | | No | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| — Analysis | On-going | Short term | | | | |
| — Implementation of actions (improvements) deriving from joint analysis | Planned | Medium term | | | | |

Topic 3: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 3 – Severe accidents | | | | | | |
| New on-site Alternative Emergency Management Centre (AEMC) designed to withstand external events and equipped with means to protect against radiations | | | | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| — Definition of characteristics | On-going | Short term | No | Provisional compensatory measures required (medium term) pending start-up of AEMC | | |
| — Construction of AEMC or modification of existing structures | Planned | Long term | No | | | |
| Setting up of an Emergency Support Centre (ESC) common to all the plants | Planned | Medium term | No | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| Reference dose levels for the personnel of the emergency response organisation | Initially performed, with non-uniform results<br>Planned according to CTI requirements | Short and medium term | No | Established by CSN in CTI of March 14th<br>Will be included in Site Emergency Plans and procedures | Evaluation/supervision within established terms. | No |

Topic 3: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 3 – Severe accidents | | | | | | |
| On and off-site voice and data emergency communications systems | | | | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| — Analysis of availability | On-going | Short term | No | Implementation of provisional compensatory measures required (medium term) | | |
| — Implementation of improvements identified | Planned | Long term | No | | | |
| Capacity to access sites (people and equipment) in extreme situations caused by earthquakes or flooding | | | | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| — Analysis | Performed | Short term in the case of additional analyses being required | Yes | In certain cases additional analyses and proposals for improvements have been required | | |
| — Improvement proposals | Planned | Medium term | No | | | |

Topic 3: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 3 – Severe accidents | | | | | | |
| Radiological implications for workers' interventions in the event of a severe accident | | | | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| — Analysis and identification of situations that would prevent performance of work for radiological reasons | Planned as requested | Medium term | No (preliminary analyses performed) | The scope of the analyses and the drawing up of the guidelines have been established | | |
| — Drawing up of specific action guidelines associated with the SAMG's to address radiological protection issues depending on expected radiological conditions and doses | Planned as requested | Medium term | No | | | |
| Radiological protection measures during local manual actions in the event of accidents involving loss of pool cooling | Dose rates assessed | N/A | Yes | CSN CTI issued on March 14th | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| | New calculations planned according to the requirements of the CTI | Short term | No | Requirement regarding new dose rate assessments and inclusion in the procedure of the radiological protection measures to be considered in the case of local manual actions | | |
| | Planned following the requirements of the CTI | Medium term | No | | | |

Topic 3: Summary table of activities indicated in sections 2.a, 2.b, 2.c, 3.a, 3.b and 3.c. (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 2.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 2.c)<br>Results<br>Available<br>- Yes?<br>- No? | (Item 3.a)<br>Activity<br>- Taken?<br>- On-going?<br>- Planned? | (Item 3.b)<br>Schedule<br>or milestones<br>for planned<br>activities | (Item 3.c)<br>Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 3 – Severe accidents | | | | | | |
| Human resources and radiological protection equipment additional to those already in place to respond to severe accidents | | | | CSN CTI issued on March 14th establishing the scope of analysis and the implementation of improvements | Evaluation/supervision of improvement measures and actions, within established terms. | No |
| — Analysis | Planned | Short term | No | | | |
| — Implementation of improvements | Planned | Medium term | No | | | |
| Joint analysis of possible improvements to strengthen the response to severe accident scenarios, in relation to the monitoring and control of workers' doses and radioactive emissions | Planned | Short term | No | CSN CTI issued on March 14th | Evaluation/authorisation of improvement measures and actions, within established terms. | No |
| Implementation of improvements | Planned | Medium term | No | | | |

# Topic 4: National organisations

## 1. Regulatory bodies

- In Spain, the regulatory function in relation to nuclear safety and radiological protection is carried out by several different authorities.
- The Government is in charge of energy policy and of decreeing binding regulatory standards.
- The Ministry of Industry, Energy and Tourism is the competent department of the General State Administration in relation to nuclear energy, and is responsible for issuing the different authorisations relating to nuclear facilities, subject to the mandatory and binding reports of the Nuclear Safety Council and, where appropriate, other ministerial departments, and for issuing standards proposals, adopting provisions for the development of the standards in force and applying the system of sanctions in relation to nuclear energy.
- The Nuclear Safety Council, created by Law 15/1980, of April 22nd, is the State organisation solely responsible for nuclear safety and radiological protection. It is an entity existing under Public Law, independent from the General State Administration,that reports on its activities to Parliament. This organisation plays no role in promoting nuclear energy.

### 1.a. Ministry of Industry, Energy and Tourism

#### 1.a.1. Functions

In keeping with Royal Decree 344/2012, of February 10th, which establishes the basic organic structure of the organisation, the Ministry of Industry, Energy and Tourism (Minetur) carries out the following functions in the area covered by the Convention on Nuclear Safety:

- Issuing of permits for nuclear and radioactive facilities[4], following a mandatory and binding report by the CSN.
- Drawing up of standards proposals and enforcement of the system of sanctions.
- Contribution to definition of the research, technological development and demonstration policy in this area, in collaboration with the Ministry of Economy and Competitiveness.
- Monitoring of compliance with the international commitments subscribed by Spain in the field of nuclear energy, in particular in relation to non-proliferation, the physical protection of nuclear materials and facilities and civil liability for nuclear damage.
- Relations with International Organisations specialising in this field.

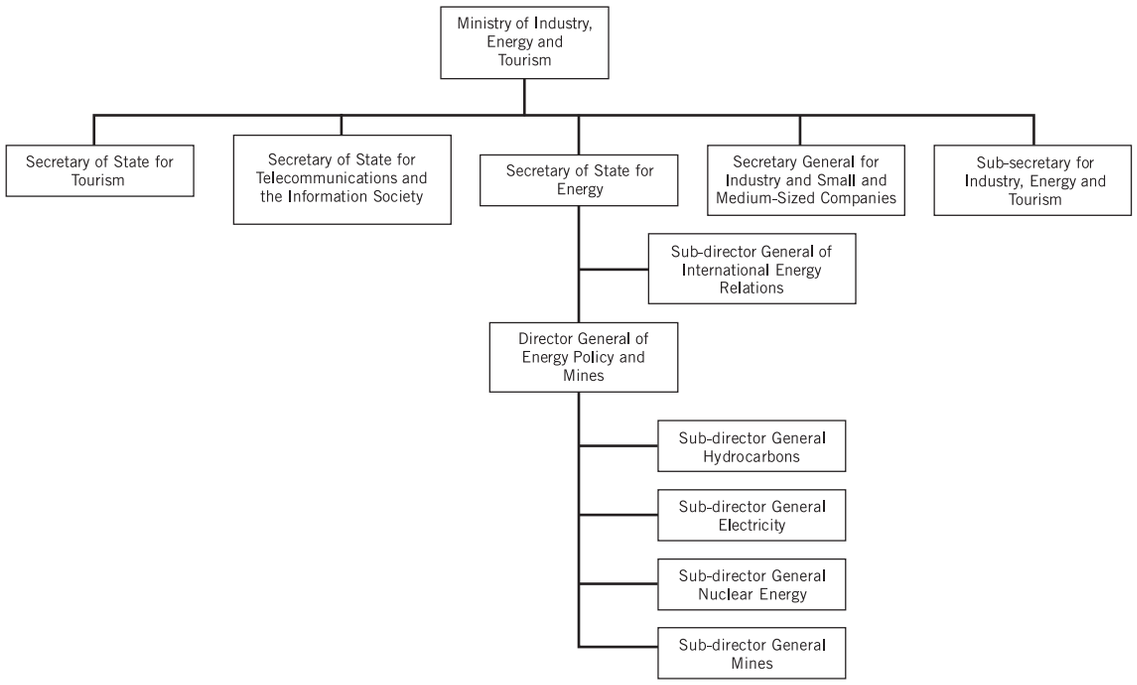
The functions and responsibilities described above have not been substantially modified with respect to the *Fifth Spanish National Report* issued to comply with the obligations deriving from the Convention on Nuclear Safety.

In keeping with what is established by the aforementioned Royal Decree, the CSN's relations with the Government are via the Minetur.

4 Except for second and third category radioactive facilities located in Autonomous Communities to which administrative functions have been transferred in this area.

### 1.a.2. Structure

The structure of the Minetur is regulated by Royal Decree 1887/2011, of December 30th, which sets out the basic organic structure of the ministerial departments, and by the aforementioned Royal Decree 344/2012. This structure is currently as follows[5]:




Within the Minetur, the Secretariat of State for Energy is the supreme body responsible for energy issues and, within this the Directorate General for Energy Policy and Mines, to which the Sub-directorate General for Nuclear Energy reports, is the management body that undertakes the functions referred to in the previous section specifically applicable to nuclear energy.

### 1.a.3. Participation in international organisations and activities

The Minetur, through the Sub-directorate General for Nuclear Energy, participates actively in activities relating to nuclear energy and promoted by the International Organisations to which Spain belongs.

The Minetur collaborates in the drawing up of bilateral agreements with other countries in relation to the peaceful use of nuclear energy and represents the Spanish Government in the Assemblies of Contributors to the different international Funds to which Spain contributes.

Within the framework of the European Union, the Minetur provides advisory services to the Spanish Permanent Representation regarding its participation in the working groups of the Council that deal with issues regulated by the Euratom Treaty. Within the International Atomic Energy Agency, the Minetur is part of the Spanish Delegation to the Agency's General Conference.

5 The organisational flowchart shows only the organisations that report to the Secretary of State for Energy.

Likewise, the Minetur is part of the Spanish Delegation to the Steering Committee of the OECD Nuclear Energy Agency, and participates on several of the Agency's technical committees.

## 1.b. Nuclear Safety Council

### 1.b.1. Functions

The main functions of the Nuclear Safety Council (CSN) in relation to nuclear and radioactive facilities and related activities are as follows:

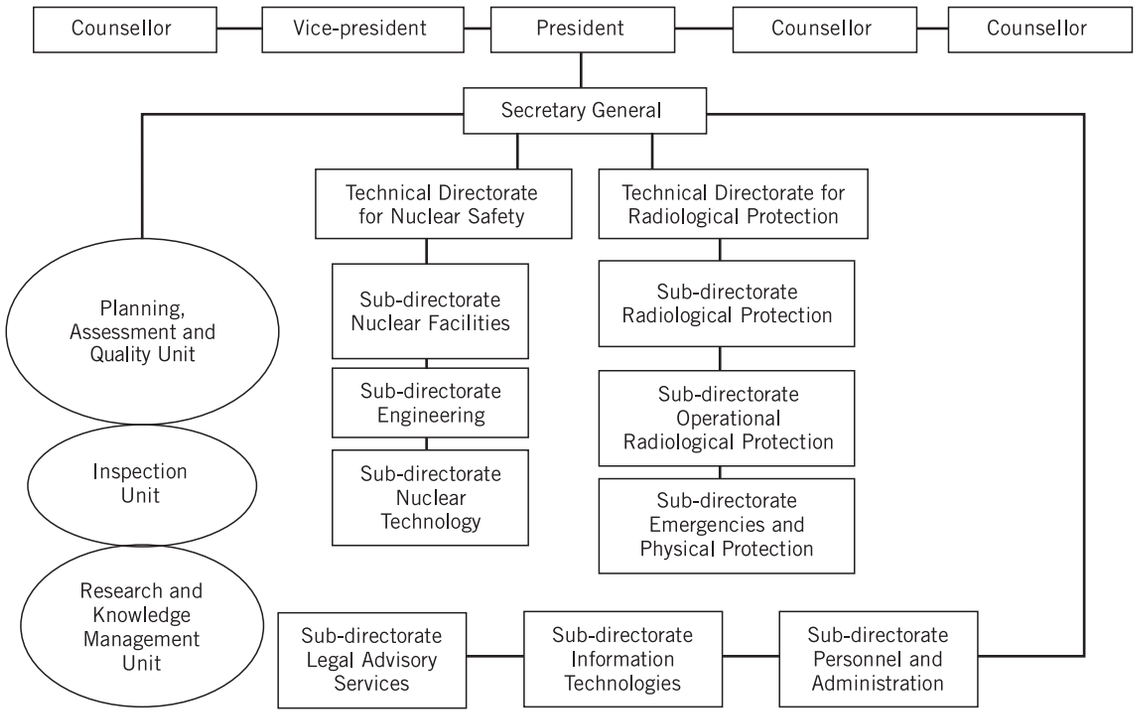
- To make proposals to the Government regarding necessary regulations in its realm of competence, and to draw up and approve technical instructions, guidelines and circulars in this area.
- To issue the corresponding reports to the Minetur for the latter to take decisions regarding the granting of the legally established authorisations. These reports shall be binding when negative and denying such authorisation, and also as regards the conditions established when positive.
- To undertake the control and inspection of all the facilities and during all phases, especially during design, construction, start-up and operation and in the transport, manufacturing and homologation of equipment incorporating radioactive sources or generating ionising radiations. In this respect, the CSN is authorised to suspend the operation of activities and facilities for safety reasons.
- To collaborate with the competent authorities in the setting out of the criteria to be fulfilled by the off-site emergency plans and plans for the physical protection of nuclear and radioactive facilities and, following the drawing up of these plans, to participate in their approval and coordinate the support and emergency response measures.
- To propose the initiation of sanctions proceedings in the event of infringements relating to nuclear safety and radiological protection, in keeping with the legislation in force, and to issue technical reports adequately describing the events.
- To control measures for the radiological protection of professionally exposed workers, the public and the environment. As regards the radiological protection of the environment, the CSN controls and monitors the radiological quality of the entire Spanish national territory and assesses the environmental radiological impact of the nuclear and radioactive facilities and of activities involving the use of ionising radiations.
- To collaborate with the competent authorities in relation to programmes for the radiological protection of persons subjected to medical diagnosis or treatment procedures using ionising radiations.
- To issue favourable reports on new designs, methodologies, simulation models or verification protocols relating to nuclear safety and radiological protection.
- To grant and renew nuclear and radioactive facility operator and supervisor licences, Head of Radiological Protection Service diplomas and accreditations in the field of radiodiagnosis.
- To carry out studies, assessments and inspections of plans, programmes and projects for all phases of radioactive waste management.

The functions and responsibilities of the CSN have not been substantially modified with respect to the *Fifth Spanish National Report* for compliance with the Convention on Nuclear Safety.

Since the Council was set up in 1980, all its competences and functions have been successively developed, such that it currently possesses the regulatory capacities and legal instruments required to carry out its functions with full guarantees that the regulated entities and activities meet the most demanding international standards, criteria and guidelines.

### 1.b.2. Structure

The organic structure of the CSN, which has recently been modified through the approval of its Charter by means of Royal Decree 1440/2010, of November 5th, is currently as follows:




As may be observed in the organisational flowchart shown above, the two Technical Directorates, three Sub-directorates and three Units report to the Secretariat General.

The Technical Directorate for Nuclear Safety groups together all the functions relating to the safety of the nuclear facilities, except those used for the disposal of low and intermediate level radioactive waste and facilities in the dismantling phase, which are the responsibility of the Directorate General for Radiological Protection. It is also in charge of safety in the transport of nuclear substances and radioactive materials. This bringing together of competences under a single highly specialised management centre makes it possible to optimise inspection, regulatory efficiency and the control of nuclear facilities. The Sub-directorates of Nuclear Facilities, Engineering and Nuclear Technology report to the Technical Directorate for Nuclear Safety.

In addition to the inspection and control of radioactive facilities, the radiological protection of the workers, the management of low and intermediate level radioactive wastes and the dismantling and decommissioning of nuclear and radioactive facilities, the Technical Directorate for Radiological Protection is responsible for the radiological protection of the public and the environment and for radiological emergencies. The Sub-directorates of Environmental Radiological Protection, Operational Radiological Protection and Emergencies and Physical Protection report to the Technical Directorate for Radiological Protection.

### 1.b.3. Financing

The CSN's expenses and income budget is integrated into the General State Budget, as a result of which its approval corresponds to Parliament.

The Council's economic revenues are obtained fundamentally through the collection of fees and public prices for the services it renders in fulfilling its functions, the conditions for this being regulated in Law 14/1999, of May 4th, on Fees and Public Prices for services rendered by the Nuclear Safety Council. At present there are three financing paths:

a. Financing through fees for the performance of studies, reports and inspections prior to the granting of nuclear and radioactive facility operating and decommissioning permits by the Minetur, for the inspection and control of operating nuclear and radioactive facilities and for the awarding of licences for the personnel operating or supervising the operation of nuclear and radioactive facilities.

b. Financing through public prices for the performance of reports, tests or studies on new designs, methodologies, simulation models or verification protocols relating to nuclear safety or radiological protection.

c. Transfers from the State, for the control of radiological protection measures relating to the general public and the environment. This funding comes from the General State Budget.

### 1.b.4. Management system and auditing

The CSN has implemented a process-oriented Management System, based on the requirements of the IAEA (GS-R-3) and the ISO 9001: 2008 standard, that specifies the requirements for a quality management system subject to on-going improvement.

The results, objectives and overall strategies of the Organisation are established by the Council and included in the Strategic Plan, which also sets out the Organisation's Mission and Vision. The Strategic Plan is broken down into annual plans, which include numerical objectives (indicators). Compliance with the plans and objectives is assessed quarterly with a view to identifying possible deviations and taking the necessary corrective actions.

In addition to assessment of compliance with the plans and objectives, the CSN has an internal auditing plan, and is also systematically subjected to external evaluations by national and international organisations.

As regards the latter, in early 2008 the CSN hosted an IRRS mission that identified good practices and issued suggestions and recommendations, this requiring important preparatory self-assessment, systematisation and review efforts by the Council. Furthermore, in January 2011 a follow-up IRRS mission was carried out in order to check the degree of implementation of the recommendations contained in the 2008 mission, this being in response to a request by the Spanish Government. This mission concluded that the CSN had significantly improved its regulatory activities overall and pointed to a series of good practices.

The improvements introduced at the CSN and in the rest of the Spanish regulatory system in response to the recommendations of the 2008 IRRS mission are as follows:

- Yearly performance of a systematic compilation of the results of the inspections performed at the radioactive facilities, identifying where appropriate deviations, good practices and other noteworthy aspects encountered and lessons learned, with a view to improving both the radiological protection and safety-related performance of the licensees of the facilities and the inspection and control practices of the CSN itself.
- In late 2009, the Ministry of Industry, Energy and Tourism published a public call in order to determine which municipalities might be interested in being candidates for a Centralised Temporary Storage Facility(CTS) for spent nuclear fuel and high level radioactive wastes, along with its associated technology centre. The process came to an end in December 2011 with approval by the Cabinet of Ministers for the designation of the site proposed by the village of Villar de Cañas (Cuenca).

- Formalisation and implementation of a programme of internal management processes audits. The programme guarantees that the processes are audited every three or four years, depending on their type.

Likewise, the follow-up mission performed in 2011 made the following recommendations and suggestions aimed at strengthening the Organisation:

- To establish a formal policy regarding the use of the technical advisory bodies to adopt regulatory decisions of a technical nature.
- The CSN should continue to collaborate with the competent authorities and organisations to facilitate the process of selecting a site for a definitive spent fuel and high level waste disposal facility.
- To continue to work with the corresponding competent authorities and other organisations on regulatory aspects in the area of physical protection.

### 1.b.5. Transparency of regulatory activities

The transparency policy of the Nuclear Safety Council is defined by the law by which the body was created, Law 15/1980, of April 22nd, reformed by Law 33/2007, of November 7th. This legislative reform incorporated guaranteed access to information on the environment, the participation of the public in decision-making and access to justice regarding environmental matters, as contemplated in the Aarhus Convention, which was ratified by Spain in 2004 and materialised in the national legislation by way of Law 27/2006, of July 18th, regulating rights to access to information, public participation and access to justice in relation to environmental matters.

The reform of the Law Creating the CSN was particularly ambitious regarding public information, aiming clearly to increase the transparency of the organisation and promote public trust in the activities of the Nuclear Safety Council.

The obligations of this law as regards information and communication are channelled along three paths:

- Policy regarding information to the State Institutions: every year the CSN submits a detailed report to the National Parliament and the Regional Parliaments of the Autonomous Communities housing nuclear facilities on the activities carried out by the Council throughout the year. This report is presented to the Parliament during an appearance by the President of the Council before the Commission for Industry, Energy and Tourism. Likewise, as part of its relations with Parliament, the CSN responds to the demands of the different political groups, made through parliamentary questions and the resolutions issued with respect to the annual report.
- Policy regarding information in the vicinity of nuclear facilities: the legislation obliges the CSN to promote and participate in information forums in the vicinity of these installations, in order to deal with issues relating to the operation of the nuclear and radioactive facilities and also aspects relating to emergency preparedness. Furthermore, the Regulation on Nuclear and Radioactive Facilities (RNRF) (Royal Decree 1836/1999, of December 3rd) contemplates the existence of Information Committees, which are information and public participation forums presided over by the Ministry of Industry, Energy and Tourism, with the clear objective of informing and educating the local population on nuclear safety and radiological protection issues, on the basis of which a programme of annual meetings is organised.
- Policy regarding information for the general public: article 14 of Law 15/1980 establishes the need to provide access to information and facilitate the participation of the members of the public and civil society. This implies the obligation to report on all relevant events relating to the operation of the facilities, with special emphasis on safety and the potential for a radiological impact affecting people and the environment, but also on the events and incidents occurring at these facilities and the corrective measures that might be implemented.

Through its website the CSN provides information on inspection reports, the minutes of Council meetings, the technical reports supporting the agreements reached by the Council and all relevant events relating to the operation of the nuclear and radioactive facilities (operating status of the plants, information on environmental quality (automatic and environmental radiological surveillance stations networks), news items, reviews and press releases on events occurring at nuclear power plants and radioactive facilities, information on the integrated plant supervision system (SISC), etc.). As regards information for the media and stakeholder groups, and in addition to what is included on the website, the CSN responds to direct requests from the media applying criteria of transparency and agility as dictated by technical rigour.

Furthermore, the legal requirement for transparency obliges the CSN to subject its instructions and safety guides to public feedback during the preparation phase, for which it has set aside an area online for comments. Also established is the procedure to be adhered to for communications made by physical or legal persons, in application of article 13 of Law 15/1980. The Council also makes a form available to the workers of nuclear and radioactive facilities in order for them to report on any event affecting the safety of these installations, with guaranteed confidentiality.

The CSN also makes use of other communication channels, such as the organisation of conferences, seminars and training activities, operation of the public information centre and publications generally available free of charge via the website.

### 1.b.6. Advisory Committee for Information and Public Participation

The Advisory Committee for Information and Public Participation in relation to nuclear safety and radiological protection was set up in compliance with article 15 of Law 15/1980, specifically in accordance with the wording of reform Law 33/2007, with the mission of issuing recommendations to the CSN to promote and improve transparency, access to information and public participation in areas included with the Council's realm of competence. This legal provision was enacted in 2010 through the approval of the new CSN Statute, by Royal Decree 1440/2010, with establishment of the rules applicable to its working. The legal basis having been established, the appointment of the members representing the entities and organisations contemplated by law took place at the end of 2010.

The Advisory Committee was set up on February 24th 2011 during the course of its initial meeting, held at CSN headquarters. This meeting was basically informative, dealing with the functions of the CSN and its activities in relation to information and transparency, and provided the committee members with the opportunity to set forth their initial impressions and suggestions regarding the tasks to be performed.

The Committee met for the second time on October 20th 2011, agreeing on an operating approach whereby two ordinary meetings will be held each year, one in spring and the other in autumn, during which the Committee will generally approve recommendations. The CSN will report on the treatment given to the previously formulated recommendations and on its most important activities.

One of the most significant points being dealt with by this Advisory Committee is its role in drawing up a programme for the broadcasting to the public of the definitive results of the stress tests applied to the Spanish nuclear power plants.

### 1.b.7. Independence

Law 15/1980 establishes mechanisms to guarantee the independence of the CSN, one of them being the procedure whereby the members of the Plenary are appointed; these are

required to be persons of recognised solvency in the areas commissioned to the CSN and special value is attached to their independence and the objectiveness of their criteria.

The members of the Plenary of the CSN (President and Counsellors) are appointed by the Government in response to proposals by the Ministry of Industry, Energy and Tourism and following the appearance of the candidates before the corresponding Congressional Commission. Their term of office is six years and they may be re-elected once only for a second term.

The posts of President and Counsellor and other high-ranking positions are incompatible with any other post or function; the persons occupying such posts shall not carry out professional activities relating to nuclear safety and radiological protection during the two years subsequent to their leaving the position.

The CSN rulings in relation to safety and radiological protection are compulsory in all cases and, furthermore, are binding when negative and denying an authorisation, and also as regards the conditions established when positive.

In drawing up its instructions, which are standards binding upon all the affected entities, the CSN promotes the participation of the stakeholders and the public, and these are made known to Congress before being approved by the Council.

The independence of the CSN is strengthened by the fact that practically all its funding comes from fees and public prices for services rendered, with only about 10% coming from the State budget, this amount being used exclusively to cover the cost of the functions performed in relation to the radiological protection of the public and environmental monitoring and to preparation for and management of nuclear and radiological emergencies.

## 2. Technical support organisations

In the case of Spain, the Regulatory Body (CSN) is self-sufficient because of its technical know-how, not requiring technical support from other organisations. Occasionally the CSN's technical know-how is complemented by public organisations, engineering firms and private consultants. Particular significant as regards the former is the collaboration of Ciemat (Energy, Environmental and Technological Research Center), which not only provides far-reaching technical knowledge but also research facilities that are available to and used by the CSN to improve its technical capacities.

## 3. Spanish nuclear sector

The licensees of the Spanish NPP's are grouped together into Unesa (the Spanish Electricity Industry Association). Unesa is a professional sector-specific business organisation that coordinates, represents, manages, promotes and defends the business and professional interests of its members. The 5 most important Spanish electricity utilities are currently members of Unesa, among them the owners of the 8 operating nuclear groups. The Unesa Nuclear Energy Committee (NEC) comprises the top-ranking nuclear officers of these companies.

The NEC coordinates aspects relating to the safety and operation of the Spanish nuclear power plants through 5 Commissions reporting to the Committee: the Operations Commission (COP), the Radiological Protection and Waste Commission (PRR), the Technology Commission (TCN), the Nuclear Safety and Licensing Commission (CSL) and the Quality, Organisation and Human Factors Commission (COF). Reporting in turn to these Commissions is a large number of working groups including representatives from all the nuclear power plants that address highly specific issues.

There are also permanent organisations covering relations with the CSN (CSN-Unesa Liaison Committee) and with Enresa[6] (Enresa-Unesa Parity Commission) that deal with strategic questions of mutual interest.

Throughout this organisational structure there is a valuable exchange of information and experiences and common positions are adopted, favouring the on-going improvement of the safety of the facilities within a rational and flowing framework of dialogue with all the agents involved.

## 4. Responsibility in emergencies

Within the Spanish State, the Basic Nuclear Emergency Plan (Plaben) (Royal Decree 1546/2004, modified by Royal Decree 1428/2009) is the civil defence plan that sets out the basis and criteria for the efficient management of emergencies having repercussions off site and arising as a result of incidents and accidents at nuclear power plants (NPP's).

The licensees of the nuclear power plants are responsible for maintaining and activating the site emergency plans and for collaborating with the public Administrations in the off-site emergency plans. The competence and responsibility of the General State Administration, directed and coordinated by the Ministry of the Interior as the Department responsible for civil defence, cover all phases of the emergency: planning, preparation of the response, maintenance of efficiency, emergency response and management of all interventions, all this without prejudice to the necessary participation of the services, means and resources of the other Public Administrations and the collaboration of the NPP licensees.

Listed below are the competent Authorities and organisations concerned belonging to the public Administrations.

1. For the General State Administration:
   a) Competent Authorities: Ministry of the Interior (Directorate General for Civil Defence and Emergencies, Directorate General of the Guardia Civil, Directorate General of the Police, Government Delegations and Sub-delegations in the territorial areas housing the NPP's), Nuclear Safety Council.
   b) Organisations concerned. Competent bodies in the fields of energy regulation, meteorological information, public health, the environment,law enforcement defence policy, infrastructures and tracking for crisis situations.
2. For the Autonomous Community Administration: Organisations of the autonomous communities affected by the Nuclear Emergency Plans (NEP's) and responsible for civil defence, health, public works, transport and communications, supplies and shelter, social assistance and education and road safety.
3. For the Local Administration: Town Councils included in the NEP's and corresponding provincial councils.
4. Other concerned organisations: Public organisations and bodies responsible for radioactive waste management (Enresa), management of the hydraulic, maritime-terrestrial and aerial public domain, safety in foodstuffs and public consumption, land planning and radio and television broadcasting.

The Military Emergency Response Unit (UME) was set up in 2005 to provide a capacity for rapid intervention in the event of serious risk, catastrophe, calamity or other public needs.

6 ENRESA is the public company that undertakes the management and safe storage and disposal of the radioactive wastes produced in Spain.

The UME includes a unit providing the human and material resources required to respond to nuclear accidents.

Among the functions of the Nuclear Safety Council (CSN), the organisation solely responsible for Nuclear Safety and Radiological Protection, is collaboration with the competent authorities in establishing the criteria to be met by the NPP off-site emergency plans and, following the drawing up of these plans, participation in their approval, as well as coordination of the emergency situation support and response measures, for all aspects relating to nuclear safety and radiological protection, integrating and coordinating all the different organisations and public or private companies whose intervention is required for compliance with the functions attributed to this Organisation. The Council is also responsible for performing whatever other emergency response activities might be assigned to it in the applicable regulations.

Finally, in compliance with the functions assigned to it by law, the regulatory body has a *CSN nuclear emergency action plan* that sets out its actions in response to nuclear and radiological emergencies. Furthermore, the CSN has an emergency response centre (Salem) that renders its services 24 hours a day, 365 days a year, and that in addition to being manned by specialist personnel is equipped with communications and data acquisition and management systems and with computer resources for the performance of different calculations.

# Topic 5: Emergency preparedness &response and post-accident management (off-site)

In Spain the planning of the response to emergencies at nuclear power plants is established on two complementary levels that go to make up an integrated planning and response system. On one hand is the planning of the response actions taken inside the nuclear power plants, which is accomplished by way of the so-called On-Site Emergency Plans, regulated specifically by the Regulation on Nuclear and Radioactive Facilities (Royal Decree1836/1999), while on the other is the planning of emergency response actions outside the plants, which is regulated by civil defence standards, specifically the Basic Nuclear Emergency Plan (Royal Decree 1546/2004, modified by Royal Decree 1428/2009).

The organisation and structure for response actions in off-site emergency situations are dealt with in the previous section, which also contemplates the capacities available to the Nuclear Safety Council: the CSN nuclear emergency action plan (EAP) and the emergency response centre (Salem), which is in service 24 hours a day, 365 days a year, and which in addition to being manned by specialist personnel is equipped with communications and data acquisition and management systems and with computer resources for the performance of different calculations.

The licensees of the nuclear power plants are responsible for the On-Site Emergency Plans, while the public authorities are responsible for the Off-Site Emergency Plans, with collaboration from the licensees.

The nuclear emergency plans (on and off-site) are already designed to respond to accident situations beyond the design basis. Despite this, it is considered that analysis of the emergency response actions taken in the case of the accident that occurred at Fukushima nuclear power plant will be essential in order to learn lessons allowing the capacities and procedures of the on and off-site nuclear emergency plans to be improved and reinforced.

The actions taken by the licensees of the facilities, with CSN supervision, to improve the on-site emergency plans are described in Topic 3: Severe Accident Management.

As regards the off-site emergency plans, a systematic analysis of the information available on the management of the accident at the Fukushima nuclear power plant has also been initiated. In particular, the information provided, mainly by the IAEA, on the Fukushima accident, its evolution, the protective measures implemented and the possible applicability of the lessons learned to the nuclear emergency planning, preparedness and response system in place in Spain is being analysed. Additionally, this analysis considers coordination with the review and reinforcement actions that are planned to be performed to improve the nuclear power plant on-site emergency plans, with a view to making available a sufficiently harmonised integrated response system.

The analysis of this information is being performed jointly by the Directorate General for Civil Defence and Emergencies, which is responsible for drawing up the applicable regulations, for example the Basic Nuclear Emergencies Plan (Plaben), and the CSN as a regulatory body playing an essential role in defining the criteria underlying the emergency plans. These two institutions collaborate closely in all aspects relating to the planning of and preparation for nuclear emergencies.

An initial joint reflection on the available information has served to identify a series of aspects that might affect the Plaben and the off-site emergency plans of the nuclear power plants

and that will be analysed in the light of the experience gleaned from Fukushima with a view to determining whatever reinforcement actions might be required. Summarised below are the most relevant aspects for which specific studies have been initiated or are foreseen:

1. Suitability of the resources assigned to the emergency response organisation.

   Degree of suitability of the resources assigned to the off-site Nuclear Emergency Plans to adopt the necessary reinforcement measures, where necessary.

2. Reference levels, former intervention levels, for the establishment of urgent and medium-term measures to protect the population.

   An analysis of the values mentioned will be carried out, taking into account the experience of Fukushima and the need to adapt those existing in the Spanish standards to the requirements of the recent Basic Safety Standards on Radiological Protection (BSS).

3. Reference levels, former dose levels, for the establishment of measures to protect the intervening personnel.

   The reference levels will be defined from a more integrated joint perspective for both the personnel intervening in the Nuclear Power Plant On-Site Emergency Plans and those intervening in the Off-Site Nuclear Emergency Plans, and the corresponding Plans will be modified accordingly. In this respect, the licensees of the nuclear power plants have already been required to establish reference levels for the emergency response personnel identical to those contemplated in the Plaben for people intervening off site, which are based on the recommendations of the ICRP and on the applicable IAEA standards.

4. Accident scenarios and timescales.

   Extreme accident hypotheses such as those analysed within the framework of the nuclear power plant stress tests will be studied, along with their coincidence with the most unfavourable circumstances, in order to obtain scenarios that may be used to assess the suitability of the criteria currently used as a basis for the off-site Nuclear Emergency Plans.

   Likewise, an analysis will be performed of aspects relating to the coordination between the emergency management centres of the Competent Authorities and those of the affected Nuclear Power Plant, especially when implementing mitigation measures implying off-site releases. An evaluation will also be made of the advisability of planning and response reinforcements during the urgent phase of the emergency, in order to take into account the possibility of this phase lasting longer than initially expected, as was the case at Fukushima.

5. Delimitation of planning zones

   The dimensions of these zones will be reconsidered, as will their possible adaptation depending on the evolution of the accident and the social or environmental circumstances.

6. Criteria relating to decision-making regarding the adoption of measures for the following:

   a) Sheltering.

   b) Radiological prophylaxis.

   c) Evacuation.

   d) Relocation.

   e) Control of foodstuffs.

   The criteria and methods for the establishment of such protection measures will be reconsidered taking into account the need for harmonisation with similar measures in the EU countries, and in particular with neighbouring countries.

7. Systems for public warning and communications in emergencies.

   Studies will be performed with a view to possibly improving the public early warning system and the efficiency of communications with the population, allowing the publicto be kept informed of the protective measures adopted and awareness of the evolution of the emergency and the measures applied at each moment

8. Installations for the radiological control and, where necessary, the decontamination of the population affected by an emergency, and other associated aspects.

   In view of the possibility of an emergency affecting a large number of persons, an analysis will be made of the means available for these activities and, if necessary, their capacity and effectiveness will be increased.

9. Role of municipal organisations in nuclear emergency planning and response.

   The complexity of the measures that might be adopted during a nuclear emergency requires a greater involvement by the affected municipalities, as a result of which it is considered necessary to assess and strengthen the capacity of the municipal organisations in order to ensure a more efficient performance of the functions assigned to them.

10. Participation and collaboration of the plant licensees in the preparation and response phases of the off-site plans.

    The Plaben currently foreseesthe collaboration of the licensees in the off-site preparation for and response to nuclear emergencies, but does not specify this collaboration in detail. Although the licensees of the plants currently contribute to the Off-Site Nuclear Emergency Plans through specific activities and resources, the authorities responsible for these Off-Site Emergency Plans have considered it advisable to establish more detailed criteria in order to streamlinethe participation of the licensees of the nuclear power plants in these plans.

11. Transition between urgent, intermediate and recovery phases.

    At present, the Plaben focuses very much on the measures to be implemented during the urgent phase. The experience gleaned from Fukushima underlines the importance of better defining the criteria for the transition to the intermediate phase and the activities to be performed during this phase, as a result of which this aspect will be analysed with a view to defining appropriate improvements.

Also, it is concluded from the experience acquired in tracking this emergency from the CSN's Salem that there is a need to revise the CSN Emergency Action Plan, at least as regards the following aspects:

- Analysis of the issuing of official technical communications on the situation and the evolution of the accident.
- Actions during long-lasting emergencies.
- Improvement of the tools used for assessment of the consequences and aiding decision-making.

Work has already begun on aspects relating to improvements to the Plaben and, in general, to the off-site emergency plans, to be undertaken jointly by the Directorate General for Civil Defence and Emergencies of the Ministry of the Interior and the Nuclear Safety Council. As of the moment of drawing up of the present report, the action plans required to address these studies are being prepared and, in view of the complexity of the issues involved, the corresponding improvement and reinforcement proposals are expected to be defined in the medium term. In performing these studies, consideration will be given to the results of the international initiatives currently under way, undertaken by several of the international organisations with which Spain participates (IAEA, NEA, HERCA, etc.), to evaluate the experience acquired from Fukushima and identify lessons learned that might be applicable to emergency planning, preparedness and response.

Topic 5: Summary table

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | Activity<br>- Taken?<br>- On-going?<br>- Planned? | Schedule<br>or milestones<br>for planned<br>activities | Results<br>Available<br>- Yes?<br>- No? | Activity<br>- Taken?<br>- On-going?<br>- Planned? | Schedule<br>or milestones<br>for planned<br>activities | Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 5 – Emergency preparedness and response and post-accident management (off-site) | | | | | | |
| Analysis of off-site nuclear emergency plans | | | | Ongoing | | Yes<br>Plans have already been designed to respond to accident situations beyond the design basis. |
| Analysis of possible improvements arising from the lessons learned from the Fukushima accident, to determine the reinforcement actions that might be required. The most relevant aspects to be considered are as follows:<br>— Suitability of the resources assigned to the emergency response organisation<br>— Reference levels, former intervention levels, for the establishment of urgent and medium-term measures to protect the population. | | | | On-going/planned | Medium term | — |

Topic 5: Summary table (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | Activity<br>- Taken?<br>- On-going?<br>- Planned? | Schedule<br>or milestones<br>for planned<br>activities | Results<br>Available<br>- Yes?<br>- No? | Activity<br>- Taken?<br>- On-going?<br>- Planned? | Schedule<br>or milestones<br>for planned<br>activities | Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 5 – Emergency preparedness and response and post-accident management (off-site) | | | | | | |
| Analysis of possible improvements (continued)<br>— Reference levels, former dose levels, for the establishment of measures to protect the intervening personnel.<br>— Accident scenarios and timescales.<br>— Delimitation of planning zones.<br>— Criteria relating to decision-making regarding the adoption of measures for the public.<br>— Public warning and communications systems in emergencies.<br>— Installations for the radiological control and, as appropriate, decontamination of the affected population.<br>— Role of municipal organisations in nuclear emergency planning and response.<br>— Participation and collaboration of the municipal organisations the planification and response in nuclear emergencies. | | | | On-going/planned | Medium term | — |

Topic 5: Summary table (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | Activity<br>- Taken?<br>- On-going?<br>- Planned? | Schedule<br>or milestones<br>for planned<br>activities | Results<br>Available<br>- Yes?<br>- No? | Activity<br>- Taken?<br>- On-going?<br>- Planned? | Schedule<br>or milestones<br>for planned<br>activities | Conclusion<br>Available<br>- Yes?<br>- No? |
| Topic 5 – Emergency preparedness and response and post-accident management (off-site) | | | | | | |
| Analysis of possible improvements (continued)<br>— Transition between urgent, intermediate and recovery phases. | | | | On-going/planned | Medium term | — |
| Implementation of improvements arising from the aforementioned analysis. | | | | Planned | Medium/long term | — |
| Revision of certain aspects of the CSN emergency Action Plan. | | | | Planned | Short/mid term | — |

# Topic 6: International Cooperation

International activities may be broken down into the following categories:

- International Conventions.
- Mechanisms for communication with neighbouring countries and the international community. Bilateral relations.
- Cooperation with international organisations. Multilateral relations.
- Hosting of peer reviews.
- Dissemination of international operating experience.

## 1. International conventions

The Spanish State has subscribed to the following international Conventions and agreements relating to nuclear safety and radiological protection:

- Convention on Nuclear Safety (CNS).
- Joint Convention on Safety in the Management of Spent Fuel and Safety in the Management of Radioactive Waste (Joint Convention).
- Convention on the Early Notification of Nuclear Accidents (CENNA).
- Convention on Mutual Assistance in the event of a Nuclear Accident or Radiological Emergency.
- Convention on the Physical Protection of Nuclear Materials (CPPNM).
- Convention for Protection of the Marine Environment of the North-western Atlantic (OSPAR).

The different actions undertaken within the framework of the International Conventions are described below.

### 1.a. Convention on Nuclear Safety

Spain signed the Convention on Nuclear Safety on October 15th 1994, this being ratified by means of an instrument of the Ministry of Foreign Affairs signed by H.M. the King on June 19th 1995.

The Contact point for organisation and participation in the review meetings of the Convention on Nuclear Safety is the Nuclear Safety Council.

In compliance with the commitments adopted following ratification of this Convention, Spain has drawn up five national reports that have been submitted during the five review meetings held within the framework of this Convention.

The Nuclear Safety Council, the Ministry of Industry, Energy and Tourism (Minetur) and the Association of the Spanish Electricity Industry (Unesa) participate in drawing up the national reports.

Spain has participated actively in the review meetings of this Convention, both during the preparation phase, providing experts to act as Officers in the groups of countries, and during

the phase of questions and answers on the national reports, as well as during the process of preparing and carrying out the meetings themselves, participating actively in the discussions during the reviews of the national reports by the groups of countries and in the analyses and discussions within the framework of the open groups to improve the efficiency and effectiveness of the Convention.

## 1.b. Convention on Safety in the Management of Spent Fuel and Safety in the Management of Radioactive Waste

Spain ratified this Convention by means of an instrument of the Ministry of Foreign Affairs, signed by H.M. the King on April 30th 1999. The present Convention entered into force for Spain on June 18th 2011, as established in its article 40.

The Contact point for organisation and participation in the review meetings of the Convention on Safety in the Management of Spent Fuel and Safety in the Management of Radioactive Waste is the MINETUR.

In compliance with the commitments adopted following the ratification of this Convention, Spain has drawn up four national reports, the fourth to be submitted during the next review meeting, scheduled for 2012.

The Ministry of Industry, Energy and Tourism (Minetur), the Nuclear Safety Council and the Spanish public entity responsible for radioactive waste management (Enresa) participate in drawing up the national reports.

Spain has participated actively in the review meetings of this Convention, both during the preparation phase, providing experts to act as Officers in the groups of countries, and during the phase of questions and answers on the national reports, as well as during the process of preparing and carrying out the review meetings themselves, participating actively in the discussions during the reviews of the national reports by the groups of countries.

## 1.c. Convention on the Early Notification of Nuclear Accidents and Convention on Mutual Assistance in the event of a Nuclear Accident or Radiological Emergency

Spain signed the instrument ratifying the Convention on the early notification of nuclear accidents on October 26th 1986, and the instrument ratifying the Convention on mutual assistance in the event of a nuclear accident or radiological emergency on that same date, October 26th 1986.

In complying with the commitments implied by its ratification of the Convention on Early Notification, Spain has appointed the CSN to be its national Contact point, through its Emergency Response Centre (Salem), which implements the contents of the Convention (EMERCON/ ENAC). The CSN participates in periodic exercises of varying scope, performed to check the correct operation of the system.

As regards the Convention on Mutual Assistance, the Points of Contact in Spain are the Directorate General for Civil Defence and Emergencies, through its operations coordination room (Sacop), and the CSN, through the Salem.

## 1.d. Convention on the Physical Protection of Nuclear Materials (CPPNM)

Spain signed the instrument ratifying this Convention on April 7th 1986 and ratified it on September 6th 1991.

Subsequently, on July 8th 2005, the States Party to the Convention on the Physical Protection of Nuclear Materials approved by consensus an amendment that substantially increased the

controls on nuclear materials, incorporated the physical protection of nuclear facilities and strengthened international cooperation in this area, especially regarding the urgent measures to be taken to locate and recover stolen or contraband nuclear material, to mitigate the radiological consequences of sabotage and to attempt to prevent and combat any possible crime involving such materials.

Spain accepted this amendment on November 9th 2007.

The Minetur is the competent authority appointed as the contact point in Spain.

### 1.c. OSPAR (Oslo-Paris) Convention

The OSPAR Convention came about in 1992 as a result of the linking of the Oslo Convention of 1972 for the prevention of marine pollution and the Paris Convention of 1974 for the prevention of marine pollution of terrestrial origin.

Spain signed its adherence to this Convention on September 22nd 1992, and subsequently ratified it on January 25th 1994.

Spain is represented in this Commission by representatives of the Ministry of the Environment and Rural and Marine Habitats.

Every year Spain provides data on the releases from the country's nuclear facilities and an estimate of the releases of radioactive effluents from non-nuclear facilities during the year.

## 2. Mechanisms for communications with neighbouring countries (bilateral relations) and with the international community

The CSN gives great importance to bilateral relations with the regulatory bodies of other countries. In particular, it is party to numerous technical cooperation agreements having as their main objective the establishment of bases for collaboration and the exchange of information, both of a general nature and in specific fields, with particular attention given to the bilateral agreements signed with the United States and France.

Also to be underlined is the CSN's interest in having specific collaboration agreements regarding preparedness for and the management of nuclear or radiological emergency situations with neighbouring countries, this being the case for France and Portugal.

In this respect, in November 2009 the CSN signed a specific collaboration agreement with the French regulatory body in relation to the planning, preparedness and management of nuclear and radiological emergency situations.

The main objective of this agreement is to promote the exchange of information, know-how and experiences in relation to the planning and preparation for and response to nuclear and radiological emergency situations. Furthermore, the two regulatory bodies collaborate in the development of nuclear and radiological emergency procedures and plans and establish bilateral mechanisms for the early notification of nuclear or radiological accidents occurring in either of the countries and potentially affecting the national territory, the population or the environment of the other. Mechanisms are also established to facilitate mutual assistance between the respective national emergency response organisations in the event of an accident.

In order to accomplish these objectives, experts in emergency situations participate in drills carried out in both of the countries, as well as in *ad hoc* meetings and working groups dealing with this issue, this facilitating communication and understanding of the action procedures of the two organisations.

Since 2009, the CSN has been promoting the signing of a specific collaboration agreement on the planning and preparation for and response to nuclear or radiological emergency situations

and environmental radiological protection with the Portuguese authorities. The arrangements for the signing of this agreement are now in an advanced stage . The Portuguese authorities involved are the Portuguese Environmental Agency and the Nuclear Technology Institute of Portugal.

Further to the interest of the CSN set out above, the Moroccan regulatory authorities have been approached with a view to identifying opportunities for collaboration and mutual cooperation.

Furthermore, Spain as a European Union member country fulfils the requirements of Council Decision 87/600/EURATOM on Early Notification and the exchange of Information.

The system implementing the contents of this Decision is known as the European Community Urgent Radiological Information Exchange system (ECURIE). The Spanish Contact point with the ECURIE Management Centre is the CSN, through its Emergency Response Centre (Salem). The Council Decision requires the ECURIE System to be regularly checked by means of exercises of varying scope and classified from 0 to 3.

In the event of a nuclear or radiological emergency, the European Union provides other support systems such as the European Union Radiological Data Exchange Platform (EURDEP) and Atmospheric dispersion forecast model results (ENSEMBLE)

As regards the EURDEP programme, the CSN submits data from its network of automatic environmental radiological surveillance stations (REA) and from the stations of the autonomous communities daily; in compliance with the commitment acquired by the countries participating in EURDEP, these data are sent at a frequency of less than one hour in the event of an emergency and during the performance of drills.

Furthermore, within the framework of the International Associations, the CSN has been a permanent member from the very start of the Heads of European Radiological protection Competent Authorities (HERCA). During the seventh meeting of its Steering Committee, held in June 2011, this Association agreed that in the wake of the accident that occurred in Japan there was a need to improve the mechanism for communication and coordination at international level, mainly at European level. With this aim in mind, HERCA and the European Commission (EC) are working jointly to develop a video conferencing system between the member countries of HERCA and the EC, the objective of which will be to strengthen the exchange of information and coordination of responses in the event of an emergency.

The CSN supports this initiative within the framework of HERCA and the EC and will participate in whatever drills or exercises the EC might organise.

## 3. Cooperation with international organisations (multilateral relations)

Spain maintains multilateral relations with international organisations through the CSN, MINETUR and UNESA, and occasionally also directly through the country's nuclear power plants, attending meetings, workshops, seminars and conferences dealing with nuclear safety and radiological protection.

### 3.a. CSN and Minetur

These relations may be sub-divided into four categories of activities:

- Those relating to the European Union (EU).
- Those relating to the International Atomic Energy Agency (IAEA).
- Those relating to the OECD Nuclear Energy Agency (NEA).
- Those relating to other major international forums or associations.

The CSN collaborates with other Spanish public entities (MAEC and Minetur) in international relations within its realm of competence, i.e., nuclear safety, radiological protection and the security of nuclear facilities.

The CSN's participation in international working groups is briefly described below:

**a) European Union**

Multilateral relations within the European Union are of great importance for Spain, in particular activities arising as a result of the EURATOM Treaty. Through these relations community practices relating to nuclear safety and radiological protection are shared, driving cooperation between the Member States. Through the CSN and Minetur Spain participates in several European Union Commission and Council groups dealing with these areas of work.

An important forum for discussion in relation to nuclear safety and radiological protection, radioactive waste, transport, supply of nuclear fuel and third-party collaboration agreements in the field of nuclear energy is the Atomic Questions Group (AQG), which advises the EU Council on issues contemplated by the Euratom Treaty. Spain is represented in this group by both the Minetur and the CSN.

Furthermore, in 2007 the European Nuclear Safety Regulators Group (ENSREG) was set up, with a view to harmonising nuclear safety and radioactive waste management practices among the Member States. Spain is represented in this group by both the Minetur and the CSN.

Likewise, the CSN and Minetur participate in various technical initiatives, committees and working groups, as well as in the definition, coordination and performance of regulatory assistance programmes within the framework of the European Union's Instrument for Cooperation in Nuclear Safety (INSC). Spain has defined a national strategy for the selection of those countries to which it provides support, participating in projects for cooperation and assistance to regulatory authorities within the framework of INSC. This national strategy has always focussed on giving priority to participation and technical collaboration with the regulatory authorities of countries in the north of Africa and in Latin America, on the basis of strategic and geopolitical criteria.

In this respect, Spain has participated through the CSN in the project for assistance to the Jordanian and Egyptian regulatory bodies, and is currently participating in projects for assistance to the regulatory authorities of Brazil and Morocco.

Within the framework of the EURATOM Treaty, Spain is represented by the CSN, which has representatives on the experts committees of various articles (Articles 31; 35 and 36; and 37).

Spain also participates in ESA (the European Supply Agency), where it is represented by the Minetur and the nuclear industry. The provisions of EURATOM contemplate the setting up of this Agency to ensure a stable and equitable supply of nuclear fuel to the EU users. With this aim in mind, the ESA focuses on improving security of supply for its members and shares responsibilities regarding the viability of the European nuclear industry.

**b) International Atomic Energy Agency (IAEA)**

Spain maintains close relationships with the IAEA and is part of many of the Agency's organisations and working groups; in particular it participates in numerous technical activities within the framework of its technical and/or international cooperation programmes.

As regards participation in technical activities, the Spanish Government closely monitors the IAEA's working programme through the CSN, and actively participates in it. As a result, the CSN participates on different technical committees and in different working groups. Specifically, it participates in the International Nuclear Safety Advisory Group (INSAG), the Commission on Safety Standards (CSS) and its four committees: the Nuclear Safety Standards Committee

(NUSSC), the Radiological Protection Standards Committee (RASSC), the Transport Safety Standards Committee (TRANSSC) and the Waste Ma nagement Safety Standards Committee (WASSC). In addition, the CSN participates in other technical working groups for the development of standards and working guidelines.

Particularly noteworthy is the collaboration provided in maintaining the activities of the agency in relation to the seismic safety of nuclear facilities, the development and implementation of the new manual of the International Nuclear and Radiological Events Scale, INES (which includes radioactive facilities and transport).

Included among the IAEA's cooperation activities are the management and organisation of training workshops and regional courses. In this respect, Spain regularly hosts international conferences and seminars on specific issues, organised by the CSN in collaboration with the IAEA, and also contributes to this activity by providing experts to participate in this type of events in other countries. As regards Spain's role in technical cooperation, the CSN and other national institutions open their doors to scholarship holders and scientific visits in response to requests from the IAEA, to share their national experience in matters relating to nuclear safety and radiological protection.

### c) OECD/NEA

The Nuclear Energy Agency (NEA) of the Organisation for Economic Cooperation and Development (OECD) operates as a forum for international cooperation, allowing for the exchange of information and experience, and as a vehicle facilitating consensus or the reconciliation of different positions between the Member States, based on technical work.

The Government of Spain participates through the CSN in the technical committees and working groups of the OECD/NEA to which it belongs:

- Committee on the Safety of Nuclear Installations (CSNI).
- Committee on Nuclear Regulatory Activities (CNRA).
- Radioactive Waste Management Committee (RWMC).
- Committee on Radiation Protection and Public Health (CRPPH).
- Nuclear Science Committee (NSC).
- Nuclear Legislation Committee (NLC).

Spain also participates through the CSN in numerous international research and development projects and programmes coordinated by the NEA, the initiatives on risk assessment, the ageing of structures and components, operating experience, human factors and public communication being particularly significant.

### d) Other regulatory groups

With a view to increasing the efficiency of international collaboration, a series of regulatory associations were set up in the 1990's, based on interest in cooperating to achieve a higher level of nuclear safety and radiological protection. The CSN is a member of several of these associations, those set out below being particularly noteworthy.

*International Nuclear Regulators Association (INRA)*

INRA brings together the regulatory bodies with the widest experience in the field of nuclear regulation (Germany, Canada, South Korea, Spain, United States, France, Great Britain, Japan and Sweden). The heads of these organisations meet twice a year to debate issues of common interest and openly deal with the challenges facing their organisations.

The major lines of work of the regulators are continuously reviewed and common positions are sought, notes being issued for international organisations such as the IAEA or NEA. At present the actions taken in the wake of the Fukushima accident are being discussed.

*Western European Nuclear Regulators Association (WENRA)*

WENRA is made up of the regulatory authorities of countries having nuclear reactors in operation or in the dismantling phase in the EU and Switzerland.

The main objective of this Association is to harmonise the main practices and technical standards relating to nuclear safety in the different European countries, thus contributing to the on-going improvement of safety.

Spain participates, through the CSN, in the meetings of the plenary group of WENRA, and in the three working groups dedicated to the harmonisation of the nuclear safety requirements of reactors, the safe management of radioactive waste and dismantling and the harmonisation of inspection practices.

The CSN has also integrated the terms of reference developed by WENRA in its regulatory practices, through the issuing and publication of binding Technical Instructions.

Safety objectives for new reactors are being developed within the framework of WENRA, these including the strengthening of the design of nuclear facilities to prevent accidents and to minimise their consequences if they occur. This association has also participated actively from the very beginning in defining the scope of the stress tests within the framework of the EU.

*Latin American Forum of Radiological and Nuclear Regulatory Bodies (FORO)*

FORO is an association that brings together the radiological and nuclear regulatory bodies of Argentina, Brazil, Chile, Cuba, Spain, Mexico, Uruguay and Peru. Its main objective is to promote a high level of safety in all practices involving the use of radioactive materials or nuclear substances in the Latin American region.

FORO carries out an internally defined technical programme that has proven to be an excellent example of sustainable collaboration in a large region, with its own funding but with the indispensable help of the IAEA as scientific secretary. The technical programme is coordinated by a steering committee, which is currently presided over by a representative of the CSN.

A working group was set up within FORO in 2011 with the task of defining and agreeing on the contents of a programme of nuclear power plant stress tests applicable in all the FORO member countries. The countries involved in analysing the stress tests programme will be Argentina, Brazil, Mexico and Spain, and the evaluation of the results obtained will be carried out by all the FORO member countries, including the non-nuclear members.

Also launched has been a new activity aimed at harmonising and updating the working methodologies of the organisations comprising FORO and the capacities of the corresponding countries as regards preparedness for and response to nuclear and radiological emergencies.

*Heads of European Radiological protection Competent Authorities (HERCA)*

Although the regulatory framework for radiological protection in the European Union revolved around the European directives, the practical application of the requirements established in these directives may be accomplished in very different ways; it was in this context that HERCA came about. The objective of this Association is analysis of the practical application of the European Directives and Regulations in order to promote harmonised ways of working.

Spain participates in the Steering Committee of HERCA and in the working sub-groups that carry out the Association's activities through the CSN.

## 3.b. Spanish nuclear sector

The licensees of the nuclear power plants maintain relations, individually or jointly through Unesa, with international organisations and European and North American organisations grouping nuclear power plants or electricity utilities with nuclear interests, the European organisations for reasons of proximity and area of influence and the North American for technology and regulation reasons. Occasionally, the licensees of the nuclear power plants participate directly in certain international forums.

### a) World Association of Nuclear Operators (WANO)

The objective of WANO is to maximise the safety and reliability of all nuclear power plants, cooperating in order to assess, compare and improve the operation of these facilities through mutual aid, the exchange of information and the emulation of good practices. The Spanish operators are full members of WANO and belong to the WANO-Paris region, participating actively and accepting both to host peer reviews and technical missions at their facilities and to provide engineers to WANO for peer reviews or technical missions at other plants. They also participate actively in all the other WANO programmes, providing and receiving information, products, operating experience, courses, seminars and meetings.

Each operator participates on the WANO governing bodies and has a WIO (WANO Interface Officer) who acts as its contact point with the international organisation.

### b) Institute of Nuclear Power Operations (INPO)

The INPO mission is to promote the highest levels of safety and reliability —promote excellence— in the operation of nuclear power plants. INPO operates by way of four main programmes. The Spanish licensees have participated in INPO's International Programme from the very beginning and benefit from all its products, such as documents, courses, seminars and workshops, the exchange of operating experience, technical assistance visits, the participation of INPO evaluators in WANO peer reviews or prolonged visits to INPO by Spanish engineers.

### c) Electric Power Research Institute (EPRI)

This is a non profit-making organisation set up by the North American electricity utilities for the performance of R&D&i programmes and the exploitation of their results. The Spanish NPP's are full members of EPRI-Nuclear through Unesa. They are voting members on the management bodies of the EPRI nuclear programme and have access to the EPRI products and assistance contemplated in the Institute's basic programmes. In addition, they participate in 17 of the so-called supplementary programmes, due to the interest of these programmes for the operation of the Spanish nuclear fleet.

This significant participation in EPRI Nuclear, along with participation in NEI and INPO, provides the added advantage of being in prompt and direct contact with the North American nuclear power plants, facilitating the exchange of information.

### d) International Atomic Energy Agency (IAEA)

Representatives of the NPP's participate in events organised by this Agency and collaborate in working groups, such as the PRIS (Power Reactor Information System), the TWG-ATLWR (Technical Working Group on Advanced Technologies for LWR's) and the TWG-LMNPP (Technical Working Group - Life Management of Nuclear Power Plants).

### e) NEA/OECD

Both Unesa and the NPP's participate in the working groups of this organisation; specifically, the licensees are represented in the following forums: Working Group on Integrity of Components and Structures (IAGE) and Working Group on Human and Organisational Factors (WGHOF), all reporting to the CSNI (Committee on the Safety of Nuclear Installations). As regards the CNRA (Committee on Nuclear Regulatory Activities), they participate in the Working Group on Operating Experience (WGOE) and, finally, collaborate also on the Committee on Radiation Protection and Public Health (CRPPH).

### f) Nuclear Energy Institute (NEI)

This is the association of the North American nuclear industry that promotes the safe use and development of nuclear technology in the USA and internationally. The Spanish NPP's are members of the NEI through Unesa and maintain close relations with it, consisting specifically of numerous contacts, visits and attendance at meetings and conferences and, fundamentally, of the exchange of information on regulatory matters.

### g) European Nuclear Installations Safety Standards (ENISS-FORATOM)

Since 2005, this has brought together licensees from 17 European countries under the umbrella of FORATOM and shares with WENRA (Western European Nuclear Regulators Association) an interest in harmonising European nuclear safety standards, including waste and dismantling. The Spanish NPP's participate actively in the governing bodies of ENISS through UNESA, for example its Steering Committee and the groups reporting to it: the Reactor Safety Group (RSG) and the Waste & Decommissioning Safety Group (WDSG). In the wake of the accident that occurred in Japan, a working group known as STORE (Safety Terms of Reference) was set up, which is particularly active in the development of criteria for the stress tests, in interacting with WENRA in the development of the specification for these tests and in establishing technical positions regarding the improvement measures that are being implemented at all the European plants in this context.

### h) Association of the Electricity Industry in Europe (Eurelectric)

This is the sector-specific association that represents the common interests of the electricity industry at pan-European level. Its mission is to contribute to the development and competitiveness of the electricity industry and to promote the role of electricity in the development of society. The NPP's participate through UNESA in the Nuclear Working Group, which reports to the Energy Policy and Generation Committee. The objective of this group is to observe, influence and react to European political initiatives and legislative proposals having a potential impact on nuclear power generation. The association also focuses its attention on the development of nuclear technology.

# 4. International peer review missions

## 4.a. Regulatory Body

The Government of Spain was subjected to a full-scope Integrated Regulatory Review Service (IRRS) mission between January 28th and February 8th 2008. For the CSN, preparing for this IRRS mission meant performing a self-assessment of all the Organisation's processes. The results of the mission produced 7 recommendations and 26 suggestions and identified 19 good practices.

The recommendations and suggestions made by the IRRS mission led the CSN to revise its Action Plan in order to adopt the mission's results. This produced improvements to the Spanish regulatory system, such as the following:

- The CSN performs a systematic annual compilation of the results of inspections carried out at radioactive facilities, identifying where appropriate deviations, good practices and other noteworthy aspects encountered and learning lessons to improve the safety and radiological protection of the licensees and the inspection and control practices of the CSN.
- A programme of internal audits of the CSN's management processes.

From January 24th to February 1st 2011, the CSN hosted an IRRS follow-up mission.

The results of this follow-up mission, with respect to the mission performed in 2008, were as follows:

- Four recommendations and 23 suggestions have been completely closed, since either all the actions mapped out have been completed or are in the process of being closed in view of the progress made.
- All except one of the recommendations and suggestions in the area of physical protection or security have been closed or are in the process of being closed in view of the progress made.
- One recommendation and one suggestion were amended (open).
- Seven good practices were identified (including two in the area of security or physical protection).

Although the binding legal framework for Spain is the Euratom Treaty, having been subjected to an integrated regulatory review service (IRRS) mission ensures that the national regulatory framework is in line with the legal framework of the IAEA.

The CSN provides support for the performance of IRRS missions to other countries through the participation of members of its technical staff in the review teams, when requested by the IAEA. The commitment of Spain, and in particular of the CSN, to the IAEA's peer review tool is made clear by the fact that very high level representatives of the CSN's technical organisation are appointed to participate in these reviews. During 2011, the CSN Technical Director of Nuclear Safety participated in the peer review to the United States of America and in preparing the follow-up mission to Germany. That same year the Technical Director of Radiological Protection participated as an expert in the IAEA mission on the Accident at Tepco's Fukushima Daiichi nuclear power plant. Also in 2011, a CSN expert participated in the IRRS mission to Australia and in 2012 an expert from the CSN has participated in the IRRS mission to Sweden.

In addition to the IRRS missions, the IAEA has missions known as International Physical Protection Advisory Service (IPPAS) missions, the objective of which is to reinforce the protection of nuclear materials and facilities. The CSN also provides support for these missions, and experts from the Organisation have participated in IPPAS missions to Holland, Cuba and Chile.

## 4.b. Licensees

The Spanish NPP's also receive IAEA OSART and SCART missions. In this respect, an OSART follow-up mission was carried out at the Vandellós II plant in May 2011, and a SCART follow-up mission was performed at Santa María de Garoña in 2009.

Furthermore, the Spanish NPP's actively participate with WANO, both hosting WANO peer reviews and technical missions and providing experts to participate in WANO peer reviews and technical missions internationally.

Thus, during 2010 and 2011 WANO peer reviews were held at the Sta. María de Garoña, Trillo, Vandellós II, Almaraz and Ascó plants and a further 12 missions are scheduled for performance over the next 4 years.

During 2010 and 2011, experts from the Spanish nuclear power plants participated in 16 WANO peer reviews at nuclear power plants in Germany, China, France, Mexico, Great Britain and Sweden, and in 38 WANO technical missions at plants in Germany, Argentina, China, France Finland, Slovenia, Great Britain and Sweden.

In 2012, the participation of experts from Spanish nuclear power plants is scheduled for 16 peer reviews, to be performed in Germany, Argentina, China, France, Holland and Great Britain, and for 7 WANO technical missions at nuclear power plants in Finland and Great Britain.

# 5. Mechanisms for the exchange of operating experience at international level

Both the CSN and the Spanish nuclear power plants have mechanisms in place for the analysis of operating experience, both national and international.

## 5.a. Channels for the exchange of Spanish operating experience at international level

The CSN and Unesa, as the representative of the Spanish plants, participate in the Working Group on Operating Experience (WGOE) of the Nuclear Energy Agency (NEA), the objective of which is to improve nuclear safety, this being achieved by sharing operating experience and know-how and by identifying solutions to common problems through studies and analyses. The CSN also participates permanently in the IRS, a group that meets annually.

In addition, the CSN has considered its future participation in the European Clearinghouse, where the EU member countries with nuclear power plants meet once a year to determine which of their generic problems are most relevant for the performance of studies and analyses.

Furthermore, the CSN reports on its operating experience internationally via the following channels:

- Incident Reporting System (IRS), reporting to the International Atomic Energy Agency and the OECD Nuclear Energy Agency. The CSN reports on events classified at least at level 1 on the INES scale.
- Nuclear Events Web Based System (NEWS), reporting to the IAEA. The CSN reports on events classified at least at level 2 on the INES scale.

For their part, the licensees of the nuclear power plants carry out their international exchange of operating experience through their participation in the forums mentioned previously in topic 4:

- The Spanish nuclear power plants regularly send information on events to WANO (World Association of Nuclear Operators) for publication as *Significant Event Reports* (SER), *Event Notification Reports* (ENR), *Event Analysis Reports* (EAR) or *Miscellaneous Event Reports* (MER), and in turn receive such reports from the rest of the NPP's.
- They receive information on operating experience from INPO (IER)
- Participation in international seminars, some of which are held in Spain.
- Sending of experts to participate in WANO missions (Peer Reviews) or IAEA OSART missions (Operational Safety Review Team).

- Hosting at the Spanish plants of WANO missions (Peer Reviews, Technical Support Missions) and INPO and IAEA missions.

## 5.b. Analysis of international operating experience at national level

In 2012 the CSN set up an International Incidents Review Panel (PRIN), the function of which is to systematically review the different documents on international operating experience to be dealt with and assess the need for the Spanish nuclear power plants to take actions in this respect. This panel of experts meets quarterly.

The events analysed by this Panel shall be as follows:

- IAEA IRS *(Incident Reporting System)* reports.
- USNRC IN *(Information Notice)*.
- International events classified on the INES scale at levels higher than 1.
- IER-1 (INPO *Event Report Level* 1) and IER-2 (INPO *Event Report Level* 2), equivalent respectively to the former SOERs and SERs.
- USNRC notifications to 10CFR21 considered to be important.
- USNRC LER's *(Licensee Event Reports)* considered to be relevant.
- And whatever other international operating experience is considered to be of interest by the experts in the specialist areas involved.

The activities carried out by the PRIN are as follows:

- Detailed analysis of events to determine their direct or root causes.
- Evaluation of corrective actions and analysis of their applicability to the Spanish nuclear power plants.
- Identification of the existence of generic issues that might affect the Spanish nuclear power plants.

Furthermore, the Spanish nuclear power plants have established internal forums for the joint analysis of national operating experience, where there is a continuous process of information exchange and in-depth analysis of certain previously selected events.

Topic 6: Summary table of International Cooperation

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 6 – International Cooperation | | | | | | |
| WANO Follow-up Peer reviews at Cofrentes NPP | Performed | 2012 | No | | | |
| WANO Follow-up Peer review at Vandellós II NPP | Planned | 2012 | No | | | |
| WANO Follow-up peer review at Sta. Maria de Garoña NPP | Planned | 2012 | No | | | |
| WANO Peer review at Trillo NPP | Planned | 2013 | No | | | |
| WANO Follow-up peer review at Ascó | Planned | 2013 | No | | | |
| WANO Peer review at Almaraz NPP | Planned | 2014 | No | | | |
| WANO Peer review at Vandellós II | Planned | 2014 | No | | | |
| WANO Peer review at Cofrentes NPP | Planned | 2014 | No | | | |
| WANO Follow-up Peer review at Trillo NPP | Planned | 2015 | No | | | |
| WANO Peer review at Ascó NPP | Planned | 2015 | No | | | |
| WANO Follow-up peer review at Almaraz NPP | Planned | 2016 | No | | | |
| WANO Peer review at Cofrentes NPP | Planned | 2016 | No | | | |

Topic 6: Summary table of International Cooperation (continued)

| | Activities by the operator | | | Activities by the Regulator | | |
|---|---|---|---|---|---|---|
| Activity | (Item 2.a) Activity - Taken? - On-going? - Planned? | (Item 2.b) Schedule or milestones for planned activities | (Item 2.c) Results Available - Yes? - No? | (Item 3.a) Activity - Taken? - On-going? - Planned? | (Item 3.b) Schedule or milestones for planned activities | (Item 3.c) Conclusion Available - Yes? - No? |
| Topic 6 – International Cooperation | | | | | | |
| Follow-up IRRS Mission in Spain | | | | Taken in January 2011 | Improvements at the CSN and in the rest of the Spanish regulatory system after implementation of the recommendations identified by the follow-up mission | Yes |
| FORO group for the evaluation of nuclear power plant stress tests | | | | On-going | Single document evaluating the stress tests performed by all the countries included in this group and reviewed by members of FORO<br>Scheduled for completion in August 2012 | No |
| Formalisation of a specific agreement with Portugal on the planning and preparation for and response to nuclear and radiological emergency situations | | | | On-going | 2012 | No |

# APPENDIX I

## CSN Complementary Technical Instructions of may 2011

## Appendix 1. Stress tests to be performed by the npp's in accordance with the criteria defined by WENRA and ENSREG

Before October 31st 2011, the NPP shall submit to the CSN a detailed report containing the results of the analyses indicated below, which correspond to the so-called "Stress Tests" defined for the European nuclear power plants within the framework of WENRA, ENSREG and the European Union, along with a proposal detailing the measures to be implemented and corresponding schedule.

In addition, before August 15th 2011 the NPP shall submit to the CSN a Progress Report detailing the degree of progress of its analyses, including any proposals for measures to be implemented already identified.

### 1. Definition of Stress Tests

In an initial phase the Stress Tests are defined as a "guided" reassessment of the safety margins of the nuclear power plants in the light of the events that occurred at Fukushima: extreme natural phenomena that might endanger the safety functions of the plants and lead to severe accident situations.

This reassessment should consist of the following:

- An evaluation of the response of the plant to a set of extreme situations considered in section 3 of this appendix ("Technical Scope"), and
- A verification of the preventive and mitigation measures chosen in accordance with the philosophy of "defence in depth": initiating events, consequent losses of safety functions and severe accident management.

Adopting a deterministic approach, the existing lines of defence are assumed to be lost sequentially in these extreme situations, regardless of the probability of such loss occurring. Specifically, it should be taken into account that safety functions may be lost and severe accident situations occur only when numerous design provisions have failed. In addition, it must be assumed that the measures available to manage these situations adequately are lost successively.

For a given plant, this reassessment shall include the plant response and the effectiveness of the preventive measures, underlining any potential weakness and any cliff edge situation identified in the analyses. These cliff edge situations are those that might induce a significant change in the sequence of events and, where appropriate, the measures in place to avoid reaching extreme conditions and might correspond, for example, to exceeding a point at which significant flooding of plant areas might commence, with the height of the existing walls or dykes being exceeded, or to depletion of the capacity of the batteries in the event of loss of a.c. power supply. The objective is to assess the robustness of the defence in depth philosophy applied and the suitability of the accident management measures and identify the potential for the implementation of technical and organisational safety measures, such as procedures, human resources, the emergency response organisation or the use of off-site resources.

By nature the Stress Tests should tend to focus on measures that might be adopted following loss of the safety functions installed to address accidents already considered in design. The adequate functionality of these systems has already been verified in connection with the plant licensing conditions. Hypotheses relating to their operation should be reassessed in the Stress Tests and presented as already existing measures. Finally, it is important to recognise that all the measures adopted to protect the reactor or the integrity of the spent fuel pools are an

essential part of "defence in depth" and that it is always better to prevent accidents from occurring than to manage their consequences.

## 2. Licensees' process for Stress Test performance

The primary responsibility of the licensees of the plants is the safety of their facilities; it is for this reason that they should perform these reassessments. The regulatory bodies will subsequently undertake their revision in a completely independent manner.

The timeframe for the performance of these analyses by the licensees is as follows:

- The licensees of the plants will have until August 15th 2011 to draw up a progress report on the on-going analyses, which should be submitted to their national regulatory body along with the associated documentation.
- The licensees of the plants will have until October 31st to complete their analyses and submit the results and associated documentation to their national regulatory body.

In view of the tightness of the foreseen schedule, certain of the engineering studies supporting the licensees' reassessments might not be available by the dates established, especially in the case of scenarios not included in the current design of the plants. In such cases, analyses based on "engineering judgement" shall be applicable.

## 3. Technical scope of the Stress Tests

The safety assessments existing for the nuclear power plants in European countries cover a wide variety of situations. The technical scope of the Stress Tests has been defined taking into account the problems underlined by the events that took place at Fukushima, which included a combination of initiating events and multiple failures. Consequently, the following extreme situations, which correspond to increasingly serious circumstances, should be addressed:

a) Initiating events *credible* on the site.
   - Earthquakes.
   - Flooding.
   - Other extreme natural events.

b) Subsequent loss of safety functions.
   - Loss of power supply, including complete loss or station blackout (SBO).
   - Loss of ultimate heat sink (UHS).
   - Combination of both.

c) Aspects associated with the management of severe accidents.
   - Measures to protect against and manage loss of the core cooling function.
   - Measures to protect against and manage loss of the spent fuel storage pool cooling function.
   - Measures to protect against and manage loss of containment integrity.

The initiating events considered are not limited to earthquakes and tsunamis like those that occurred at Fukushima: the analysis of flooding shall be included regardless of its origin. Consideration shall also be given to possible adverse meteorological conditions.

Furthermore, the evaluation of the consequences of the loss of safety functions may also be relevant if the situation is caused, indirectly, by other initiating events; for example, major

disturbances of the electricity grid that might affect the alternating current (a.c.) feed systems or forest fires.

The review of severe accident management issues centres mainly on the measures already adopted by the licensees, but may also include the off-site support foreseen to maintain the safety functions of the plant. Although the feedback of experience from the Fukushima accident might lead to the inclusion of emergency preparedness measures managed by the pertinent public protection services external to the facilities (fire brigade, police, health services, etc.), this issue is beyond the scope of these stress tests.

The following sections of this document define the following:

- The general information required of the licensees.
- The aspects to be addressed by the licensees for each of the extreme situations considered.

# 4. General aspects

## a) Format of report to be submitted by licensee

The licensee shall submit a single document for each site, regardless of the number of groups that might be on it.

- The initial section of the report should briefly describe the characteristics of the site:
  - — Location (next to the sea, a river, etc.).
  - — Number of groups.
  - — Permit holder.

  The main characteristics of each group should also be included, in particular the following:
  - — Type of reactor.
  - — Thermal power level.
  - — Date of first criticality.
  - — Presence of spent fuel storage facilities (or shared storage facilities).

Any significant safety differences between the groups should be identified and underlined. Likewise, the scope and main results of existing Probabilistic Safety Assessments should be included.

- In a second section the licensee shall analyse each of the extreme situations included in the scope, adhering to the indications given below.

## b) Hypothesis

The reassessments for operating plants refer to the current status of each of the facilities, as built and operated as of June 30th 2011.

The approach should be essentially deterministic: when analysing an extreme scenario, a progressive approach shall be applied, in which it shall be assumed that the protective measures are successively lost.

The initial conditions of the plant shall represent the most unfavourable operating states allowed by the technical specifications (limiting conditions for operation) of the facility. All operating states shall be considered. For severe accident scenarios, the consideration of non safety-related equipment, and a realistic assessment of the scenario, is acceptable.

It shall be assumed that all the reactors and spent fuel storage facilities are affected at the same time. Consideration shall also be given to the possibility of there being degraded conditions in the areas surrounding the site.

In addition, consideration shall be given to the following aspects:

- automatic actions
- operator actions specified in emergency operating procedures
- any other accident prevention, recovery or mitigation measure already contemplated

## c) Information to be included in the reports

The three main aspects to be included in the reports are as follows:

- The provisions included in the plant design basis and compliance by the latter with the design requirements.
- The strong points of the plant beyond the design basis. In this respect, the robustness (available design margins, diversity, redundancy, structural protection, physical separation, etc.) of safety-significant structures, systems and components (SSC) and the effectiveness of the "defence in depth" concept should be evaluated.
- As regards the robustness of the installations and of the available measures, one of the focal points of the review is the identification of the possible "cliff edge situations" that might lead to a significant change in the sequence of events and, where appropriate, the measures in place to prevent extreme conditions from being reached.
- The possibility of implementing modifications that might improve the current level of defence in depth in terms of the improved resistance of the components or the strengthening of independence with respect to the other levels of defence.

In addition, in order to provide a context for these stress tests, the licensee may describe the protective measures in place to prevent the extreme situations considered within the scope of the tests. The analysis should be completed, where necessary, with the results of the plant walkdowns specifically performed.

In this respect the licensee shall identify the following:

- The means available to maintain the three fundamental safety functions (reactivity control, fuel cooling and confinement of radioactivity) and the support functions (sources of electrical feed and cooling via ultimate heat sink). In this respect consideration should be given both to the possible damage caused by the initiating event and to any additional measure not accredited in the safety assessments considered in the licence of the plant.
- The possibility of making external mobile resources available and the conditions for their use.
- Any already existing procedure for the use of the resources of one group to help another.
- The possible dependences of the safety functions of one group with respect to the other groups on the same site.

As regards the management of severe accidents, the licensee shall determine, where appropriate, the time available before fuel damage becomes inevitable.

- If the core is in the reactor vessel, the time available before the water level reaches the top of the fuel and the time before fuel degradation is initiated (onset of rapid cladding oxidation with significant generation of hydrogen) should be indicated.
- If the fuel is in the spent fuel pool, there should be an indication of the time to boiling, the time during which adequate shielding against radiation is maintained, the available before the water level reaches the top of the fuel and the time to the onset of fuel degradation.

### d) Supporting documentation

The documents included or referenced by the licensee in his analyses may correspond to any of the three following categories:

- Validated in the processes associated with the licence, or
- Subject to the plant's quality assurance programme, or
- Developed or applied specifically for this process, within the framework of a specific review and acceptance process.

## 5. Analysis of relevant aspects of the Stress Test programme

Addressed below are the different aspects to be considered by the licensee for each of the situations to be analysed in detail:

### i. Earthquakes

**I. Design Basis**

a) Earthquakes for which the plant was designed:

- Level of the design basis earthquake (DBE), expressed in terms of Peak Ground Acceleration (PGA), and reasons for its choice.
- Indication of whether the DBE is different from that assumed in the initial Licensing Basis of the plant.
- Methodology used to assess the current DBE (return period, past events considered and reasons for their having been chosen, possible added margins, etc.) and validity of the data over time.
- Conclusions regarding the adequacy of the current Design Basis.

b) Arrangements to protect the plant against the DBE.

- Identification of the SSC's necessary to reach safe shutdown conditions and that it is assumed will continue to be available following the earthquake.
- Main provisions existing (including procedures for emergency operation, mobile equipment, etc.) to prevent damage to the reactor core or to the spent fuel following the earthquake.
- Indication as to whether consideration has been given to the indirect effects of the earthquake, including:
  1. Failure of SSC's not designed to withstand the DBE and that, in the event of loss of their integrity, might cause damage to the SSC's that are to remain available (for example, leakage from or rupturing of non-seismic piping located on the site or in its buildings and that might be the source of flooding, and potential consequences).
  2. Loss of off-site electrical feed sources.
  3. The situation off site, including problems that might prevent or delay the access of the necessary personnel and equipment.

c) Compliance by the plant with its current Licensing Basis:

- Licensee's general process to guarantee such compliance; for example periodic maintenance, inspections or tests.
- Licensee's process to guarantee that the off-site mobile equipment and supplies considered in the emergency procedures, where such equipment and supplies exist, are available and continue to be suitable for service.

- Any known deviation and its consequences in terms of safety. Planning of remedial actions.
- Specific verification activities and tests already initiated by the licensee in the wake of the Fukushima accident.

**II. Assessment of margins**

d) On the basis of the available information (which might include the seismic PSA, assessment of the seismic margin or other seismic engineering studies to support engineering judgement) an assessment should be made of the severity of the earthquake as from which the loss of the fundamental safety functions or serious damage to the fuel (in the core or in the spent fuel storage facility) becomes inevitable.

- Indication of weak points and of any potential "cliff edge" situation, depending on the seriousness of the earthquake.
- Indication as to whether additional measures might be contemplated to avoid the effects of the "cliff edge" situations identified or to increase the robustness of the plant: equipment modifications, modifications to procedures, organisational measures, etc.

e) On the basis of the available information (which might include the seismic PSA, the seismic margin assessed or other seismic engineering studies to support engineering judgement), an analysis should be made of the range of severity of the maximum earthquake that the plant might withstand without loss of confinement integrity.

f) Earthquakes exceeding the DBE with flooding caused by the above in excess of the design basis flood (DBF) level.

- Indication as to whether this situation is physically possible given the location of the plant. For this purpose, a specific identification should be made as to whether the potential serious damage to structures on and off the site (such as dams and dykes or the buildings and structures of the plant) might have an impact on the safety of the installation.
- Indication of the weak points and failure modes that might lead to unsafe plant conditions, identifying any potential "cliff edge" situation and the buildings and equipment that would be affected.
- Indication as to whether additional measures might be contemplated to avoid the effects of the "cliff edge" situations identified or to increase the robustness of the plant: equipment modifications, modifications to procedures, organisational measures, etc.

## ii. Flooding

**I. Design Basis**

a) Maximum flood for which the plant was designed:

- Level of the design basis flood (DBF) and reasons underlying its choice.
- Indication as to whether the DBF is different from that assumed in the initial Licensing Basis of the plant.
- Methodology used to assess the DBF (return period, past events considered and reasons for their having been chosen, possible added margins, etc.)
- Sources of flooding (tsunamis, tidal waves, storms, rupturing of dams, etc.) and validity of the data over time.
- Conclusions regarding the adequacy of the current Design Basis.

b) Arrangements to protect the plant against the DBF.

- Identification of the critical SSC's necessary to reach safe shutdown conditions and that it is assumed will continue to be available following flooding, including the following:
  - — Provisions to ensure the availability of the water intake function.
  - — Provisions to maintain emergency electricity supply.
- Identification of relevant design requirements to protect the site against flooding (level of platforms, dykes, etc.), indicating the surveillance programmes that might be associated with them.
- Main measures contemplated to mitigate the effects of flooding, including emergency operating procedures, mobile equipment, monitoring of flooding, alert systems, etc., to warn of the flood and facilitate the mitigation of its effects, indicating the surveillance programmes that might be associated with them.
- Has consideration been given to the possible effects associated with flooding, such as adverse meteorological conditions, including the following?
  - — Loss of off-site electrical feed sources.
  - — The situation off site, including problems that might prevent or delay the access of the necessary personnel and equipment.

c) Compliance by the plant with its current Licensing Basis:

- Licensee's general process to guarantee such compliance; for example periodic maintenance, inspections or tests.
- Licensee's process to guarantee that the off-site mobile equipment and supplies considered in the emergency procedures, where such equipment and supplies exist, are available and continue to be suitable for service.
- Any known deviation and its consequences in terms of safety. Planning of remedial actions.
- Specific verification activities and tests already initiated by the licensee in the wake of the Fukushima accident.

**II. Assessment of margins**

d) On the basis of the available information (including engineering studies in support of engineering judgement), what level of flooding might the plant withstand without severe damage to the fuel (in the core or in the fuel storage facility)?

- Depending on the time margin available between the warning and flooding, indication as to whether additional protective measures might be contemplated and implemented.
- Indication of weak points and of any potential "cliff edge" situation, identifying the buildings and equipment that would be flooded first.
- Indication as to whether additional measures might be contemplated to avoid the effects of the "cliff edge" situations identified or to increase the robustness of the plant: equipment modifications, modifications to procedures, organisational measures, etc.

## iii. Loss of electricity supply and of ultimate heat sink

The alternating current (a.c.) electrical feed sources considered are as follows:

- Electricity sources external to the facility (grid)
- Main plant electricity generator

- "Normal" back-up sources (emergency diesel generators, etc.)
- Any other back-up sources (diesel generators, gas turbines, etc.).

In the analyses to be performed, the sequential losses of these sources should be assumed; see points a) and b) below.

The ultimate heat sink (UHS) is the medium to which the residual heat from the reactor is ultimately transferred. In certain cases the plants have a primary UHS, such as the sea or a river, complemented with an alternative UHS, for example a lake, a pool of water or the very atmosphere. In this exercise consideration should be given to the sequential loss of these sinks; see point c) below.

a) Loss of off-site power (LOOP)[7]

The following aspects should be addressed:

- Description of the way in which this situation has been taken into account in design and of the on-site back-up feed sources available to respond to it.
- Indication as to how long the on-site back-up feed sources could operate without any type of off-site support.
- Indication of the actions required and foreseen to extend the operating time of the on-site electricity supply equipment: filling of the diesel generator fuel tanks, etc.
- Identification of possible measures to increase the robustness of the plant, such as system modifications, modifications to procedures, organisational measures, etc.

For clarification it should be pointed out that systems such as turbine-driven pumps, systems with energy stored in gas tanks, etc. may be considered functional as long as they do not depend on the sources of electricity that are assumed to be lost and as long as they are designed to withstand the effects of the initiating event (for example the earthquake).

b) Loss of off-site power and on-site back-up sources or station blackout (SBO)

Two situations should be considered in these analyses:

- LOOP + Loss of "normal" back-up sources.
- LOOP + Loss of "normal" back-up sources + loss of any other back-up source.

For each of these two situations the licensee shall:

- Provide information on the capacity of the batteries and their duration.
- Provide information on the measures foreseen in the design for these situations.
- Indicate for how long the plant can withstand an SBO without any off-site support before serious damage to the fuel becomes inevitable.
- Indicate the external actions foreseen to prevent damage to the fuel:
  - — Equipment already present on site; for example, equipment belonging to other groups.
  - — Assuming that all the groups on the site have been equally damaged, equipment available from off site.
  - — Electricity generating plants located close to the site (for example, gas turbine plants or hydroelectric stations) that might be aligned via a direct "dedicated" connection.

7 In this case the loss of all off-site power is assumed for several days. Furthermore, the site is considered to remain isolated for 72 hours, as regards the possibility of supplying heavy materials by road, rail or waterways, although light portable equipment may arrive on site as from 24 hours into the event.

— Time required for each of the aforementioned systems to be made available.

— Availability of competent human resources for the performance of these connections, in view of their exceptional nature.

- Identify the possible "cliff edge" situations that might arise and, when they might occur, indicating the additional measures that might be incorporated to avoid their effects or increase the robustness of the plant: system modifications, modifications to procedures, organisational measures, etc.

c) Loss of main ultimate heat sink (UHS)[8]

A description should be provided of the provisions existing in the design to prevent loss of the UHS. For example, different water intakes for the main UHS in different locations, use of an alternative heat sink, etc.

Consideration should be given to two situations:

- Loss of the primary ultimate heat sink (UHS); i.e., loss of access to water from the river or sea.
- Loss of the primary ultimate heat sink(UHS) and of the alternative heat sink where appropriate.

For each of these situations the licensee shall:

- Indicate for how long the plant might withstand the situation without support from off site before serious damage to the fuel becomes inevitable.
- Provide information on the provisions existing in the design for these situations.
- Indicate what off-site actions are contemplated to prevent fuel damage:

  — Equipment present on the site; for example equipment from another group.

  — Assuming all the reactors on the site to have been equally damaged: equipment available off site.

  — Times required for these systems to be operable.

  — Availability of competent human resources for the performance of these connections, in view of their exceptional nature.

- Identify the possible "cliff edge" situations that might arise and, when they might occur, indicating the additional measures that might be incorporated to avoid their effects or increase the robustness of the plant: system modifications, modifications to procedures, organisational measures, etc.

d) Loss of main UHS with SBO

The licensee shall provide the following information:

- Indication of for how long the plant might withstand a loss of the "main" UHS coincident with SBO without support from off site before serious damage to the fuel becomes inevitable.
- Indication of what off-site actions are contemplated to prevent fuel damage:

  — Equipment present on the site; for example equipment from another group.

8 It is considered that the connection with the main UHS is lost for all safety and non safety-related functions. Furthermore, the site is considered to remain isolated for 72 hours, as regards the possibility of supplying heavy materials by road, rail or waterways, although light portable equipment may arrive on site as from 24 hours into the event.

— Assuming all the reactors on the site to have been equally damaged: equipment available off site.

— Times required for these systems to be operable.

— Availability of competent human resources for the performance of these connections, in view of their exceptional nature.

- Identification of the possible "cliff edge" situations that might arise and, when they might occur, indicating the additional measures that might be incorporated to avoid their effects or increase the robustness of the plant: system modifications, modifications to procedures, organisational measures, etc.

## iv. Severe accident management

This section deals mainly with mitigation measures. Even though the probability of the event is very low, it should be assumed deterministically in this reassessment that the severe accident occurs. The management of severe accidents, which is part of the licensee's last line of defence in depth, should be consistent with the measures available to prevent fuel damage and with the general philosophy of nuclear safety of the plant.

a) Description of the accident management measures currently available for the different stages of a loss of core cooling function scenario:

- Prior to the onset of damage to the fuel in the reactor core

— Indication of last resource measures to prevent fuel damage.

— Indication as to whether means are available to attempt to remove the possibility of fuel damage in high pressure sequences.

- Following the occurrence of damage to the fuel in the reactor core.
- Following reactor vessel failure.

b) Description of the accident management measures and the design characteristics of the plant for the protection of containment integrity following the occurrence of fuel damage.

- Prevention of $H_2$ combustion and detonation (inertisation, recombiners or igniters), also taking into account the actual venting capacity.
- Prevention of containment overpressure. If off-site releases are necessary to protect the containment, an analysis should be carried out to determine whether or not this release should be filtered. In this case, the means available to estimate the quantity of radioactive material released to the environment should be described.
- Prevention of return to criticality conditions.
- Prevention of through-basemat meltdown situations.
- Need for alternating current, direct current and compressed air supplies to the equipment required to protect containment integrity.

c) Description of the accident management measures currently available to address the successive stages of a loss of fuel storage facility cooling function scenario. The following indications refer specifically to the fuel pools:

- Prior to and following loss of adequate protection against radiation.
- Prior to and following uncovering of the upper part of the fuel in the pool.
- Prior to and following degradation of the fuel in the fuel pool (rapid oxidation of the cladding with production of hydrogen).

For a), b) and c) and in each stage:

- Identification of any "cliff edge" situation that might arise and assessment of the time available before it is reached.
- Evaluation of the suitability of the existing management measures, including guidelines and procedures, to address a severe accident, and study of the possibility of adopting additional measures. In particular, the licensee should take the following into account:
  - The suitability and availability of the required instrumentation.
  - The habitability and accessibility of vital areas of the plant: control room, emergency response centres, local controls and sampling points, possibilities for repair, etc.
  - Potential accumulations of H2 in buildings other than containment.

The following aspects should also be addressed:

- Licensee's organisation for adequate management of the situation, including:
  - Staffing, resources and shift management.
  - Use of off-site technical support and place from which accident management is performed, including contingencies in case this should become unavailable.
  - Procedures, training and exercises.
- Possibility of using existing equipment.
- Provisions for the use of mobile equipment. Availability of such equipment, time required to put it in place and in operation, accessibility to site.
- Availability and management of supplies (fuel for diesel generators, water, etc.).
- Management of possible radioactive emissions and measures for their limitation.
- Management of possible doses to workers and measures for their limitation.
- Communications and information systems (on and off site).
- Long-term post-accident activities.

The accident management measures foreseen shall be analysed taking into account the situation that might be caused on the site:

- The possible destruction of infrastructures around the plant, including communications (making technical support and the provision of personnel from off site more difficult).
- Hindrance of certain tasks, including impact on accessibility to and habitability of the plant main and secondary control rooms and emergency/crisis centres due to high local dose rates, radioactive contamination and the possible destruction of installations on site.
- Feasibility and effectiveness of the accident management measures under the conditions of external risk (earthquakes, flooding).
- Unavailability of power supply.
- Potential lack of instrumentation.
- Potential effects on other plants close to the site.

The licensee shall identify what situations would prevent the work of the personnel operating in the main or secondary control room and emergency/crisis centres of the plant, and the measures that might prevent such situations.

# National Report for the Second Convention on Nuclear Safety Extraordinary Meeting

(Vienna from 27th to 31st August 2012)

## SPAIN