CSN CONSEJO DE SEGURIDAD NUCLEAR

"Current nuclear regulation in Spain"
Excerpts from the conference of Mr. Aníbal Martín, Vice-President of the CSN, at the Opening Session of the 25th Annual Meeting of the Spain's Nuclear Society

First of all, the nuclear activity is constantly evolving even though development has reached a state of maturity, and this evolution modifies the mid- and long-term challenges. Issues such as waste management and installation dismantling, aging and life management, staff restructuring and renovation, and maintenance of technological capabilities give rise to questions that are being addressed, and should be addressed systematically and sufficiently in advance. Therefore, it is to be expected that new initiatives will be undertaken in the form of research and development programs that may possibly be more important than current ones. Work methods should be equal to the challenge, and there is an obvious need to intensify multi-institutional and multinational collaboration, to which end each organization should have a clear idea of its specific goals.

It is highly recommended that short- and long-term needs be analyzed, and that strategies be established to systematically provide solutions. The current Consejo de Seguridad Nuclear established its Strategic Target Plan in 1995 to address the modernization and updating of regulatory activities in Spain, and it can be safely said today that it has been a useful tool and that in general its goals have been achieved, such as implementation of a new licensing policy, improved standards, improved work procedures and information systems, etc. A short- and mid-term analysis is now an established practice both in industry and regulatory bodies, as well as in international organizations, and this requires periodic refining and upgrading. Again, the type of challenges foreseen for the next 10-15 years require highly innovative initiatives, in which research, development and innovation plans will play an increasingly relevant role.

The 1997 Electric Industry Law has resulted in competition of different electric power generating sources, where nuclear power generation is no different from the rest. This is forcing often profound restructuring in the way nuclear power plants are operated, in an effort to reduce costs and improve efficiency.

New challenges also represent an opportunity to improve the way we work, and that the new system should lead to greater maturity as the business is conducted with enhanced quality, thus resulting in a better situation in all senses. The two basic tools that the operator has available to face these challenges are innovation and high quality standards in management. Optimization of management and technological enhancement are the tools for reconciling the apparently insolvable dilemmas of increased safety versus cost reduction. Nuclear safety is an inevitable premise of nuclear activity, and thus it can and should be reinforced by deregulation of the electrical market, along with all those technical and economic parameters required to improve the competitive position within the new regulatory framework. This more advanced framework should stimulate optimal use of the resources involved in production and, I repeat, nuclear safety is an immutable premise of production.

I have already mentioned the growing importance that I believe technological upgrade, innovation and research and development programs will have in the future, and these should be methodically and systematically established. I will now refer to the demand for higher quality in operational management. Experience demonstrates that a high level of safety is an attribute of excellent management. Safety is therefore not a goal that conflicts with economic or technical operating results. Moreover, safety is not achieved by pursuing it as an isolated objective, but rather it is the result of a series of correct actions that make up management. It is known that there is a relationship between management quality and safety. The concept of the Safety Culture refers to this aspect.

More attention should be paid to this point, wherein lies a good part of possible safety improvements; electricity market deregulation requires that quality methodologies be developed in order to optimally allocate the limited available resources according to their impact on safety. Operators face a situation in which the range in which they can operate profitably is diminishing and the pressures of an increasingly intolerant public opinion, not only with accidents but with any problem, are increasing, which means the margin for failure is narrowing. For the operator, the solution again is to maintain high levels of technical competence and to make use of improved management techniques. For the regulator, the task is to ensure that the processes of change do not negatively affect the levels either of the safety culture or of safety itself.

The enormous stock of knowledge and the methodologies of the organizational and management sciences can contribute extensively to this task. It is a sensitive issue and should be based on cooperation, such that the regulator does not [illegible] any of its responsibilities. For the regulator, the objectives should be [illegible] and make sure that the operator performs its function.

Here I would like to briefly refer to the growing international activity in this area. The IAEA has a project underway for "developing guidance and services to provide to the senior management and regulators of nuclear facilities, in order to ensure that safety is not compromised by processes of economic, social or political change."

Another activity is the ORFA seminar on Evaluation of Organizational Factors for Improving Nuclear Safety, which was recently held in Madrid under the sponsorship of the European Commission's D.G. XII, for the purpose of defining research projects in this area that will be included in the V Framework Program.

The products will provide operators with enhanced tools for their optimization efforts and will help regulators objectify the concepts associated with the safety culture and determine the possible limits of acceptance.

The new electrical framework also creates other challenges. Greater regulatory effectiveness is not only a demand placed on regulators in our countries, but is also a specific focus of attention in international regulatory forums. The Consejo de Seguridad Nuclear addresses this aspect in its Strategic Target Plan, and the activities in progress are paying increasing attention to the application of knowledge acquired through probabilistic safety analyses, so that this knowledge can begin to be used to improve evaluation and propose resolutions.

The year has witnessed two important events that are related to the new regulatory framework of electrical activities. These are the processes of consolidated management, which were begun first in the Ascó and Vandellós power plants, and later in the Almaraz and Trillo plants. From a position of noninterference and respect, the Consejo is going to track and monitor these processes, so that safety will be modernized and fortified as a result of the structural modernization of these consortiums.

The importance of safety is a global concept that knows no bounds and must be addressed within its full transnational context. The exchange of experiences between operators and reviews by teams of experts are today increasingly advisable practices, just as regulatory bodies, specifically within the framework of the European Union and in spite of their different peculiarities, try to establish the bases for progressive, effective harmonization.

Finally, some considerations on information and communication. Whatever the future of nuclear power may be, I have already mentioned that safety is a fundamental condition, and the way it is perceived will play a relevant role in the interaction between the different players in this activity and society.

Communication is thus a preeminent aspect of this process, and more efforts must be devoted to it. Information should not only be true and transparent, but also readily accessible and available. To conclude, I would like to call on the professionals present here today to intensify the attention that we should all pay to this facet of our business, as society as a whole demands this of us.

CSN CONSEJO DE SEGURIDAD NUCLEAR

EXCERPTS from Mr. J.M. Kindelan's closing speech, Chairman of the CSN, as the Chairman of the IAEA International Conference on the Safety of Radioactive Waste Management (Córdoba, Spain, March 2000)

Radioactive wastes already exist and doing nothing with them is not a sustainable option. It is the duty of the present generation to avoid imposing undue burden on future generations and therefore to design and implement viable solutions to dispose safely of these wastes. The Parliaments and Governments of each country have the responsibility to take appropriate steps to build a legislative framework and take political decisions for the implementation of a national radioactive waste management policy.

There are a number of principles, which should govern the formulation of a radioactive waste management policy:

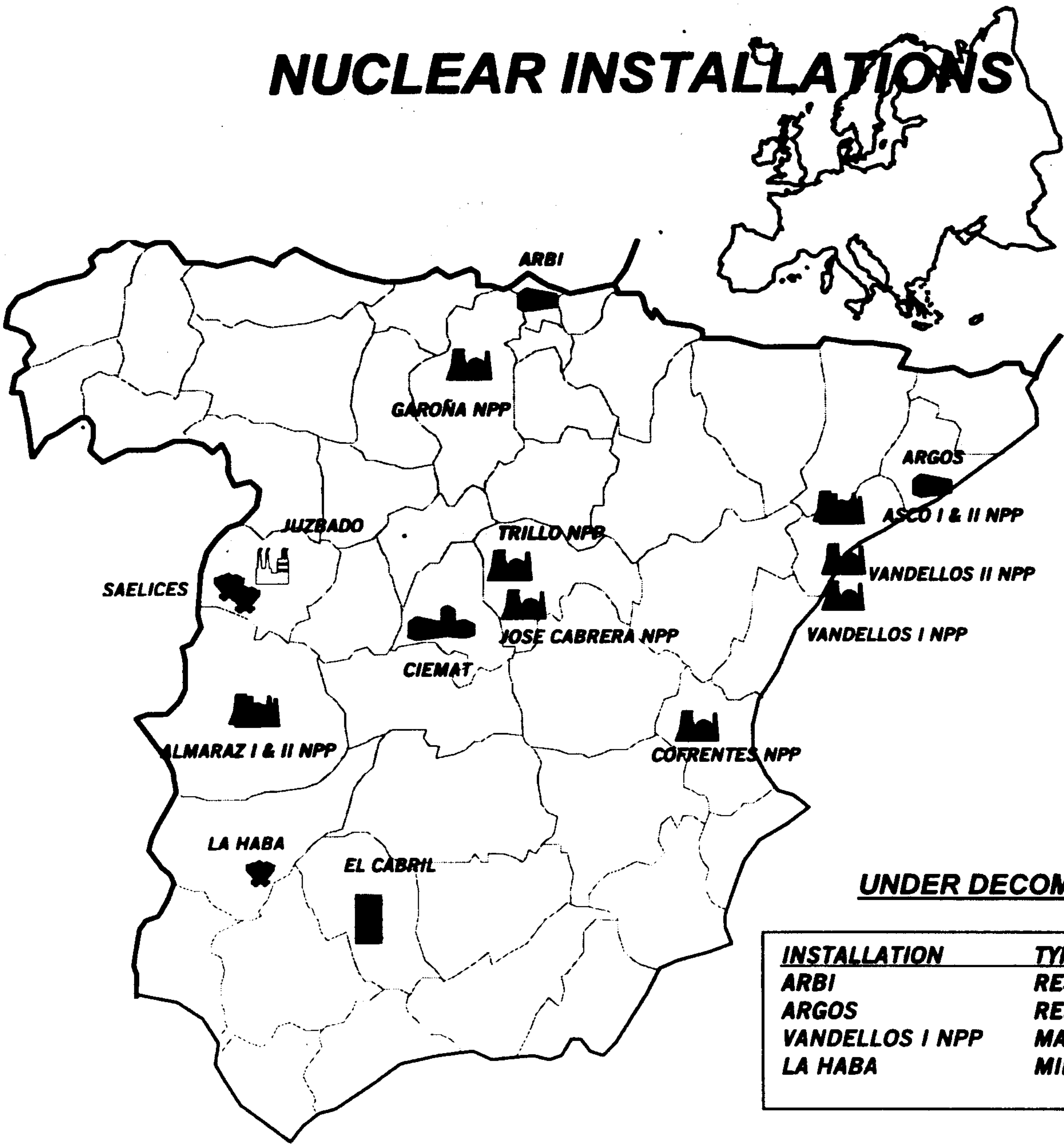
- Waste producers are primarily responsible for the safe management of their waste, by proposing adequate disposal options, and by funding the corresponding projects.
- The management of radioactive waste should be considered as a holistic approach, to avoid specific actions aimed at resolving particular issues, that could constrain future decisions. However, where the demands of safety are overriding or long-term safety benefits can be obtained, then waste can be treated to improve storage conditions.
- Some issues of relevance to the safety of radioactive waste management, while not unique to the subject, are rarely encountered in public policy decision making, in particular issues relating to extremely long time frames.
- Because there are many uncertainties inherent to waste management options, the scheme should be robust to be effective and acceptable under a wide range of possible future conditions. This applies not only to scientific or technical uncertainties, but also to legal and political ones.
- Safety cases must be assessed independently to ensure compliance with regulations and criteria, to be defined by the administration and that may need periodic revision, to take account of developing scientific and technical knowledge.
- Effective implementation of disposal options cannot occur without the definition, at a national level, of a graduated and transparent approach that enable the different parties involved, including the general public and public institutions, to take part in the decision making process.

Good progress has been made on the development of technical options and in designing new disposal routes for managing radioactive waste. Therefore it is not true that no technical solutions are available for disposing safely radioactive waste, though research and development work still need to be continued to confirm these options. Irrespective of the option eventually adopted by each country for high level and long lived waste, there is a need to continue with the assessment and development of deep geological disposal, since this will be needed in the future, to a greater or lesser extent.

International co-operation has an important role to play in achieving scientific and public consensus in support of national programmes:

- The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management provides a mechanism to build confidence in national programmes through self-assessment and international peer review.
- International co-operation can provide a much broader pool of experience on generic issues, allowing countries to make a more efficient use of resources.
- Improvement can still occur in the international consistency of safety standards, and the means for determining compliance with them, particularly in relation to the long term. A greater degree of consensus on the main issues would be extremely valuable in building public confidence in technical solutions.

NUCLEAR INSTALLATIONS



UNDER DECOMMISSIONING

INSTALLATION	TYPE	DATE
ARBI	RESEARCH	1962
ARGOS	RESEARCH	1963
VANDELLOS I NPP	MAGNOX-GCR	1972
LA HABA	MINING	1977

IN OPERATION

NPP	TYPE (Mwe)	DATE	LIFETIME TOTAL MWH
JOSE CABRERA	W-PWR(160)	1968	29,247,214
GAROÑA	GE-BWR(460)	1970	83,741,425
ALMARAZ I & II	W-PWR(973/982)	1980/83	227,713,153
ASCO I & II	W-PWR(973/966)	1982/85	205,909,034
COFRENTES	GE-BWR(1025)	1984	112,576,997
VANDELLOS II	W-PWR(1009)	1987	88,077,305
TRILLO	KWU-PWR(1066)	1987	88,178,469

INSTALLATION	TYPE	DATE
CIEMAT	RESEARCH	1951
JUZBADO	FUEL MANUF.	1985
EL CABRIL	WASTE STORAGE	1992
SAELICES	MILLING	1993

CSN CONSEJO DE SEGURIDAD NUCLEAR

Specific Applications of Risk Informed Regulation in Spain (Presented by the CSN at the 11th Meeting of the Committee on Nuclear Regulatory Activities of the Nuclear Energy Agency OECD, Paris Nov./29, 30/99)

The development of the first PSA in Spain began about 1984. In 1986 the Regulatory Authority (CSN) approved a PSA development program for all the NPPs. A PSA were required to one plant after another and the required scope of the PSAs was ever increasing. The last PSA started in 1993 and is not finished yet. This PSA will be a level 2 PSA at any operational state (from full power to refueling), including any relevant external hazards. Older PSAs are now in the process of being reviewed and upgraded to reach the same scope as the last one.

Along with the development of PSA, the Utilities have submitted an important amount of PSA applications to the CSN during the last 15 years. The amount, variety and complexity of PSA uses or applications has been continuously increasing. At the beginning PSA applications where mostly focused on increasing the safety level of the plants while after sometime PSA applications were more focused on making an optimal or rational use of resources. The evolution towards a risk informed regulation framework has of course encouraged the use of PSA and the transition of the initial PSAs to a Living PSA concept.

A summary of PSA applications developed during the last 15 is presented in table 1. The list of applications presented in this table is not exhaustive. PSA applications rank from simple interpretation of PSA results (e.g. importance measures) for ranking and prioritization to sophisticated uses of PSA models and techniques. Not all the applications have been completely successful . A classification of them is made in the following.

<u>Use of PSA to support design change evaluation</u>
All the plants have performed at greater or lesser extents design changes after the PSA for design improvement and backfitting, especially the older ones. Plant design changes to comply with new regulations have been analyzed using the PSA, fire protection according to Ap. R

<u>Use of PSA in connection with NPP operation</u>
PSAs have been used for:

- *NPP maintenance policy and activities*: Most NPPs have used PSA insights in connection to the compliance with the maintenance rule, thus helping to establish maintenance requirements on components and systems according to their risk significance. On the other hand, one plant has already developed a risk-monitoring tool and applies it for risk informed online maintenance and other non-regulatory uses.
- *In service testing*: Specific in-service testing requirements have been submitted in some cases based on risk significance of equipment tested according to ASME XI requirements. A pilot project to optimize in-service inspection is also underway.
- *Improvement of Technical Specifications*: Many applications have been submitted for extending AOTs and STIs. Some of them have been accepted. Temporary exemptions to TSs have been also accepted. A Guide is being developed for the performance of this type of PSA application.
- *Risk based configuration control*: A plant has developed a risk monitor that helps to identify plant risk levels and ensures that the plant configuration is in compliance with mandatory regulations (e.g. TSs). This tool is also used to develop risk-based safety indicators.
- *Use of PSA to evaluate safety issues:* Several types of safety issues have been analyzed taking into account PSA insights
- *Graded QA:* A joint project of the Utilities and the CSN is being developed to establish QA requirements depending on the safety significance of systems and components.
- *Use of PSA to support NPP periodic safety review:* Periodic safety reviews are now being done for some plants taking thereby into account PSA insights. A specific case is presented below.

<u>Use of PSA in connection with incident and accident mitigation and management</u>
PSAs have been used for:

- *Use of PSA to improve emergency operating procedures (EOPs):* EOPs changes have been done at almost any plant after the development of the PSA. Such changes arise mainly from human reliability analysis, accident sequence development and hazard analysis. Changes affect not only instructions but sometimes also values of physical parameters. In addition, some plants avail now of information about the failures and effects that can occur as a result of a fire at any plant location.

- *Use of PSA to improve operator training programs:* **Training programs have been changed according to the importance of accident sequences and human actions in the PSA. On the other hand, many plants have tried to estimated based on PSA techniques the safety benefits of training in a replica full scope simulator requested by the CSN rather than in the simulators available.**
- *Use of PSA to support NPP accident management*

Selected PSA Applications

1. Use of PSA for exemptions to compliance with compliance Ap. R to 10CFR50.

This use of the PSA is complex and difficult and has been used in different ways by some utilities. The most thorough and formal application of this type has been performed by Ascó NPP and is going through the regulatory decision-making process.

The main advantages of using PSA insights for the reduction of fire risk in front of Ap. R requirements are that:

- PSA can provide risk estimates from having redundant safe shutdown cables or equipment together and unprotected. Ap. R cannot do that.
- Ap. R allows alternative acceptable ways to protect a safe shutdown train from a fire (automatic detection and suppression an 1 hour rated barrier, 3 hour rated barriers, or distance). These different ways don't achieve the same risk reduction. The effectiveness of a given solution can be assessed by PSA in some cases. Ap. R cannot do that.

The problems arise when PSA is used to ask for exemptions to the rule. They main difficulties are:

- Technical problems: Plant layout makes compliance with Ap. R criteria almost impossible at an acceptable cost in some cases. Compensatory or alternative measures should be then analyzed.
- Confidence on PSA results, understanding between deterministic and probabilistic areas.

Fire analysis techniques have not reached the same level of maturity than internal event analysis for standard PSA applications. Quantitative results are much more affected by uncertainties, arising from poor data (e.g. fire frequencies), lack of knowledge about fire spreading an fire effects, expert judgments, etc. In order to establish an acceptable basis for discussion some criteria have to be met:

- Maintaining defense in depth philosophy: Ensure low fire frequency, allow for prompt and reliable fire detection and suppression, impede fire damage to different safety functions. By this way for instance:
  - cable spreading rooms will not be considered low risk significant due to very low fire frequency even though the maximal predictable fire damage are very important
  - Defensive measures should not be concentrated in one aspect, e.g. human performance.
  - No exemptions can be supported if high consequence accidents (condition III or IV) can be caused by the fire or the fire can lead to total loss of relevant safety systems, independently from the PSA results obtained.
- Compensate PSA uncertainties in fire analysis with clearly conservative estimates, e.g.: probability of an undesired valve opening caused by a hot short in a burned cable equal to 1. This would lead to defensible PSA results in front of deterministic evaluation.
- Advantage should be taken of fire PSA analysis, requiring to the utility to have information available at the control room on the predictable effects of a fire in the fire zone and how the fire could affect plant operation and shutdown.
- Possible compensatory measures should be analyzed and the effectiveness of decisions made should be monitored.

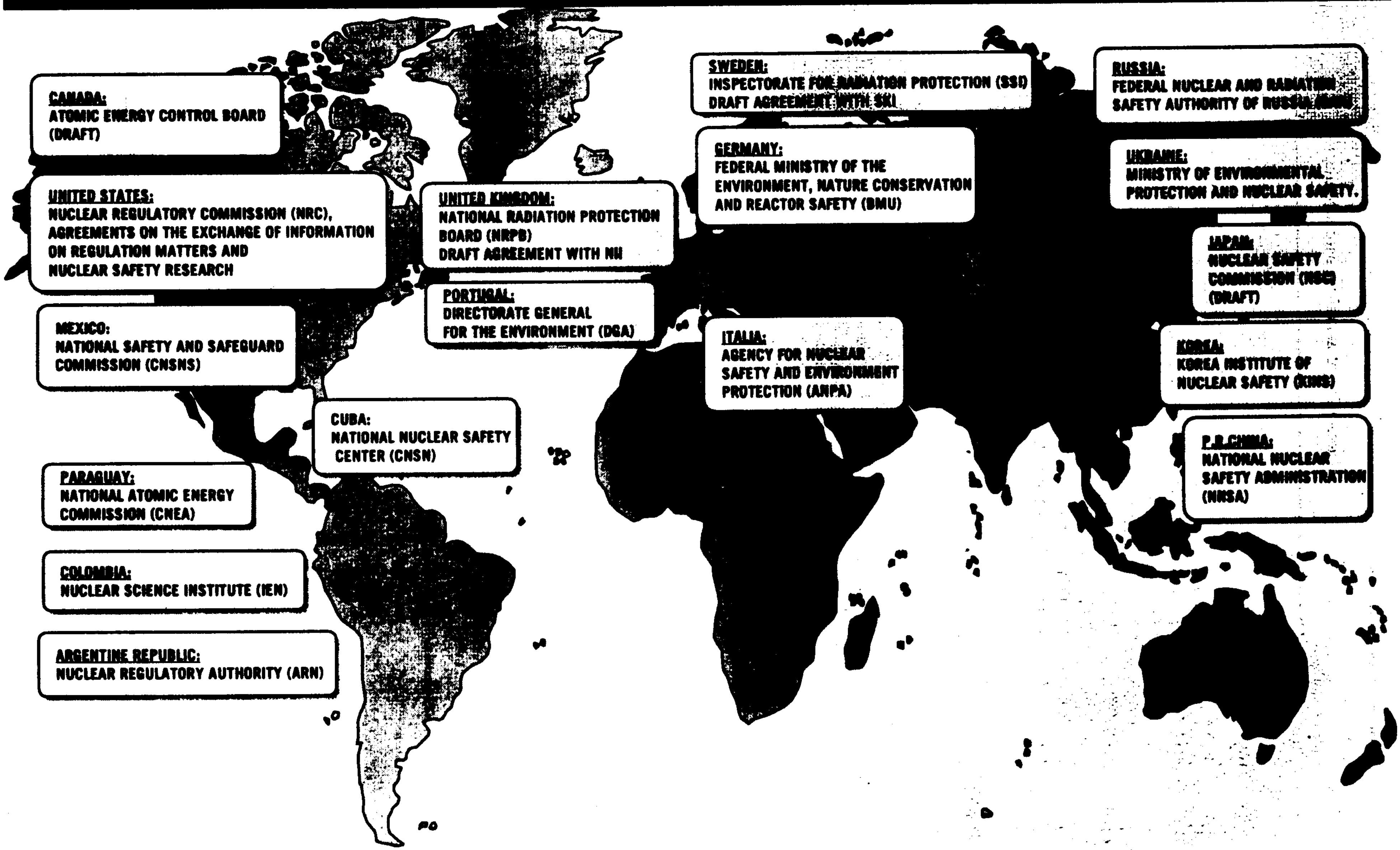
The most frequent exemption accepted by the CSN for Ascó NPP has been to accept as alternative way to the installation of passive protections the reinforcement of active protections, installing conventional fire detectors and incipient detectors, diverse suppression systems, and establishing effective control processes for heat sources, transient fuels, etc. including relevant protective devices in the Technical Specifications. Thus, Ascó NPP has installed at the cable spreading room incipient fire detection besides the already existing ionic smoke detection, which actuates the fire water suppression system automatically. A fixed carbon dioxide suppression system can be also manually and remotely operated. Thermographic inspection of cables will be done periodically. Electrical cabinets in the room have been moved to another room.

2. Use of PSA for periodic safety review.

The Periodic safety review of José Cabrera NPP is being now performed and is directly linked to the Operating permit of the plant. The plant has used the PSA to support ensuring an adequate safety level in relation with several licensing aspects. On the other hand, the CSN has required the utility to provide PSA analyses for assessing the safety significance of several issues. The plant started commercial operation in 1968, the design was significantly upgraded in the middle 1980's, but still departs significantly from standard Westinghouse designs, e.g. as a very particular feature the plant has only 1 steam generator.

CSN CONSEJO DE SEGURIDAD NUCLEAR

CSN´S INTERNATIONAL RELATIONS



Summary list of main PSA uses in Spain

José Cabrera NPP

PSA applications performed by the utility, mainly to support PSR:

- Several design changes
- Use of the PSA to support an exemption to compliance with 10 CFR50.62.
- PSA evaluation to support not having by-pass reactor trip breakers
- Evaluation of the risk significance of not having specific emergency guides
- Analysis of the ESFAS test policy and intervals
- Analysis the risk significance of containment penetrations
- Evaluation of the safety significance of passive components
- Risk significance of different operational states of the emergency offsite power supply for safety train B, that has no Diesel generator.
- Risk significance analysis of the lack of compliance with some aspects of G.L. 91-06.

PSA analysis requested by the CSN as a part of the Periodic Safety Review:

- Estimation of the risk impact of atypical control room design
- Estimation of the risk significance of not having a remote shutdown panel
- Analysis of machine-man interface for local actions when changing from safety injection to recirculation
- Analysis of the safety significance of the AFW turbine driven pump
- Reassessment of PSA taking into account the loss of HVAC of electrical cabinets
- Analysis of SGTRs affecting to more than one tube and the applicability of EOPs .
- Reanalysis of some accident sequences considered as stable states.
- Analysis of level 2 scenarios concerning hydrogen explosions or overpressurization

Vandellós 2 NPP

The PSA has not been formally approved by the CSN yet. PSA has been used for:

- Design improvements: Actuation circuitry for chillers and steam admission valves to AFW turbine driven pump.
- Temporary exemption to TS affecting water level meters in the pump house
- Support to set point change of high-pressure level 3 in the containment
- Support to maintenance rule implementation (under development)

Trillo NPP

Only the level 1 part of the PSA and some hazard analysis have been submitted to the CSN. Applicability of this PSA is therefore constrained. Nevertheless some PSA findings have led to design improvements.

A brief summary of PSA uses made by the utility to support the PSR and the additional PSA analyses required by the CSN is presented in the following:

PSA uses made by the utility to support the PSR:

- Use of the PSA to support an exemption to compliance with 10 CFR50.62. The plant has not an AMSAC system
- PSA evaluation to support low risk significance of not having by-pass reactor trip breakers (main breaker test cannot be done at power).
- Evaluation of the risk significance of not considering specific guides in the EOPs: ECA-1.1., ECA-1.2, ECA-3-2 and ECA-3-3.
- Analysis of the ESFAS test policy and intervals previously requested by the CSN
- Analysis the risk significance of some containment penetrations that don't met general design criteria for containment isolation.
- Evaluation of the safety significance of passive components given that many safety systems, as safety injection, RHR, AFW, CCW and ESW have common pipelines for both safety trains.
- Risk impact analysis of different operational states of the emergency offsite power supply for safety train B, which has no Diesel generator.
- Risk significance analysis of the lack of compliance with some aspects of G.L. 91-06.

PSA analyses required by the CSN:

- Estimation of the risk impact of having the panels for most of the safety systems behind the main control room panel, and not availing of a replica full scope simulator.
- Estimation of the risk significance of main control room fires taking into account that the plant has not a remote shutdown panel, and of the loss of instrumentation in the control room due to a fire in some other plant area.
- Analysis of machine-man interface for changing from safety injection to recirculation, taking into account that the valves cannot be operated remotely. Analysis as a particular case of fire induced accidents for these actions.
- Analysis of the safety significance of the AFW turbine driven pump for SBO, a major risk contributor, in relation with flow control and feed&bleed actions given the location of the related instrumentation in the control room.
- Reanalysis of PSA taking into account the adverse effect of loss of HVAC on some electrical cabinets (e.g. inverters), that had been assumed negligible.
- Analysis of SGTRs affecting more than one tube (neglected in the PSA) and the applicability of EOPs for that case.
- Reanalysis of accident sequences considered as stable states where at least some risk management measures would be necessary.
- Analysis of level 2 scenarios concerning hydrogen explosions or overpressurization not addressed in level 2 PSA.

As it can be seen, the amount of analyses is very large, encompassing many aspects of plant safety. Assuming that PSA could be used as an effective tool to assess the safety significance of all these issues, the combined effect of all of them is very difficult to predict.

3. Use of PSA to change Technical Specifications (AOTs, STIs)

PSAs have been used successfully in Spain for changing Technical Specifications. The technical background for performing the associated safety calculations is well established. However, especial difficulties can arise in some cases, which have made necessary to develop guidance on performing this type of PSA application. A Research and Development project is being sponsored by the CSN and the Utilities with support of the University of Valencia and Brookhaven National Laboratory (USA) for this purpose. This project uses the Ascó NPP for pilot experiences.

Relevant aspects affecting the development of this PSA application are:

- Adequacy of the PSA scope for the intended PSA analysis. Sometimes a level 1 PSA could be enough. In some cases however, it could be important to assess the impact of changes on level 2 PSA. LPSPSA could be also important.
- Analysis of the risk associated with bringing the plant to shutdown when an AOT is exceeded.
- Frequency of entrance in a given TS.
- AOTs for some systems, e.g. support systems can influence the frequency of initiating events, the safe shutdown capability and even accident management measures. Some of these aspects are not explicitly modeled in the PSA, some initiating events are just represented as basic events..
- PSA modeling assumptions could be very sensitive to the changes analyzed.

STIs changes have been easier to approve by the CSN than AOTs extensions. Among AOTs, those having a limited impact on plant systems have been approved with easy, whereas some AOTs changes for support systems have been rejected.

[illegible] PSA uses in Spain

Santa Maria de Garoña NPP

The PSA of this plant is the oldest one (only level 1, without hazards and common cause analysis) and was developed along with the Systematic Evaluation Plan of the plant. A new upgraded version is being reviewed by the CSN. The applicability of this PSA today is rather limited. Nevertheless some PSA applications have been developed:

- **Improvement of design and testing: Many changes were performed supported by PSA analysis, e.g. elimination of the broken loop selection of the LPCI system.**
- **Changes of AOT for Diesel generators.**
- **Support to maintenance rule implementation (under development)**
- **Pilot plant for the implementation of Risk Informed ISI program.**

Almaraz NPP

- **Several design changes.**
- **TS changes: AC power supply to a safety injection valve, AOT for DC-inverters, AOT of room cooling for electrical equipment (rejected)**
- **Compliance with Ap. R, 10CFR50**
- **Prioritization of MOVs (compliance with G.L. 96-05)**
- **Support to maintenance rule implementation**
- **Applications for Risk Informed ISI and Severe Accident Management are being developed.**

Ascó NPP

- Changes to design and procedures, e.g. RHR valve interlocks.
- TS changes: AOTs for inverters and accumulators
- Compliance with Ap. R, 10CFR50.
- Risk informed performance based check valve testing
- Prioritization of MOVs
- Support to maintenance rule implementation
- Risk informed IST of pneumatic valves
- Pilot plant for the development of a Risk Informed ISI research & development project
- Pilot plant for the development of a Tech. Spech. Optimization research & development project
- Risk ranking to support compliance with Ap. J.

Cofrentes NPP

- Changes to design and procedures
- Prioritization of MOVs
- Risk Informed on-line maintenance
- Risk Monitoring
- TS changes: Extension for AOT of RHR, several extensions of STIs
- Risk ranking to support compliance with Ap. J.
- Risk evaluation of alternative measures for compliance with Ap.R
- Support to maintenance rule implementation
- Use of PSA insights to improve EOPs, eg. for SBO.
- Pilot plant for the development of a graded QA program
- Use of PSA to support severe accident management (under development)