Nuclear Safety Council Instruction number IS-20, of January 28th 2009, establishing safety requirements relating to spent fuel storage casks

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Article 2.a) of the Law creating the Nuclear Safety Council, Law 15/1980, of April 22nd, modified by Law 33/2007, of November 7th, attributes to this Public Entity powers to "draw up and approve technical instructions, circulars and guides relating to nuclear and radioactive facilities and activities relating to nuclear safety and radiological protection".

Article 80 of the Regulation on Nuclear and Radioactive Facilities, in the wording given by Royal Decree 35/2008 of January 18th (Official State Gazette number 42 of February 18th 2008), provides, regarding the storage of spent fuel, that the design of casks for this purpose must be approved by the Directorate General for Energy Policy and Mines following a mandatory and binding report by the Nuclear Safety Council.

To date, in drawing up the mandatory and binding reports contemplated by the Law for such approvals, the Nuclear Safety Council has fundamentally adhered to the standards in force in the country of origin of the technology and the international standards of the International Atomic Energy Agency (IAEA) relating to spent fuel storage and, in particular, to those referring to the dry storage of spent fuel.

The Nuclear Safety Council has also been inspecting the manufacturing of such casks and their conditions of use at the authorised storage facilities in order to verify compliance with the conditions set out in the approvals.

The objective of the present Instruction is to develop the nuclear safety and radiological protection requirements for the design of spent fuel casks, establish the contents of the documentation to be submitted for approval and guarantee adequate coordination of the licensees involved in the design/ manufacturing and use of these casks, since the responsible parties may be different in each stage.

Consideration has been given in this process to the international standards, especially theJoint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, done in Vienna on September 5th 1997 and ratified by Spain (Official State Gazette No 97 of April 23rd 2001), to the IAEA standards and to the standards in force in the most advanced countries in the design and use of this technology, as well as to the in-house experience acquired in relation to the design, manufacturing and use of the casks.

In addition, consideration has been given in this Instruction to the work being performed on radioactive waste by WENRA (Western European Nuclear Regulators Association), with a view to bringing the different regulations into line, establishing a set of common requirements or reference levels based on international standards that are to be applicable in the national standards during 2010.

Pursuant to the above, and in keeping with the legal entitlement contemplated in article 2. section a) of Law 15/1980 of April 22nd, creating the Nuclear Safety Council, modified by Law 33/2007 of November 7th, and following the appropriate technical reports and consultations with the affected sectors, this Nuclear Safety Council has agreed as follows during its meeting held on January 28th 2009:

One. Objective and scope of application

1. The objective of the present Nuclear Safety Council Instruction is to establish nuclear safety and radiological protection requirements to be met in the design of spent fuel casks for use in authorised temporary storage facilities, define the necessary

documentation and guarantee that interdependencies among design, manufacturing and use are appropriately accomplished.

2. The present standard provisions are applicable to physical or legal corporate applying for design approval of spent fuel storage cask, in accordance with article 80 of the Regulation on Nuclear and Radioactive Facilities, and to the licensee of the installation where the cask is to be used at.

Second. Definitions

Definitions of terms and concepts contained in the present Safety Instruction correspond to those contained in the following standards:

– Nuclear Energy Act, Law 25/1964, of April 29th (Official State Gazette No 107, of May 4th 1964).

– Law 15/1980, of April 22nd, creating the Nuclear Safety Council (Official State Gazette No 100, of April 25th 1980).

– Royal Decree 1836/1999, of December 3rd, approving the Regulation on Nuclear and Radioactive Facilities.

– Royal Decree 783/2001, of July 6th, approving the Regulation on the Protection of Health against Ionising Radiations (Official State Gazette No 178, of July 26th 2001).

– Instrument of Ratification of the Joint Convention on Safety in the Management of Spent Fuel and Safety in the Management of Radioactive Waste, done in Vienna on September 5th 1997, issued in Madrid on April 30th 1999 (Official State Gazette No 97 of April 23rd 2001).

In addition to the above, other necessary terms deriving from the international standards and the existing national framework are used, these being understood as follows within the context of this Instruction:

Design basis accidents: the set of accident conditions for which the structures, systems and components of the cask are designed. Under these conditions, the criteria used for the design of the cask keep the deterioration of the nuclear fuel and the release of radioactive materials within the authorised dose limits. These are occasionally known as "postulated accidents".

Design approval (DA): Resolution by which the Directorate General for Energy Policy and Mines of the Ministry of Industry, Tourism and Trade approves the design of the spent fuel storage cask, following a mandatory and binding report by the CSN. The DA holder will apply for amendment to the original DA should modifications met criteria set in this Instruction.

Design basis: The information that identifies the specific functions to be performed by a structure, system, or component of the spent fuel storage cask and the specific values or ranges of values chosen for controlling parameters as reference bounds for design. These values may be: conditions deriving from commonly accepted practices designed to achieve functional objectives or requirements deriving from analyses (based on calculations or experiments) of the effects of the postulated accident for which the structure, system or component must fulfil its function.

Spent fuel: nuclear fuel irradiated and definitively removed from the core of a reactor.

Off-normal conditions (foreseen operating event): these refer to foreseen operating events that deviate from normal operation and that might occur on one or more occasions during the lifetime of the temporary storage facility, such as for example the loss of off-site power. The criteria used in the design of the cask mean that these events do not cause significant damage or give rise to accident conditions.

Confinement: prevention of the release of radioactive material by means of a series of barriers.

Spent fuel storage cask: dry storage system made up of a series of elements required for the safe removal, transfer and storage of spent nuclear fuel, guaranteeing subcriticality, confinement, biological shielding, decay heat removal and the retrievability of the fuel. These storage systems may be made up of a single component or of several components having different functions. It may also contain high level wastes or other materials associated with the fuel assemblies.

Dual purpose cask: cask designed to fulfil two purposes: the storage and transport of spent fuel; in accordance with the applicable regulation requires two independent approvals.

Control of criticality: capacity to maintain neutron multiplication in the nuclear fuel within an adequate margin.

Structures, systems and components Important to Safety, this including:

1. Those structures, systems and components whose incorrect operation or failure might give rise to an undue exposure to radiation for the site personnel or members of the public.

2. Structures, systems and components that prevent foreseen operating events from giving rise to accident conditions.

3. Elements designed to mitigate the consequences of accidents caused by the incorrect operation or failure of structures, systems or components.

Spent fuel and high level waste storage facility: independent facility or linked to another existing nuclear facility designed for the reception, handling, conditioning, storage and retrieval of spent fuel and high level radioactive wastes, without undue risk to the health of workers, public and to the environment.

Design modification: any change in the design of the cask or in the procedures that affects the design functions or the methods for the performance or control of these functions or the evaluations performed to demonstrate compliance with the foreseen functions. Changes are also understood to refer to the alteration or elimination of existing items or procedures and to the implementation of new items or procedures. The changes referred to in the Instruction include both physical changes to the structures, systems and components and changes in the conditions of use, these being changes in the practices of the facility, the procedures, the analyses performed to demonstrate compliance with the design basis and the assessment methods used in these analyses.

Cask auxiliary systems: systems and/or equipment required for the handling, drying, filling with gas, closing and sealing of the casks, not including systems belonging to the temporary storage facilities and/or nuclear power plants at which they are used, such as hoisting systems (cranes), electrical supply, water supply, etc.

Licensee: physical or legal corporate to which approval of the design of the spent fuel storage cask is issued and responsible for its design and manufacturing.

User: physical or legal corporate, licensee of a nuclear facility, authorised to use an approved spent fuel storage cask and responsible for its operation.

Design lifetime: in relation to a system, structure or component, this refers to the operating period assumed in the design, during which it is expected to fulfil its function in the terms established in its specifications.

Three. Design requirements

Included below are the general criteria required in designs relating to safety significant Structures, Systems and Components (SSC).

3.1. General criteria

3.1.1. The spent fuel storage casks shall be designed to fulfil the following safety functions under both normal and off-normal conditions and design basis accident conditions:

– Control of criticality.

– Control of operational exposure of the public and the environment.

– Heat removal.

– Confinement of radioactive material.

–. Retrieval of spent fuel.

3.1.2. The concept of defence in depth shall be applied in the design of the cask by establishing multiple levels of protection to prevent or minimise the consequences of possible accidents.

3.1.3. The main design bases applicable to the cask shall be identified and the characteristics, parameters and limits of the spent fuel and high level wastes shall be defined.

3.1.4.The main design criteria applicable to safety significant Structures, Systems and Components (SSC) under normal operating, off-normal and accident conditions and with regard to natural phenomena shall be defined, along with the requirements established in design, manufacturing, construction, testing, maintenance and operation.

3.1.5. Safety significant SSCs shall be classified depending on their safety function.

3.1.6. Safety significant SSCs shall be:
(a) Designed, manufactured, assembled and checked against quality standards in keeping with their safety functions and design lifetime.

(b) Designed to withstand natural phenomena and adverse environmental conditions such as earthquakes, tsunamis, tornados, lightening strikes, hurricanes and flooding without their capacity to perform their functions being reduced. Consideration shall be given to the most severe conditions of these phenomena in the vicinity of the potential site, within reasonable margins of knowledge, and to the effects of credible combinations of these phenomena under normal, off-normal and accident conditions.

(c) Designed to withstand postulatede fires and explosions.

(d) Designed to allow for inspection, maintenance and testing.

3.1.7. The standards, codes and materials applicable in the design and manufacturing of SSCs shall be indicated, taking into account the design lifetime.

3.1.8. Instrumentation and control systems in keeping with the design characteristics of the cask shall be included for the surveillance of safety significant parameters within the ranges expected under normal and off-normal conditions. The systems required under accident conditions shall be identified.

3.1.9. The cask shall be designed in order to allow the fuel to be retrieved within a reasonable time during the design lifetime for subsequent processing or definitive disposal or for intervention in the event of unexpected failure.

3.1.10. The design of the cask shall guarantee safe storage of the fuel and compliance with the limits and conditions of use throughout the design lifetime, considering the natural phenomena described in section 3.1.6 (b).

3.1.11. The licensee shall establish and document the limits and conditions of use of the cask, with consideration given to the following:

– Ambient conditions during storage (for example, temperature, pressure, humidity, contaminants).

– The effects of heat generation by individual spent fuel units and at the overall level of the facility.

– The potential effects of gas generation in the spent fuel, in particular the risks of ignition, fire, explosion and deformation of the cask and the radiological protection aspects associated with each.

– The prevention of criticality conditions during storage (including off-normal and accident conditions).

3.1.12. Cask design, manufacturing, testing and usage activities shall be carried out in accordance with a quality system meeting the requirements established in the applicable regulations in the area of national nuclear quality assurance and the international nuclear field.

3.1.13. The design of both dual purpose and storage casks shall take into account the issue of compatibility and interdependence with the design criteria for transport, in accordance with the regulation in force in this area.

3.1.14. The safety significant auxiliary systems of the cask shall be designed, manufactured, assembled and checked in accordance with quality standards in keeping with their function and, where appropriate, the limits and conditions of use of these systems shall be established.

3.2. Criticality control criteria

3.2.1. The cask shall be designed to maintain subcriticality and guarantee the principle of double contingency, including adequate margins with respect to uncertainties in the data and methods used in the calculations, during normal operation and under off-normal or accident conditions.

3.2.2. As a priority, the criticality control methods used shall be based on a favourable geometry, on fixed neutron absorbing materials or on both. Prior to using this absorbing material, it shall be demonstrated by analysis or testing that its efficiency does not significantly degrade throughout design lifetime.

3.3. Criteria relating to radiological protection

3.3.1. The shielding and confinement of the cask shall be designed to provide sufficient protection so as to fulfil radiological protection criteria applicable to the host facility.

3.3.2. Consideration shall be given to occupational exposure in the case of SSCs used for operation or for maintenance and inspection needs. These SSCs shall be designed, manufactured, located, shielded, controlled and tested such that the external and internal exposure of the personnel is minimised in accordance with ALARA criteria. The design shall also include means to prevent the accumulation of contamination and to facilitate decontamination.

3.3.3. The cask auxiliary equipment (for handling, drying, filling with gas, closure and sealing) shall be designed in such a way as to consider aspects associated with radiological protection, to facilitate maintenance and to reduce the probability of off-normal or accident conditions associated with this equipment and their consequences.

3.4. Thermal criteria

3.4.1. The spent fuel cask shall be designed to achieve adequate heat removal by passive means during storage.

3.4.2. The design shall guarantee that the temperature of the cladding of the spent fuel assemblies does not reach values that might lead to degradation of this cladding under normal, off-normal and accident conditions.

3.5. Criteria relating to confinement

3.5.1. The confinement systems shall be designed such that throughout the storage period an inert atmosphere protects the

cladding of the fuel assemblies against degradation, such that removal of the fuel does not imply any operational problems.
3.5.2. The cask shall be designed for the confinement barrier to be redundant.

3.5.3. The confinement systems shall be designed to allow for continuous or periodic surveillance depending on the characteristics of the cask.

3.6. Structural and material requirements
3.6.1. The cask shall be designed to withstand the resulting loads under normal, off-normal and accident conditions and the natural phenomena postulated, ensuring that the system maintains its subcriticality, shielding, heat removal and confinement functions and a suitable fuel retrieval.

3.6.2. The cask shall be designed to ensure that throughout the design lifetime there are no significant chemical or galvanic reactions between the materials used or with the spent fuel and water during wet operations. Likewise, consideration shall be given to the thermal effects and the irradiation of these materials.

3.6.3. Depending on the design basis and the properties of the fuel, consideration shall be given to ageing of the SSCs, with a maintenance, testing and inspection programme established if necessary. The results obtained from this programme will serve as a basis for periodic safety review.

Four. Documentation to be submitted
The request for the design approval shall be accompanied by the following documents:

– Safety Analysis Report.

– Quality Assurance programme with the general contents set out below:

4.1. Safety Analysis Report
The Safety Analysis Report shall contain the information required for the analysis of the cask and its auxiliary systems from the point of view of nuclear safety and radiological protection, under both normal operation and accident conditions. In particular, the following issues shall be covered:
1. General description.
2. Design criteria.
3. Structural Evaluation.
4. Thermal Evaluation.
5. Shielding Evaluation.
6. Criticality Evaluation.
7. Confinement Evaluation.
8. Materials Evaluation.
9. Operating procedures.
10. Acceptance Tests and maintenance program.
11. Radiological protection.
12. Accident Analyses
13. Cask usage limits and conditions. Operating Technical Specifications.
14. Quality assurance.

4.2. Quality assurance programme
4.2.1. The quality assurance programme shall be applicable throughout all the phases of the lifetime of the cask, including design, manufacturing, testing and use, and shall contain the following aspects:
– Quality Assurance requirements.
– Organisation and responsibilities.
– Quality Assurance programme.
–Design Control.
– Procurement Document Control.
– Instructions, procedures and drawings.
– Document control.
– Control of purchased materials, equipment and services.
– Identification and control of materials, parts and components.
– Control of special processes.
– Licensee inspection.
– Test Control .
– Control of measuring and testing equipment.
– Handling, storage and shipping control.
– inspection, test and operating Status.
– Non-conforming materials, parts or components.
– Corrective actions.
– Quality Assurance records.
– Audits.

If the cask manufacturing activities begin before design approval is obtained, the

quality assurance programme for these activities must have been approved beforehand by the CSN.

Five. Conditions of design approval

5.1. The design approval is conditioned upon fulfilling the requirements and the conditions specified below:

a) The DA shall specify the documentation and basic applicable standards.

b) The DA is issued for valid for a period of 20 years as from the date of issuing of the corresponding Resolution. Requests for extension or renewal of the Authorisation shall be made at least one year prior to the limit date and shall be accompanied by a justification of fuel storage not having adversely affected the safety significant structures, systems and components, in accordance with the applicable requirements.

5.2. Each cask must be conspicuously and durably marked with model number, unique identification number and empty weight

5.3. The documentation generated during the manufacturing of each cask shall be in the custody of the user.

5.4. During the first quarter of each year, the licensee shall submit a report to the Nuclear Safety Council containing a description of whatever design modifications have not required prior approval, accompanied by a summary of the evaluation of each. In addition, the report shall include the units manufactured and delivered, the tests and documentary revisions performed and data of interest deriving from analysis of national and international operating experience in relation to casks. Likewise, the licensee shall immediately inform the CSN whenever deficiencies affecting safety are detected in the design.

5.5. The licensee shall update the cask Safety Analysis Report at least every two years and submit it to the Nuclear Safety Council. When such updating is not necessary due to there not having been any modification, this circumstance shall also be reported in writing.

5.6. The licensee shall provide the user of the cask with an updated copy of the approval and subsequent modifications or revisions thereto, along with the Safety Analysis Report.

5.7. As a prerequisite to the loading of spent fuel, pre-operational tests shall be performed on the cask, these including loading, closure or sealing, drying, pressurisation, leak testing, handling, unloading and transfer. The tests shall be performed without fuel but with an equivalent weight when this is of significance for the objective of the test, and using all the auxiliary and hoisting equipment which will be used for actual loading of the system.

5.8. The results of the pre-operational tests shall be submitted to the Nuclear Safety Council prior to actual loading of the fuel.

5.9. The licensee shall draw up and Operations Manual in accordance with the Safety Analysis Report. This shall be provided to the user, who shall implement it at the facility in accordance with a programme based on written procedures.

5.10. The licensee shall identify the equipment and systems required for maintenance, periodic testing and inspection programmes, in order to ensure their suitable operation.

5.11. The licensee shall develop the Maintenance Manual, periodic tests and inspections, the surveillance system and the consideration of ageing of the SSCs in accordance with a programme based on the Safety Analysis Report that the user will implement at the facility through a programme based on written procedures. The results of maintenance, tests and periodic inspections shall be evaluated and registered.

5.12. The licensee shall periodically revise the maintenance, testing and periodic

inspection manual to incorporate the lessons learned from experience, especially from incidents relating to secondary activities such as the preparation of maintenance and testing.

5.13. Both the operating and the maintenance manuals shall take into account the optimisation of occupational exposure.

5.14. Prior to using the cask, the user shall demonstrate that the conditions of the site at which it is to be located are covered by the cask Safety Analysis Report. The user shall incorporate the operating technical specifications of the cask and review the affected mandatory documentation on the facility housing the cask. Likewise, the Quality Manual for the facility shall include the scope and content of the cask testing, operating, storage, maintenance and registration activities carried out at the facility.

5.15. The users shall keep an updated record of the documentation generated during the loading and the period of storage of each cask, as well as of the results of the maintenance, testing, surveillance and periodic inspections performed, which shall be appropriately transferred, along with the manufacturing documentation, if there is a change in the ownership of the facility or a switch to another storage mode or management phase.

5.16. The user and the licensee of the design approval shall exchange appropriate information on the results and the conclusions drawn from the operating experience and good practices, including those reported by other facilities, in order to prevent repetition and the appearance of phenomena potentially damaging to safety. This exchange of information shall be documented and incorporated into the documentation associated with the design of the cask, its manufacturing where appropriate and its use.

Six. Design modifications

6.1. Any modification to the design, tests, methods of evaluation, procedures, manuals and, in general, to the conditions of the design or usage approval specified therein potentially affecting safety and radiological protection shall be previously assessed by the licensee, who shall determine whether any of the circumstances indicated below exist. If this is the case, the corresponding authorisation for design approval modification shall be requested:

a. Increase in the frequency of occurrence of any accident previously analysed within the framework of the safety analysis report.

b. Increase in the probability of occurrence of any malfunction of safety significant structures, systems or components previously analysed within the framework of the safety analysis report.

c. Increase in the consequences of any accident previously analysed within the framework of the safety analysis report.

d. Increase in the consequences of any malfunction of safety significant structures, systems or components previously analysed within the framework of the safety analysis report.

e. Create a possibility for an accident of a different type than any previously evaluated in the safety analysis report.

f. Create a possibility for a malfunction of safety significant structures, systems or components, with a different result than any previously evaluated in the safety analysis report.

g. Result in a design basis limit for a fission product barrier being exceeded or altered as described in the safety analysis report

h. Result in a departure from a method of evaluation described in the safety analysis report, used in establishing the design bases or in the safety analyses.

6.2. The licensee and the user shall keep records of any cask design modification, as

well as of evaluations with a justification demonstrating that the change, test or design modification does not require a design approval modification.

Seven. Infringements and penalties

The present Nuclear Safety Council Instruction shall be binding, in keeping with the requirements of article 2.a) of the Law creating the Nuclear Safety Council, Law 15/1980, of April 22nd, for which reason non-compliance therewith shall be penalised as set out in Chapter XIV (articles 85 to 93) of the Nuclear Energy Act, Law 25/1964, of April 29th.

Eight. Single final provision

The present Instruction shall enter into force on the day following the date of its publication in the Official State Gazette.

Nine. Single derogatory provision

All legal standards of equal or lower standing and opposing the present Instruction are hereby annulled.

Madrid, January 28th 2009
The President of the Nuclear Safety Council,
Carmen Martínez Ten