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III. OTHER PROVISIONS

NUCLEAR SAFETY COUNCIL

11342 *Nuclear Safety Council Instruction number IS-30, revision 2, of November 16th 2016, on the requirements of the fire protection programme at nuclear power plants.*

Article 2.a) of Law 15/1980, of April 22nd, creating the Nuclear Safety Council attributes to this public body powers to «draw up and approve Instructions, Circulars and Guidelines of a technical nature relating to nuclear safety and radiological protection» with a view to fostering regulations allowing for their safe operation; i.e., without undue risk for people or the environment.

For some time the Nuclear Safety Council has required the nuclear power plant licensees to implement a fire protection programme in keeping with the requirements demanded of US plants and with the licensing conditions for fire protection applied to each plant in particular. Pursuant to the provisions of article 8.3 of the Regulation on Nuclear and Radioactive Facilities, (Royal Decree 1836/1999, of December 3rd, modified by Royal Decree 35/2008, of January 18th), and further to the need to incorporate these requirements into the Spanish legal framework, Nuclear Safety Council Instruction IS-30 dealing with the requirements of the fire protection programme at nuclear power plants (Official State Gazette «BOE» No. 40 of February 16th 2011) was approved on January 19th 2011.

In drawing up this Council Instruction, consideration was given to the work performed by the Western European Nuclear Regulators' Association (WENRA) in order to bring into harmony the regulations of the different countries. As a result of this effort, a set of common requirements known as «reference levels» was established, these to be reflected in the national standards.

Specifically, in its chapter S (Protection against internal fires) the WENRA reference levels document sets out the basic applicable requirements which, in the terminology traditionally used within the Spanish documentary and legal framework, are known as «Fire Protection at nuclear power plants».

In order to give consistency to the standards development process undertaken by the CSN as a result of this harmonisation effort, it was considered necessary to draw up a Council Instruction contemplating the aforementioned requirements, this giving rise to approval of the said Instruction IS-30, of January 19th 2011. Subsequently, in view of the experience gleaned from application, the need to regulate the different specific characteristics of both the design and the original licensing basis of the system for fire protection of each of the different Spanish nuclear power plants and the evolution of the fire protection regulations, revision 1 of Instruction IS-30 of February 21st 2013 was approved. It has now been considered necessary to revise IS-30 in order to clarify and facilitate the practical application of the term «exemption», splitting the term coined in revision 1 into two new terms, exemption and equivalent measures, which fit perfectly into the regulatory framework governing nuclear safety and radiological protection.

By virtue of the above and in keeping with the legal empowerment contemplated in article 2, section a), of Law 15/1980, of April, 22nd, creating the Nuclear Safety Council, following consultations with the affected sectors and the appropriate technical reports, the Council agreed as follows during its meeting held on November 16th 2016:

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One. *Objective and scope of application*

1. The objective of the present Council Instruction is to require the licensees of the nuclear power plants to implement a fire protection programme and to define the criteria to be met by this programme.

2. The present Council Instruction shall be applicable to all the licensees of Spanish nuclear power plants holding operating permits.

Two. *Definitions.*

The definitions of the terms and concepts contained in the present Council Instruction correspond to those contained in the following standards:

The Nuclear Energy Act, Law 25/1964, of April 29th.

Law 15/1980, of April 22nd, creating the Nuclear Safety Council.

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

Furthermore, the following definitions are applicable within the context of the present Council Instruction:

Design basis accident: the set of accident conditions for which a nuclear facility is designed. The criteria used for the design, under these conditions, keep the deterioration of nuclear materials and the release of radioactive materials within the authorised limits. These are occasionally known as «postulated accidents».

Operator manual actions in the event of fire: all actions required to achieve and maintain safe shutdown conditions following a fire and have to be performed:

– Outside the main control room and the alternative shutdown panel in the event of a fire (or where appropriate the alternative shutdown panels in the event of a fire), or

– To undertake the recovery of this capacity from the main control room.

Analysis of safe shutdown in the event of fire: the process or method of identifying and evaluating the structures, systems and components necessary to achieve and maintain safe shutdown conditions in the event of a fire.

Fire risk analysis: analysis used to assess the capacity of the plant to maintain safe shutdown capability and minimise off-site radioactive releases in the event of a fire. The analysis shall include the following characteristics:

– Identification of permanent and transient fire risks.

– Identification and evaluation of protection and prevention resources relating to fire risks.

– Assessment of the impact of the fire on any area of the plant to reach and maintain safe shutdown conditions and minimise and control the off-site release of radioactive material.

Fire areas or compartments: Section of a building, or even a complete building, separated from other areas by fire-resistant barriers guaranteeing the impossibility of the fire propagating from this area to another, or vice versa, during the specified fire resistance time.

Safety important fire area in the field of fire protection: a fire area containing a safety important structure, system or component in the field of fire protection. These structures, systems or components of importance for safety in the field of fire protection include, at least, those necessary to achieve and maintain safe shutdown conditions in the event of a fire, along with those others that might prevent or have a negative influence on the aforementioned capacity to achieve and maintain safe shutdown conditions; those that perform safety functions and those others that might prevent or have a negative influence on the performance of the said safety functions; as well as those whose malfunction might cause off-site radioactive releases.

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Fire resistant barriers: construction components (walls, enclosures, structural floors) as well as seals, dampers, electrical duct fire resistant coatings, etc. qualified by approved laboratories as fire-resistant over a given range and used to delay the propagation of fire for a minimum period equal to that for which they are qualified.

Equipped fire hose: set of valve, hose, nozzle, pressure gauge and isolation valve, permanently connected to a water supply and used for fire protection.

Fire brigade: group of persons trained and prepared to take the necessary measures in the event of a fire.

Back-up or second-line fire brigade: group of persons with the training, preparation and knowledge of protection against fires necessary to assist the fire brigade in extinguishing tasks.

Associated circuits in the field of fire protection: safety related and non-safety related electrical circuits that might adversely affect safe shutdown of a power plant as a result of a fire. These associated circuits:

1. Do not meet the separation criteria indicated in Article three of this Council Instruction, and

2. Meet one of the following conditions:

a) They share a power supply with the safe shutdown equipment (redundant or alternative), that is not electrically protected by means of properly coordinated circuit breakers, fuses or other devices.

b) They are connected to equipment circuits whose spurious operation might adversely affect the safe shutdown capacity (for example, interface valves between the residual heat removal system and reactor coolant systems, automatic depressurisation system valves, pressuriser relief valves, other relief and safety valves, steam dump valves for flushing the steam generator, instrumentation, steam dump, etc.).

c) They share a common enclosure, for example, electrical raceways, panels, junction boxes), with shutdown cables (redundant or alternative), and are not electrically protected by means of breakers, fuses or other devices or allow for the propagation of fire.

Firewalls : this name is given to physical barriers that prevent the linear propagation of a fire along a combustible element. When the material existing on one side of the fire damper is consumed, the other end of the said element is not affected by temperature. The difference with respect to the fire barrier is that the latter protects the area or equipment from the effects of an external exposure fire.

Fire detection: action of manifesting the existence of a fire by means of items sensitive to certain phenomena accompanying the fire.

Structures, systems and components: this is the general term that includes all the elements of an installation. The structures are passive elements: buildings, vessels, shielding, etc. A system comprises several components or structures mounted in such a way as to carry out a specific function. A component is a specific system element. Examples include cables, transistors, integrated circuits, motors, relays, solenoids, piping, accessories, pumps, tanks and valves.

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Safety (or safety-related) structures, systems and components: these are elements to whose operation credit is given in design basis accident analysis with a view to:

1. Taking the facility to a safe shutdown condition and keeping it under such a condition in the long term.
2. Limiting the radiological consequences of foreseen operating events and design basis accidents within the specified limits.

Structures, systems and components required for safe shutdown in the event of a fire: these perform the functions required to achieve and maintain safe shutdown in these scenarios.

Safety important structures, systems and components: this concept includes the following:

1. Those structures, systems and components whose malfunction or failure might give rise to an undue exposure to radiation for the site personnel or members of the public;
2. Those structures, systems and components that prevent foreseen operating events from giving rise to accident conditions;
3. Those elements that are aimed at mitigating the consequences of accidents caused by the malfunction or failure of structures, systems or components.

Fire: violent process of oxidation of a combustible material with the giving off of flames, heat or gases.

Ignition source: any process or item of equipment that produces sparks, flames or heat sufficient to produce the ignition of a combustible or inflammable material.

Safety function: a function aimed at preventing accidents or mitigating their consequences, the result being the protection of the workers, the members of the public and the environment against undue risk caused by radiation.

Hydrant: connection for hoses or monitor located outdoors, whose water supply provides sufficient flow and pressure to extinguish fires in their most intense phase. They may be of the dry piping or wet piping hydrants type.

Fire : Rapid ignition of combustible materials with an abundance of oxidising agent initiated by a fire or source of ignition.

Combustible material: any substance capable of combining with oxygen in a rapid exothermic reaction.

Non-combustible material: material that in the form and conditions used does not ignite or burn, support combustion, or does not give off flammable vapours when subjected to the action of fire or heat.

Alternative shutdown: this is the term used to describe the shutdown strategy used for areas or zones in which redundant trains are not free from damage in the event of fire and re-routed, relocated or modified systems are used to achieve and maintain safe shutdown.

Dedicated shutdown: this term is used to describe the shutdown strategy used by the system or items of equipment installed specifically to reach and maintain safe shutdown by means of a separate path or train.

Cold shutdown: this term is used to describe the state, condition or operating mode of the reactor in which the conditions defined in this respect in the plant Technical Specifications are met.

Safe shutdown: this term is used to describe the plant situation in which the reactor remains subcritical, in accordance with the definition set out in the plant Technical Specifications, with heat removal and reactor inventory control guaranteed and without off-site radioactive releases.

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Fire Protection Programme : is the set of components, analyses, procedures, activities, personnel and resources required to define and develop all the fire protection activities that guarantee the prevention of fires in areas containing safety important structures, systems or components; their rapid detection and extinguishing when they occur; and their confinement in fire areas designed in such a way that in the event of any fire in any fire area of the plant, safe shutdown may be reached and maintained and the possibility of radioactive releases off site is minimised. This includes the fire protection system itself, the design of the facility, the fire prevention, administrative controls, detection, alarms and confinement, the extinguishing of administrative controls, the organisation of firefighting, inspection and maintenance, , the organisation of firefighting, training, inspection and maintenance, quality assurance, testing, etc.

Fire resistant: characteristic shown by certain materials present when subjected to the conditions determined by the standard time-temperature curve.

Access and escape route: path duly signposted to allow for entry and exit to and from any fire area or zone of the facility.

Spurious signal in the field of fire protection: signal that produces the undesirable actuation of an equipment or component, taking into consideration all its possible functional states, and that might affect its capacity to reach and maintain safe shutdown.

Safe shutdown earthquake: earthquake of the maximum intensity considered in the design of the plant, such that the facility may be taken to the safe shutdown condition in the event of the said earthquake occurring.

Fire protection system: set of detection, alarm and extinguishing structures, equipment and components designed, installed and maintained in accordance with the fire protection programme.

Postulated initiating event: this is an event identified during the design as capable of taking the facility to foreseen operating event or accident conditions.

Redundant train: set of equipment or components capable of carrying out a safety function independently.

Redundant safe shutdown train: redundant train capable of achieving and maintaining the safe shutdown condition by itself.

Fire areas: All sub-divisions mapped out within a fire area or compartment and used as a unit of study for the installation of specific active protection systems (detection, control and extinguishing). The criteria for the establishment of fire areas are based on the type of combustible material present, the assessment of the fire risk and the severity of the fire expected.

Three. *Nuclear Safety Council criteria for fire protection at nuclear power plants.*

3.1 Fire protection safety objectives:

3.1.1 The licensee of the operating permit of a nuclear power plant must adopt the principle of defence in depth in fire protecting, implementing measures to prevent fires before they occur, to detect, control and extinguish them as soon as possible if one occurs and avoid its propagation to other areas in which safety may be affected.

3.1.2 The licensee of the operating permit of a nuclear power plant must guarantee through confinement in fire areas, that a fire that cannot be extinguished will leave at least one of the redundant safe shutdown trains free from damage, such that the plant may achieve and maintain safe shutdown conditions and that the possibility of off-site radioactive releases is minimised.

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3.2 Design basis:

3.2.1 The design of the fire protection system will be based on criteria of separating safety important systems, in order to satisfy the requirements of article 3.2.3; on defence in depth, to meet those of article 3.1.1; on the postulation of a fire, to consider the total combustion of all the combustible material present in the area affected by the fire and the loss of equipment or components present in the fire area considered; on a single risk, as regards the non-existence of two fires simultaneously in two different areas of the plant; on the simultaneous nature of the causes, as regards non-concurrence of the fire with other accidents; on single failure (active or passive) to maintain the functionality of the extinguishing system in the event of its suffering a single failure; on confinement in fire areas, guaranteeing the adequate partitioning of the plant; on damage due to extinguishing system discharges, such that the failure, inadvertent operation or spurious actuation of an extinguishing system does not damage any safety important structures, systems or components (SSC); on accessibility to the affected zone, in order to allow the fire to be completely extinguished by manual means and avoid any source of re-ignition; on ventilation, to guarantee adequate operation of this system in the event of fire, and on the sharing of SSC's in order to guarantee in multiple unit plants the safety functions of all these units in the event of a single fire.

3.2.2 The safety important SSC's must be designed and located such that the probability of a fire and its consequences may be minimised and that the safe shutdown capacity may be achieved and maintained during and following a fire. The plant shall be provided with non-combustible and heat-resistant materials and detection and extinguishing systems adequate to prevent fires and explosions at the point of origin or, otherwise, minimise their consequences in fire areas containing safety important SSC's.

3.2.3 Buildings containing safety important equipment and/or cable raceways shall be designed as fire resistant items, sub-divided into fire areas such that the redundant safety important equipment and/or cable raceways are separated one from another by fire resistant barriers providing protection for at least three hours. When this is not possible, fire zones containing compensatory active and passive resources (detection and extinguishing systems, distances, distances, fire resistant cable racerways coverings , etc.) duly justified in the fire risk analysis shall be used.

3.2.4 Resources shall be provided to limit the damage a fire might cause in any fire area, such that:

a. One train of the systems required to achieve and maintain safe shutdown conditions from the control room or the alternative shutdown panel in the event of a fire (or where appropriate the alternative shutdown panels in the event of a fire) shall remain free from damage caused by the fire; and

b. The systems necessary to achieve and maintain cold shutdown from the control room or from the alternative shutdown panel (or where appropriate the alternative shutdown panels in the event of a fire) can be repaired within the 72 hours following the onset of the fire.

3.2.5 In order to comply with the provisions of previous article 3.2.4, one of the following requirements must be met in fire areas in which all the redundant safe shutdown trains coincide (including their associated circuits):

1) One of the following resources shall be available outside containment:

a. Separation of cables, equipment and associated circuitry (safety and non-safety) of the redundant safe shutdown train considered as being free from damage following a complete fire in the fire area with respect to the other redundant safe shutdown trains as a result of barriers with a resistance to fire of three hours. The structural profiles of steel forming part of or supporting this fire-resistant barrier shall be protected in order to also achieve a resistance to fire of three hours.

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b. Separation of cables, equipment and associated circuits (safety and non-safety) of the redundant safe shutdown train considered as being free from damage following a complete fire in the fire area with respect to the other redundant safe shutdown trains for a horizontal distance of more than 6 metres, without intermediate fuel (including the cables) and sources of ignition. Furthermore, fire detectors should be installed in the area, along with a fixed automatic extinguishing system.

c. Separation of cables, equipment and associated circuits (safety and non-safety) of the redundant safe shutdown train considered as being free from damage following a complete fire in the fire area with respect to the other redundant safe shutdown trains as a result of barriers with a resistance to fire of one hour. Furthermore, fire detectors should be installed in the area, along with a fixed automatic extinguishing system.

d. Other media equivalent to one of those indicated in sections 1.a, 1.b or 1.c of this Article and favourably appreciated by the CSN in response to a request from the licensee.

2) In non-inerted containment buildings, one of the measures set out in the previous section or one of the following resources shall be made available:

a. Separation of cables, equipment, and circuits associated with the redundant shutdown train considered as being free from damage following a complete fire in the fire area with respect to the other redundant safe shutdown trains for a horizontal distance of more than 6 metres without intermediate fuel or sources of ignition.

b. Installation of a fire detection system and a fixed extinguishing system in the area.

c. Separation of cables, equipment and associated circuits of the redundant safe shutdown considered as being free from damage following a complete fire in the fire area with respect to the other redundant safety shutdown trains as a result of fire resistant barriers providing protection for at least 30 minutes, as long as the fire risk analysis demonstrates that this barrier guarantees the non-propagation of a fire to all the redundant safe shutdown trains.

3.2.6 If in any fire area it were not possible to meet the requirements of the aforementioned article 3.2.5, there shall be available an alternative or dedicated shutdown capacity, independent from the cables, components and systems in the area being considered.

3.2.7 Must be protected, in accordance with articles 3.2.4 and 3.2.5, those associated circuits that, as a result of a fire, may lead to failures or decrease the functional capacity of any of the redundant safe shutdown trains.

3.2.8 A valid alternative to meet the requirements of articles 3.2.3 to 3.2.7, or others especially approved by the CSN, is adherence to a «risk informed and performance based» methodology previously accepted by the CSN. In order to opt for this methodology, the holder of the nuclear power plant operating permit must formally apply for modification of his licensing basis.

3.2.9 The use of manual operator actions in the event of a fire as an alternative to that indicated in articles on 3.2.4 to 3.2.7 will require the favourable appreciation of the CSN.

3.2.10 Buildings containing radioactive substances, unless appropriately justified in the analysis of fire risks and unless the non-release of radioactive fumes off site is guaranteed, must be fire resistant and be equipped with a controlled ventilation system ensuring the non-release off site of radioactive fumes following a fire. Buildings containing materials that may affect the safety of the plant in the event of a fire must be fire resistant unless this situation is duly justified in the fire risk analysis and there is a guarantee that such a situation cannot occur.

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3.2.1.1 Access and escape routes necessary to evacuate the personnel from the facility and facilitate the performance of the people in charge of emergency operation and fire-fighting must be set in place.

3.2.1.2 A dedicated or alternative shutdown capacity should be provided for the control room, independent of the cables, systems and components that might be located therein. As a bounding condition for the design of the alternative shutdown panel for cases of fire, (or where appropriate of the alternative shutdown panels for cases of fire) used in the case of the control room having to be abandoned due to a fire in the said control room or in another fire area leading to functional losses making it necessary to abandon the control room, it shall be considered possible to scram the reactor prior to leaving the control room itself; that for 72 hours off-site power and the automatic start-up of the diesel generators are lost; and there is no automatic actuation of the valves and pumps to which to give credit for reaching the cold shutdown condition from the alternative shutdown panel (or where appropriate the alternative shutdown panels in the event of a fire) when their cables or circuits may be affected by the fire that led to the main control room being abandoned. In addition to the above, in the case of the control room being abandoned as a result of a fire in the control room itself or in another fire area causing functional losses requiring such evacuation, the possibility of reaching the cold shutdown condition during the first 72 hours as from the onset of the fire that led to the evacuation of the main control room shall be guaranteed.

3.2.1.3 The programme for protection against fires shall ensure the minimisation of the effects of a potential fire on the safety functions and the possibility of an unacceptable off-site release of radioactivity during power operation and other operating modes, including situations in which all the fuel is in the storage pool.

3.2.1.4 The cables of safety-related systems and components shall be qualified to withstand the flame propagation test. A valid alternative for cables that, as of the date of publication of the present Council Instruction, are installed but do not hold the aforementioned qualification is the establishment of adequate compensatory measures based on flame-retardant paints or on automatic extinguishing systems, duly justified in the fire risk analysis.

3.3 Fire Risks Analysis:

3.3.1 A fire risks analysis shall be performed and kept updated demonstrating that the fire safety objectives are met, that there is compliance with the design basis, that the active and passive fire protection systems are appropriately designed and that administrative controls are duly implemented.

3.3.2 Fire risk analysis shall be performed in a deterministic manner and shall cover at least the following:

1. A single fire and its propagation, where there is fixed or transitory fuel used in normal operations, such as power operation, refuelling activities, maintenance or modifications, up to a barrier that, if not duly justified, shall have a three-hour resistance to fire.
2. Consideration of the combination of a fire with other initiating events caused by it (for example loss of off-site power).
3. Consideration of the loss of off-site power for fire areas in which the provisions of article 3.2.6. are applicable
4. Study of associated circuits that might negatively affect safe shutdown.
5. Identification of safety important SSC's in the field of fire protection. These safety important SSC's in the event of a fire shall include, at least, those SSC's required to achieve and maintain the safe shutdown condition in the event of a fire, along with those others that might prevent or hinder the said capacity to achieve and maintain the safe shutdown condition; SSC's performing safety functions and those others that might prevent or hinder the performance of the aid safety functions; and those SSC's whose malfunction might cause off-site radioactive releases.

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3.3.3 The licensees shall perform a safe shutdown analysis based on identification of the redundant safe shutdown trains considered at the plant and demonstrating that in the event of a postulated fire in any of the plant fire areas, it is possible to achieve and maintain safe shutdown and, within the 72 hours following onset of the fire, recover all the equipment and systems required to achieve and maintain cold shutdown. The analysis shall identify the safe shutdown and cold shutdown systems, components and circuits existing in each fire area and be capable of demonstrating that the requirements included in article 3.2 of this Council Instruction are met.

3.3.4 The fire risk analysis shall demonstrate that consideration has been given to the possible consequences and effects of the actuation, both deliberate and spurious, of the fire extinguishing systems.

3.3.5 The analysis of fire risks shall be completed by a level 1 probabilistic fired analysis at power operating mode.

3.3.6 This fire risk analysis for nuclear power plants contemplated under the provisions of Article 3.2.8, may also be carried out in accordance with the criteria of the «risk informed, performance based» methodology looked upon favourably by the CSN.

3.4 Fire protection systems:

3.4.1 Each fire area and/or zone containing safety important SSC's (including cables) shall be equipped with fire detection and a local alarm means and with an alarm and indication of the location of the fire for the control room personnel, except in those fire areas which due to their special characteristics and being duly justified in the fire risk analysis, have been favourably approved by the CSN. These resources shall be fed by a main electricity supply and by another alternative, independent, autonomous power supply by means of batteries with a lifetime of four hours, such that within these four hours it be possible to couple the feed to a diesel generator source or a 24-hour battery. Furthermore, the electrical feed shall be provided by means of flame propagation resistant cables.

3.4.2 Manual or automatic, fixed or portable extinguishing systems shall be installed, as justified in the fire risk analysis. These systems shall be designed and located such that their failure, rupturing, or spurious or inadvertent operation does not prevent the safety important SSC's from performing their functions.

3.4.3 Distribution of the firefighting water shall be accomplished by means of a main external ring designed exclusively for this service. This ring shall be made up of sections fitted with isolation valves, interlocked in the open position, the aim being to be able to isolate part of the main ring for maintenance or repair, without this implying the loss of water supply to the primary extinguishing systems and support systems so requiring and serving areas containing safety important equipment. Furthermore, the ring shall include a double supply to buildings containing safety related SSC's.

3.4.4 The fire protection ring shall provide sufficient coverage to the hydrants outside the buildings, the fire hose protecting the inside of the buildings and the fixed extinguishing systems.

3.4.5 The ventilation and air-conditioning system shall be designed such that it allows a fire area to be isolated from the rest in the event of a fire and that no loss of air supply to a defined fire area has any impact on the correct operation of safety important components located in other areas of the plant. The ventilation system designed to remove potentially radioactive fumes or gases shall be assessed to ensure that no inadvertent operation or single failure will infringe the radiological control during the removal of such fumes or gases.

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3.4.6 Ventilation system items (ducts, fans or filters) located outside fire areas shall have the same resistance to fire as these areas or shall provide the capacity to be isolated by means of fire dampers with the same resistance to fire.

3.4.7 Safety important filters that include any combustible material shall be protected by means of appropriate detection and extinguishing systems and the fire risk analysis shall take into account any filter that includes combustible materials and constitutes a potential fire risk for safety important components. In enclosures where the extinguishing systems used operate on the basis of complete flooding with gas, the air inlet and outlet dampers must maintain sufficient leaktightness for gas concentrations to be adequate.

3.4.8 Although no fire or fire protection system failure coinciding with a design basis accident or with the most severe natural phenomenon is postulated, in the event of a safe shutdown earthquake (SSE), there must be an extinguishing system (seismic sub-system) capable of supplying water to equipped fire hose in fire areas containing equipment necessary for safe shutdown of the plant (either located indoors or under cover).

3.4.9 Stand-alone emergency lighting units shall be installed, with individual batteries providing an autonomy of at least 8 hours, in areas in which operator manual actions are performed in the event of a fire, and on the route spanning from the corresponding point of origin to the SSC's in question. In addition, the access and escape routes to and from all plant fire areas containing safety important SSC's shall be equipped with stand-alone emergency lighting units, with individual batteries providing an autonomy of at least 4 hours.

3.4.10 There shall be a two-way emergency communications system independent from the normal system, whose scope shall cover all areas of the plant containing safety important SSC's.

3.4.11 The reactor coolant pumps shall be equipped with an oil collection system if the containment is not inerted during normal operation. The oil collection system shall be designed and installed such that its failure will not lead to a fire during normal or design basis accident conditions and in order to withstand the safe shutdown earthquake. Such system shall be capable of collecting lube oil corresponding to any leakage from the reactor coolant pump lubrication systems. The leakages must be collected and drained to a vented tank capable of containing all the oil from the lubrication system. A flame suppressor shall be installed in the vent if the oil flash point means the risk of flame flash-back .

3.4.12 The fire protection measures used shall be specific to and suitable for fire areas that, in view of their characteristics, pose specific risks of fire or special safety impacts, such as the primary and secondary containments, the control room and rooms annexed to it, cable spreading room, computer rooms, electrical equipment rooms, the remote and alternative shutdown panel, safety-related battery rooms, the turbine building, diesel generator areas, diesel generator fuel storage areas, areas housing safety-related pumps, transformer areas, fresh nuclear fuel areas, the spent fuel pool, radioactive waste and decontamination areas, safety-related water tanks, the acetylene and oxygen store and areas hosing ion exchange resins, hazardous chemical products and materials containing radioactivity.

3.4.13 The fire detection and extinguishing systems shall meet the requirements of Appendix A of this Council Instruction. Methods alternative to those required in Appendix A may be accepted as long as they are duly justified in the fire risk analysis and have been favourably looked upon by the CSN.

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3.5 Quality assurance programme:

3.5.1 A quality assurance programme applicable to the design, acquisition, assembly, testing and administrative control of fire protection systems for safety important areas of the facility shall be developed and implemented. The quality assurance programme shall be in accordance with the CSN instructions applicable to quality assurance.

3.6 Administrative controls and maintenance:

3.6.1 Procedures shall be established to control and minimise the quantity of combustible material and sources of ignition that might affect safety important SSC's as well as establish the inspections, maintenance and tests necessary for active and passive fire protection components (fire resistant barriers, detection and extinguishing systems).

3.7 Organisation of firefighting and fire brigade:

3.7.1 Within the framework of the fire protection programme , the licensee shall implement the organisation to undertake actions deriving from the firefighting and from the fire risk analysis. In this organisation shall be identified all those responsible for the performance of these actions in order to meet the requirements relating to fire protection (maintenance, control of combustible materials, training, testing, exercises and drills, design modifications, etc.).

3.7.2 A duly equipped, trained and prepared fire brigade shall be set up. Emergency procedures clearly defining the responsibilities and functions of the persons in charge of firefighting (fire brigade) in response to a fire at the plant shall be established and maintained. A firefighting strategy shall be developed, kept updated and trained covering all areas in which a fire might affect a safety important SSC.

3.7.3 Firefighting strategies shall be defined for each safety important fire area , which shall include, at least, the fire risk covered, the extinguishing systems to be used, the components necessary for safe shutdown and the safety functions that might be affected by the fire, other associated potential risks (toxic, radiological or any other that might affect the tasks of the fire brigade), access and escape routes and the basic instructions required to undertake the extinguishing of the fire.

3.7.4 Fire drills shall be carried out at the plant such that the fire brigade might practice as a team. These drills shall be carried out at regular intervals not exceeding three months and in such a way that each member of the brigade participates in at least two drills per year. At least one drill per year shall not be announced previously and this shall be performed on a rotary basis such that every year it is carried out by a different shift. Furthermore, one drill per year must be performed by the second-line or back-up fire brigade. Likewise, at least one of the annual drills must include the participation of the off-site firefighting back-up organisation.

3.7.5 An off-site organisation (for example, local fire departments) shall be available to provide support for the plant in firefighting , and adequate coordination shall be provided between the plant personnel and these off-site personnel in order to ensure familiarisation of the latter with the resources and risks of the plant.

3.7.6 The organisation, minimum knowledge, equipment, physical conditions and training of the fire brigade shall be documented and the skills of its members shall be approved by a competent person.

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3.8 Procedures and operating aids:

3.8.1 Post-fire safe shutdown procedures shall be established for those areas that require alternative or dedicated shutdown, taking into account the possibility of loss of off-site power for 72 hours.

3.8.2 Taking into account the information from the different fire analyses, operating aids shall be developed including relevant actuations and information for the operating shift to manage the operation of the plant more safely during a fire. These aids shall be designed and validated in accordance with human factors criteria guaranteeing their complementary, coordinated and coherent use with the other operating procedures applicable in these scenarios. The scope of the operating personnel training programmes shall include training in the use of procedures and operating aids for operating scenarios coinciding with fires, in keeping with the corresponding design criteria.

Four. *Exemptions.*

The CSN may grant temporary exemption from compliance with any of the requirements of this Instruction, as long as the licensee justifies both the difficulty of abiding by them as established preventing such compliance, and the compensatory measures proposed for their exemption.

Equivalent measures. The CSN may, in response to a proposal by the licensee, favourably judge equivalent measures for compliance with the requirements set out in this Instruction, as long as the licensee duly accredits such compliance by justifying the equivalent measures proposed.

Five. *Infringements and sanctions.*

The present Nuclear Safety Council Instruction is binding, in accordance with the provisions of article 2.a) of Law 15/1980, of April 22nd, creating the said Nuclear Safety Council, as a result of which any failure to comply with it shall be penalised as set out in chapter XIV (articles 85 to 93) of the Nuclear Energy Act, Law 25/1964, of April 29th.

Single additional provision

In the case of new nuclear power plants, it shall be considered from the very early stages of design that among the fire protection requirements to achieve and maintain safe shutdown and minimise the possibility of off-site radioactive releases, the requirements of section 1) of article 3.2.5 will not be taken into account, such that outside the containment building, redundant safe shutdown trains, including the associated circuits, shall be located in different fire areas. Furthermore, their design shall minimise or remove the use of alternative or dedicated shutdown systems, except in the case of the main control room. Likewise, operator manual actions shall be avoided in the case of fire and the use of fire-resistant coatings on electrical ducts shall be minimised.

First transitory provision.

An adaptation period of two years is established for the entry into force of the provisions of article 3.2.5, for those cases for which the application of section 1.d) has been requested in the terms established by the third transitory provision of Revision 1 of IS-30, of February 21st 2013, not favourably looked upon by the CSN, this counted as from the date of its communication.

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Second transitory provision.

An adaptation period lasting until December 31st 2016 is established for the entry into force of the provisions of articles 3.2.9, 3.2.12, 3.2.13, 3.4.1, 3.4.3, 3.4.5, 3.4.6, 3.4.7, 3.4.9, 3.4.10, 3.4.12, 3.4.13 and 3.8.2, for those cases identified in the adaptation programme drawn up pursuant to the fourth transitory provision of Revision 1 of IS-30, of February 21st 2013.

Single derogatory provision.

Revision 1 of Instruction IS-30, of February 21st 2013, on the requirements of the programme for protection against fires at nuclear power plants, and whatever provisions of equal or lower rank oppose what is established in the present Council Instruction, are hereby made null and void.

Single final provision.

The present Council Instruction shall enter into force on the day following its publication in the «Official State Gazette».

Madrid, November 16th 2016.– the President of the Nuclear Safety Council, Fernando Martí Scharfhausen.

APPENDIX A

Detection and Suppresion Systems Requirements

A1 Fire detection

The frequencies used by the linear thermal detectors shall not affect the actuation of the protection relays of other plant systems, this must be demonstrated by means of pre-operational and periodic testing.

Fire alarms shall be unique and differentiated, such that they cannot be confused with any other plant system alarm.

There shall be primary and secondary electrical power supply systems for the detection system and for the electrically operated control valves for suppression systems.

A2 Fire Protection Water supply system

There shall be two separate sources of freshwater supply. Salt water shall not be used until the supply of freshwater runs out.

The supply of firefighting water shall be calculated on the basis of the largest expected flow rate for a period of 2 hours, but may not be less than 1,136 m3. This flow rate shall be based conservatively at 1,900 l/m for manual hoses streams and at the largest demand of any sprinkler or atomisation system. This flow rate of water shall be considered assuming the most unfavourable in-service path. If tanks are used, there shall be two, each providing 100% of the capacity required by the system: at least 1,136 m3. The tanks shall be interconnected such that the pumps may take suction from one or both. The main water supply must have the capacity to fill the tanks in a maximum of 8 hours.

Common tanks may be used for the firefighting system and the services or sanitation water. If this is the case, the minimum volume of necessary firefighting water must be guaranteed, the connection for other services will be configured such that the said minimum volume may not be used by these services. Administrative controls, including outlet tank valves interlocks, are inacceptable as the only way to ensure the minimum volume.

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Lakes, rivers or ponds with sufficient water capacity may be qualified as single sources of firefighting water, but require separate and redundant suctions at one or more intake structures. This separation shall be such that the failure of one intake does not affect the other.

Whenever the ultimate heat sink of the plant is allowed to be used as a supply of firefighting water, the following conditions shall also be met:

a) The capacity of water required for fires protection shall be additional to that required for the ultimate heat sink functions itself.

b) No failure of the fire protection system shall degrade the heat sink functions.

Whenever other systems are used, such as one of the two firefighting water systems, they must be permanently connected to the main supply system and automatically aligned. All pumps, controls and power supplies for these systems shall meet the same requirements as established for the pumps of the main system for fire protection . The use of other water systems for fire protection shall not be incompatible with the functions required for safe shutdown of the plant. The failure of these systems shall not compromise the function of the main fire protection system .

The minimum requirements for the design and installation of the main firefighting water distribution ring are as follows:

a) The type of piping shall be selected such that, along with adequate water treatment, incrustations are avoided.

b) Adequate resources shall be available for the inspection and flushing of piping.

c) Isolation valves shall be fitted with a visual position indicator, such as an indicating post, the objective of which will be the isolation of part of the main ring for maintenance or repair without removing at the same time the supply of water to the primary and back-up suppresion systems serving areas containing safety important structures, systems or components (SSC).

d) Isolation valves shall be installed on the outdoor hydrants of the main ring in order to allow these hydrants to be repaired without having to cut the water supply to the automatic and manual suppresion systems serving areas containing safety important structures, systems or components (SSC).

e) The main firefighting pipe shall be separated from the services and sanitation water pipe, except as indicated above.

f) The supply, pumping system and external ring may be common in the case of plants with more than one group; in other words, they may be common to several groups as long as they are interconnected. Isolation valves shall be arranged in such a manner as to be able to isolate the external ring from one group without interrupting service to the others. In this type of installations, a common water supply may be used. At sites with several widely separated groups there must be separate main rings.

When required, the installation of fire pumps shall meet the following criteria:

a) The pumping equipment shall be constituted by a sufficient number of pumps to ensure 100% of the required flow and pressure capacity, assuming the failure of the highest capacity pump (for example, three 50% pumps or two 100% pumps) and/or a loss of off-site power. This requirement may be met by one of the following alternatives:

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1) Use of one or more electrical motor-driven pumps and one or more diesel driven pumps , or

2) Use of one or more motor-driven pumps driven by Class 1E seismic category electrical motors connected to redundant Class 1E emergency electrical basses.

b) Individual connections to the main external ring from the fire pumps shall be separated by isolation valves. Each pump with its motor and controls shall be located separately from the other fire pumps by classified FR walls providing 3 hours of resistance to fire.

c) In the case of diesel-driven pumps, the fuel storage tank shall be located such that it does not imply any risk of fire for safety important SSC's or the fire protection system itself.

d) In the control room, there shall be an alarm signal to indicate pumps running, driver unavailability , failure to start and low water pressure in the main external ring.

The hose installations inside buildings shall be sufficient to supply an effective flow of water to any internal location in which fixed fuels may compromise safety important SSC's. There shall be hydrants at least every 75 metres in outdoor areas connected to the main ring via isolation valves. There shall be huts equipped with hoses, adapters and other auxiliary equipment, which shall be installed as required and no further than 300 metres apart. Mobile hose transport media with associated equipment may be used as alternative methods, in which case equivalent material must be taken to three hose huts.

Hydrants shall be fitted with threaded connections compatible with those used by the off-site organisation providing support to the plant in the event of a fire.

A3 Spray, atomised water and foam systems and firefighting fixtures

Safety systems shall be isolated and separated from combustible materials. Whenever this is not possible due to the nature of the safety system or combustible material, special protection shall be provided to prevent a fire from affecting the function of the safety system. This protection may include the combination of an automatic suppression system and a type of construction capable of containing a fire consuming all the combustible materials present.

Permanent suppression systems based on sprays nozzel, atomised water, foam and standpipe hoses shall be used as determined in the fire risk analysis. Generally speaking, the fixed systems shall be used as the main system and standpipe hoses as a backup, with the possibility of using another suppression medium as the main system when it is necessary to prevent the equipment from being damaged by water.

There shall be administrative controls to regulate the deactivation or disabling of these systems.

The network for supply to the sprays, atomised water, foam and standpipe hoses of each building shall be connected to the external ring such that no line break or single failure can leave both the main and back-up suppression systems out of service simultaneously. As an alternative, the main and back-up systems for one same building shall be allowed to take feed from the same header, as long as this is fed independently from each end. The piping and accessories used for these headers, including the first valve supplying the spray systems, when such headers are part of a seismically analysed hose system of , shall meet the seismicity requirements applicable to the hoses system . These headers shall be considered to be an extension of the main external ring.

Each spray, atomised water or foam system and standpipe hose shall be provided with an isolation valve of the protruding stem type or with a position indicator, and with valve closure indication in the control room or administrative control. All the valves of the fire protection system shall be tested and checked periodically to verify their position.

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The standpipe hoses shall be located in such a way that any point that may imply the exposure to fire of safety important SSC's is covered by the jet from at least one hose. In this respect, all buildings containing safety important SSC's shall be fitted with standpipe hoses of 45 mm diameter, 30 metres in maximum length and separated by no more than 50 metres.

The diameter of the hose feed pipe shall be at least 65 cm when one hose is fed and 100 mm when more than one is fed.

The positioning of the standpipe hoses shall be in accordance with the risk analysis in order to facilitate firefighting. Alternative standpipe hoses shall be provided for areas in which a fire might block access to the fire standpipe hoses normally used in such areas.

In the event of a safe shutdown earthquake (SSE), a supply of water shall be guaranteed at least to the network of hoses protecting the equipment necessary for safe shutdown. The piping system supplying water to these hoses shall be analysed with respect to SSE loads and supported in order to maintain its functional integrity during and following the event. Also the supply of water must be analysed, that may be obtained by manually connecting to a seismic category I supply, such as the essential services water system or some other available system, as long as the functions of the source are not degraded. In this case the piping and valves shall meet, at least, the requirements of ANSI B31.1 «Power Piping» and shall be designed in accordance with the same standards as the seismic category I system. The connection shall be capable of providing a flow of at least 34 m^3/h.

The type of nozzles to be used for the standpipe hoses providing coverage for the different fire areas shall be based on the fire risk analysis, the stream position will be invalidated in areas in which equipment might be damaged by them. Only atomisation nozzles (or fog nozzle position) shall be used to provide coverage for areas in which a straight stream might impinge on electrical equipment, in order to prevent the jets from causing unacceptable damage. The standpipe hoses installed to provide coverage for areas housing electrical equipment shall be fitted with nozzles prepared for such equipment.

The hoses shall be subjected periodically to hydrostatic tests. Hoses stored in cabinets located outdoors shall be tested annually. Hoses located indoors shall be tested every three years.

Foam-based extinguishing systems with sprays or open nozzles shall be used for risks of a nature so requiring, such as those produced by combustible or inflammable liquids. Consideration shall be given to the use of a low expansion foam system, high expansion foam generators or aqueous film foam forming (AFFF) systems, including the AFFF «cloudburst» system, where appropriate.

Safety important SSC's not requiring protection by means of fixed water-based suppression systems, but which may be affected by the water on their opening, shall be protected by means of shielding or screens. Suitable drains shall be installed in areas housing safety important SSC's, in order to prevent possible damage due to the discharging of such water systems. If a gas system is installed, the drains shall be fitted with adequate seals or the suppression system shall be dimensioned to compensate for leakage via the said drains.

Atomised water systems may be used as suppression systems in areas in which the fire risk analysis deems this to be appropriate.

Standpipe hoses and headers shall be installed inside the non-inerted containment. Such standpipe hoses and headers shall be connected to a high quality water supply, different from the main ring supply if the specific design of the plant does not allow the feed corresponding to this ring to enter containment. In boiling water reactor (BWR) plants, the standpipe hoses shall be installed outside the drywell, with an adequate length of hose, of no more than 30 metres, allowing the stream to reach any point inside the containment. The penetration for the firefighting pipe in the containment must meet the primary containment isolation criterion and be of seismic category I and quality group B.

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A standpipe hoses shall be installed immediately outside the control room and the cable distribution rooms. Underfloor and ceiling spaces in the control room containing cables shall be protected by means of automatic fire suppression systems, unless all the cables are run along steel conduits measuring 10 cm or less or in fully enclosed raceways internally protected by automatic fire suppression system.

The main fire suppression system in cable distribution rooms, the lubricating oil tank, the turbine clean and dirty oil tanks, the diesel generator, its lubrication system and the non-buried tanks for diesel generator fuel storage shall be fixed automatic systems.

The fire suppression system in new nuclear fuel areas, the spent fuel pool, safety-related battery rooms and alternative shutdown panel shall consist of standpipe hoses and extinguishers.

A4 Carbon dioxide extinguishing systems

Whenever carbon dioxide automatic extinguishing systems are used, a pre discharge alarm system shall be in place, with discharge delay to allow the personnel to exit the areas to be protected. There shall be methods allowing the installation to be deactivated locally pursuant to administrative controls.

The following shall be analysed:

a) Minimum concentration of CO_2, distribution, absorption time and ventilation control.
b) Asphyxiation and toxicity of CO_2
c) Possibility of secondary thermal shock damage due to cooldown.
d) Study of ventilation and relief requirements during CO_2 injection to prevent - pressurisation against the seal to avoid the loss of the agent.
e) The location and selection of detectors activating the carbon dioxide system.

A.5. *Clean agent gas flooding extinguishing systems*

Fire extinguishing systems alternative to halon (clean agents) shall be fitted with a local blocking system at the discharge of automatic systems subject to administrative controls. There shall be administrative controls in place to regulate the deactivation or disabling of these automatic systems.

The systems maintenance and testing protocols shall include checking of the quantity of agent contained in the clean agent cylinders/containers and the pressure of this agent.

The following shall be analysed:

a) The minimum required concentration of clean agent, distribution, flooding time and ventilation control.
b) The toxicity and anoxia of the gas.
c) The extinguishing concentration.
d) The toxicity and corrosive characteristics of possible gas thermal decomposition products.
e) Study of ventilation and relief requirements during clean agent injection, in order for the overpressure caused by discharge against the seal not to cause any loss of agent.
f) The effectiveness of the clean agent and its design concentration to protect against risk.

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g) The location and selection of detectors activating the system.

A6 Portable extinguishers

Portable extinguishers shall be installed in areas housing safety important SSC's so requiring according to the fire risk analysis, especially in normally occupied places where human intervention may serve to combat the fire in its early stages or in areas containing low fire propagation materials and equipped with detectors.

The extinguishing agent shall be suitable for the fire risk existing in each area. The efficiency of this agent shall be evaluated, along with the possible damage that might be caused to safety equipment in the area, especially in the case of dry powder.

A7 Raceway / Cable try construction

Areas containing ducts with safety important cables shall be equipped with a detection and extinguishing system providing coverage for them. The cables for safety important systems and components must be designed to withstand being wetted by the water of the fire protection system without the occurrence of electrical faults.

Inside the containment building there shall be standpipes hoses serving as a primary fire extinguishing system, on trays not requiring automatic systems for other reasons.

The following measures shall be adopted outside the containment building:

The primary suppression system of cable trays required for safe shutdown and not protected by barriers providing a 3-hour resistance to fire shall be an automatic system. Standpipes hoses may be used as a primary suppression system for such trays only in those cases in which the fire risk analysis demonstrates that these trays are not exposed to any risk of fire external to themselves. In this respect, fire risks external to the safe shutdown trays of a train shall be any other equipment or component, other than the cables of the train to be considered, housed in the same fire area and capable of generating or propagating a fire in the trays.

Safety-related cables that cannot be separated from their redundant counterparts by barriers providing 3 hours of resistance to fire shall be protected by an automatic suppression system.

With the exception of trays carrying cables supplying signalling, control or power to systems necessary to achieve and maintain safe shutdown, and trays with safety related cables not separated from their redundant counterparts by barriers providing 3 hours of resistance to fire, trays containing safety important cables meeting any of the three following conditions shall be protected by a fixed suppression system based on sprays or atomised water, or water and foam or CO_2 or nebulized water or clean gases, manual or automatic, as applicable.

i) They are cable trays not accessible for manual firefighting.

ii) On the one hand, the equivalent number of standard trays measuring 600 mm in width (considering both safety-related and non safety-related trays) in a given fire area is greater than six. In this respect, trays measuring more than 600 mm shall be considered as two, and those of more than 1200 mm as three, regardless of their degree of occupation. On the other, the fire risk analysis does not adequately demonstrate that the combustible load present in the fire area through which these trays run is sufficiently low to allow the members of the fire brigade to confine and extinguish a fire in this area using stand pipes.

iii) There is no detection system providing coverage for the cable trays.

As primary suppresion system for trays carrying safety important cables not contemplated in the previous paragraphs of this section, fixed suppresion systems based on sprays or atomised water, or water and foam or CO_2 or nebulized water or clean gases shall be available, manual or automatic, as applicable. Stand pipes may be used as an alternative.

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