The Nuclear Safety Council's Instruction IS-30, Rev. 1, of 21 February 2013, on the requirements of the fire protection programme at nuclear power plants.

Article 2.a) of Law 15/1980, of 22 April, creating the Nuclear Safety Council, confers on this Public Entity the faculty to "prepare and approve Instructions, Circulars and Guides of a technical nature relating to nuclear and radioactive facilities and to nuclear safety- and radiological protection-related activities" to promote regulations that allow their safe operation, that is, without undue risks for people or the environment.

The Nuclear Safety Council has been individually requiring NPP licensees to implement a fire protection programme in accordance with the requirements placed on US nuclear power plants and the conditions included in the fire protection licence of each power plant in particular. Under the provisions laid down in Article 8.3 of the Regulation Governing Nuclear and Radioactive Facilities (Royal Decree 1836/1999, of 3 December, modified by Royal Decree 35/2008, of 18 January), and owing to the need to incorporate these requirements into the Spanish legal framework, the Nuclear Safety Council's Instruction IS-30 on the requirements of the fire protection programme at nuclear power plants was approved on 19 January 2011 (BOE, Issue no 40, 16 February 2011).

The work carried out by the Western European Nuclear Regulators Association (WENRA) to harmonize the regulations across the different countries has been taken into account in the drafting of this Instruction. As a result of this effort, a set of common requirements known as "reference levels", which must be reflected in national regulations, has been established.

In particular, WENRA's Reference Level document sets in its Chapter S (Fire Protection against Internal Fires) the basic requirements applicable to what is termed "Fire Protection at Nuclear Power Plants" in the terminology that has been traditionally employed within the Spanish documentary and legal framework.

In order to add consistency to the process of regulatory development undertaken by the CSN as a result of this harmonization process, it was deemed necessary to draw up a Council Instruction which contemplated said requirements. This led to the approval of the aforementioned Instruction IS-30, of 19 January 2011.

At this time it has been considered necessary to revise this IS-30 in the light of the experience derived from its application, the need to regulate the different, specific features of both the original design and licensing bases of the fire protection system at each Spanish NPP, and recent changes to fire protection regulations, which has revealed the existence of some areas for improvement that need to be regulated.

Under the foregoing, and in accordance with the legal authorization envisaged in Section a) of Article 2 of Law 15/1980, of 22 April, creating the Nuclear Safety Council, this Council, after consultation of the affected sectors and after considering the appropriate technical reports, in its meeting of the 21st February 2013, has agreed the following:

First. *Purpose and scope of application*

1. The purpose of this Council Instruction is to require NPP licensees to implement a fire protection programme and to define the criteria that must be fulfilled by such programme.
2. The present Council Instruction shall apply to the licensees of all Spanish NPPs with an operating license.

Second. *Definitions*

The definitions of the terms and concepts contained in this Council Instruction match those contained in the following Regulations:

– Law 25/1964, of 29 April, on Nuclear Energy.
– Law 15/1980, of 22 April, creating the Nuclear Safety Council.
– Royal Decree 1838/1999, of 3 December, approving the Regulation Governing Nuclear and Radioactive Facilities.

In addition, the following definitions [M1] apply within the context of the present Council Instruction:

Design-basis accident: the set of accident conditions against which a nuclear facility is designed. Under these conditions, the criteria used in the design help to keep the deterioration of nuclear materials and the release of radioactive materials within authorized limits. They are also known as “postulated accidents”.

Operator manual actions in case of a fire: all those actions needed to reach and maintain the safe-shutdown condition after a fire and which are carried out:

– Outside the main control room or the panel for remote shutdown in case of a fire (or, where appropriate, outside the panels for remote shutdown in case of a fire), or
– To achieve the recovery of said capability from inside the control room.

Safe-shutdown analysis in case of a fire: the process or method for identifying and evaluating the structures, systems and components necessary to achieve and maintain safe-shutdown conditions in case of a fire.

Fire risk analysis: the analysis used to assess a plant’s capacity to maintain safe-shutdown capability and to minimize offsite radioactive leaks in case of a fire. The analysis must include the following characteristics:

– The identification of permanent and transient fire risks.
– The identification and evaluation of the protection and prevention means relating to fire risks.
– The assessment of the impact of the fire on any area of the plant to achieve a safe shutdown and maintain shutdown conditions as well as to minimize and control the offsite release of radioactive material.

Fire areas or compartments: sections of an entire building, separated from other areas by fire-resistant barriers, that ensure that a fire cannot spread from this area to another one or vice versa during the specified fire-resistance time.

Fire area important to safety in the field of fire protection: a fire area containing some structure, system or component important to safety in the field of fire protection. Said structures, systems or components important to safety in the field of fire protection include, at least, SSCs needed to achieve and maintain the safe-shutdown condition in case of a fire, as well as others which may prevent or negatively affect said capability to achieve and maintain said safe-shutdown condition; SSCs which perform safety functions, as well as others which may prevent or negatively affect the performance of said safety functions; and SSCs whose malfunction may cause an offsite activity release.

Fire-resistant barriers: building components (walls, enclosures, structural floors), as well as seals, doors, dampers, fire-resistant electrical raceway covering, etc., that are qualified by approved labs as fire-resistant within a certain range and are used to delay the spread of fires for a minimum time equal to that for which they have been qualified.

Equipped fire hose[M2]: an assembly consisting of a valve, a hose, a nozzle, a pressure gauge and an isolation valve, permanently connected to a water supply and intended for fire protection.

Fire brigade: a group of people trained and taught to adopt the necessary measures in case of a fire.

Second intervention or backup fire brigade: a group of people having the necessary fire protection training and knowledge to help the fire brigade during fire extinction tasks.

Associated circuits in the field of fire protection: safety-related and safety-unrelated electrical circuits which, due to a fire, may adversely affect the safe shutdown of the power plant. These associated circuits are those that:

1. Do not meet the separation criteria indicated in Article 3 of this Council Instruction, and
2. Fulfil one of the following conditions:

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

b) Are connected to circuits of equipment whose spurious operation may adversely affect the safe-shutdown capability (e.g. interface valves between the residual heat removal system and the reactor cooling system, automatic depressurization system valves, pressurizer relief valves, other relief and safety valves, steam dump valves for flushing the steam generators, instrumentation, steam dump, etc.).

c) Share a common enclosure (e.g. electrical raceways, panels, junction boxes) containing (redundant or alternative) shutdown cables and are not electrically protected by means of circuit breakers, fuses or devices or allow fires to spread.

Firewalls: physical barriers that prevent the linear spread of a fire along a combustible item. When the material existing on one side of the firewall is consumed, the other end of the item is not affected by the temperature. They differ from fire barriers in that the latter protect the area or equipment from the effects of an external-exposure fire.

Fire detection: the action of revealing the existence of a fire by means of items sensitive to some of the phenomena associated with fire.

Structures, systems and components (SSCs): a general term that encompasses all items of a facility. Structures are the passive elements: buildings, vessels, shielding, etc. A system comprises several components or structures assembled in such a way as to perform a specific function. A component is a specific item of a system. Some of examples are cables, transistors, integrated circuits, motors, relays, solenoids, pipes, fittings, pumps, tanks and valves.

Safety (or safety-related) structures, systems and components: those items whose operation is taken into consideration in the analyses of design-basis accidents for:
1. Bringing the facility to a safe condition and keeping it in said condition in the long term.
2. Keeping the radiological consequences of anticipated operational occurrences and of design-basis accidents within their specified limits.

Structures, systems and components necessary for safe shutdown in case of a fire: those items that perform the functions required to achieve and maintain a safe shutdown in that scenario.

Structures, systems and components important to safety: the following is included in this concept:

1. Those structures, systems and components whose malfunction or failure could lead to an undue exposure to radiation of site personnel or members of the public;

2. Those structures, systems and components that prevent anticipated operational occurrences from leading to accident conditions;

3. Those items that are provided to mitigate the consequences of accidents caused by a malfunction or failure of structures, systems or components.

Fire[M3]: the process of violent oxidation of combustible material with the release of flames, heat or gases.

Ignition source: any process or piece of equipment that gives off sparks, flames or enough heat to cause a combustible or flammable material to ignite.

Safety function: a function intended to prevent accidents or to mitigate their consequences, the result of which is the protection of workers, the public and the environment against undue risks caused by radiation.

Hydrant: a connection for hoses or monitor, located outdoors, whose water supply provides enough flow and pressure to extinguish fires during their most intense phase. They can either be dry-piping or wet-piping hydrants.

Fire: the rapid ignition of combustible materials, with an abundant presence of an oxidizer, initiated by a flame or an ignition source.

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

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

Alternative shutdown: the shutdown strategy used for those zones or areas where, due to a fire, the redundant trains are not free from damage and systems that have been rerouted, relocated or modified to achieve and maintain a safe shutdown are used.

Dedicated shutdown: the shutdown strategy that uses the system or set of equipment specifically installed to achieve and maintain safe shutdown by means of a separate way or train.

Cold shutdown: the state, condition or mode of operation of the reactor fulfilling the conditions defined on the matter in the power plant's Technical Specifications.

Safe shutdown: a plant situation where the reactor is kept in a subcritical state, according to the definition in the power plant's Technical Specifications, the removal of residual heat and the control of core coolant inventory being guaranteed, and no offsite radioactive releases take place.

Fire protection programme: the collection of components, analyses, procedures, activities, personnel and resources needed to define and carry out all those fire protection activities that guarantee that fires in areas containing structures, systems or components important to safety are prevented; are quickly detected and put out in case they take place; and are confined to fire areas which have been designed such that, in the event of any fire in any fire area of the power plant, safe shutdown can be achieved and maintained and the likelihood of offsite releases of radioactive material is minimized. This includes the fire protection system itself, the design of the facility, fire prevention, detection, alarms, confinement, extinction, administrative controls, the fire-fighting organization, inspection and management, training, quality assurance, testing, etc.

Fire-resistant: a characteristic that certain materials show when subjected to the specific conditions of the standard time-temperature curve.

Access and escape route: a properly marked path that allows entering and exiting any fire zone or area of a facility.

Spurious signal in the field of fire protection: a signal that causes an unwanted actuation of an equipment or component – considering all possible functional states thereof – and which might affect the capability to achieve and maintain safe shutdown.

Safe-shutdown earthquake: an earthquake of the maximum intensity considered in the design of the power plant such that the latter may be taken to a safe-shutdown condition in case the former occurs.

Fire protection system: the collection of detection, alarm and extinction structures, systems and components that have been designed, installed and serviced according to the fire protection programme.

Postulated initiating event: an event identified during design as being capable of leading the facility to the conditions of an anticipated operational event or accident.

Redundant train: the set of equipment or components which are independently capable of performing a safety function.

Redundant safe-shutdown train: a redundant train which is capable of achieving and maintaining the safe-shutdown condition on its own.

Fire zone: any subdivision made inside a fire area or compartment that is used as a unit of study for the installation of the specific active protection (detection, control and extinction) systems. The criteria for laying out the fire zones are based on the type of existing combustible material, the assessment of the fire risk and the anticipated severity of the fire.

Third. *The Nuclear Safety Council's criteria for fire protection at nuclear power plants.*

3.1 Fire protection objectives.

3.1.1 The holder of the operating licence of a nuclear power plant must adopt the principle of defence in depth in fire protection, implementing measures to prevent a fire before it starts, to detect, control and extinguish it as soon as possible in case it occurs, and to prevent the spread [M4]thereof to other areas that might affect safety.

3.1.2 The holder of the operating licence of a nuclear power plant must guarantee, by means of confinement in fire areas, that a fire that cannot be extinguished will not damage at least one of the redundant safe-shutdown trains such that the power plant may achieve and maintain such safe shutdown and the likelihood of offsite radioactive releases is minimized.

3.2 Design bases.

3.2.1 The design of the fire protection system shall conform to the separation criteria for systems important to safety, in order to satisfy the requirements of Article 3.2.3; to defence-in-depth criteria, in order to meet the requirements of Article 3.1.1; to fire hypothesis criteria, so as to consider the total combustion of all combustible material in the area affected by the fire and the loss of the equipment or components in the fire area under consideration; to single risk criteria, as regards the nonexistence of two simultaneous fires in two different areas of the power plant; to cause simultaneity criteria, regarding the non-concurrence of the fire with other accidents; to single (active or passive) failure criteria, to maintain the functionality of the extinction system in the event of a single failure thereof; to fire area confinement criteria, guaranteeing the proper compartmentalization of the plant; to criteria on damages due to the discharge of the extinction system, such that the failure, inadvertent operation or spurious actuation of an extinction system is not detrimental to structures, systems or components (SSCs) important to safety; to accident area accessibility criteria, in order to allow the fire to be completely put out by manual means and prevent it from reigniting; to ventilation criteria, so as to ensure the proper operation of the ventilation system in case of a fire; and to SSC-sharing criteria, in order to guarantee, in plants with several units, the safety functions thereof in the event of a single fire.

3.2.2 SSCs important to safety must be designed and located such that the likelihood of the occurrence of a fire and its consequences is minimized and that the safe-shutdown capability is achieved and maintained during and after a fire. The power plant shall be provided with non-combustible and heat-resistant materials. Detection and extinction systems suitable for preventing fires and explosions at their source, or, failing that, minimizing the consequences thereof, shall be designed and installed in fire areas containing SSCs important to safety.

3.2.3 Buildings containing cable raceways and/or equipment important to safety shall be designed to be resistant to fires and subdivided into fire areas in such a way that redundant cable raceways and/or equipment important to safety are separated from each other by barriers of a fire resistance of, at least, three hours. When this is not possible, fire zones containing compensatory active and passive means (detection and extinction systems, distances, fire-resistant raceway covering, etc.) – duly justified in the fire risk analysis – must be used.

3.2.4 At least, means to limit the damages that might be caused by a fire in any fire area must be provided such that:

a) One train of the systems needed to achieve and maintain safe-shutdown conditions from the control room or from the panel for remote shutdown in case of a fire (or, where appropriate, the panels for remote shutdown in case of a fire) is undamaged by the fire; and

b) The systems needed to achieve and maintain cold shutdown from the control room or from the panel for remote shutdown in case of a fire (or, where appropriate, the panels for remote shutdown in case of a fire) can be repaired within 72 hours following the start of the fire.

3.2.5 In order to comply with that indicated in the preceding Article 3.2.4, one of the following requirements must be met in fire areas where all redundant safe-shutdown trains (including their associated circuits) converge:

1. Outside the containment building, one of the following measures shall be used:

a) The separation of the (safety and non-safety) cables, equipment and associated circuits of the redundant safe-shutdown train considered undamaged after a total fire in the fire area with regard to the other redundant safe-shutdown trains by barriers with a fire resistance of 3 hours. Structural steel belonging or supporting such fire-resistant barriers must be protected to achieve a 3-hour fire resistance as well.

b) The separation of the (safety and non-safety) cables, equipment and associated circuits of the redundant safe-shutdown train considered undamaged after a total fire in the fire area with regard to the other redundant safe-shutdown trains by a horizontal distance of more than 6 metres, without combustible material (including cables) or ignition sources in between. In addition, fire detectors and an automatic fire suppression [M5]system must be installed in the area.

c) The separation of the (safety and non-safety) cables, equipment and associated circuits of the redundant safe-shutdown train considered undamaged after a total fire in the fire area with regard to the other redundant safe-shutdown trains by barriers having a fire resistance of 1 hour. In addition, fire detectors and an automatic fire suppression system must be installed in the area.

d) Other means which are equivalent to any of those indicated in Conditions 1.a), 1.b) or 1.c) of this Article and which obtain, at the licensee’s request, a favourable assessment by the CSN.

2. One of the measures listed in the previous section or one of the following measures shall be used inside non-inerted containment buildings:

a) The separation of the cables, equipment and associated circuits of the redundant safe-shutdown train considered undamaged after a total fire in the fire area with regard to the other redundant safe-shutdown trains by a horizontal distance of more than 6 metres, without combustible material or ignition sources in between.

b) The installation of a fire detection system and a fire suppression system in the area.

c) The separation of the cables, equipment and associated circuits of the redundant safe-shutdown train considered undamaged after a total fire in the fire area with regard to the other redundant safe-shutdown trains by fire-resistant barriers with a fire resistance of at least 30 minutes, provided that the fire risk analysis demonstrates that these barriers guarantee that a fire will not spread to any redundant safe-shutdown train.

3.2.6 Should it not be possible to comply with that laid down in the preceding Article 3.2.5, there shall be an alternative [M6]or dedicated shutdown capability, independent from the cables, components and systems of the area under consideration.

3.2.7 Those associated circuits which, due to a fire, may cause failures or reduce the capacity of any of the redundant safe-shutdown trains to perform their function must be protected in accordance with Articles 3.2.4 and 3.2.5.

3.2.8 A valid alternative to meet the requirements of Articles 3.2.3 to 3.2.7 or other requirements specifically approved by the CSN is to follow a "risk-informed and performance-based" methodology previously accepted by the CSN. In order to opt for this methodology, the holder of the operating licence of the nuclear power plant must formally apply for a change in its licensing basis.

3.2.9 The use of operator manual actions in case of a fire as an alternative to that indicated in Articles 3.2.4 to 3.2.7 shall require a favourable assessment by the CSN.

3.2.10 Unless it is properly justified in the fire risk analysis and it is guaranteed that no offsite release of radioactive smoke will occur, buildings containing radioactive materials must be fire-resistant and provided with a controlled ventilation system ensuring that no offsite release of radioactive smoke occurs after a fire. Unless it is properly justified in the fire risk analysis and it is guaranteed that such situation cannot happen, buildings containing materials that may affect plant safety in case of a fire must be fire-resistant.

3.2.11 The access and escape routes necessary to evacuate facility personnel and facilitate the actions of the personnel in charge of the emergency operation and fire-fighting must be set in place.

3.2.12 The control room must be provided with an alternative or dedicated shutdown capability, independent from the cables, systems and components located therein. As the boundary condition for designing the panel for remote shutdown in case of a fire (or, where appropriate, the panels for remote shutdown in case of a fire) that is used in case of the vacation of the control room due to a fire inside the control room itself or in another fire area that causes functional losses that make said vacation necessary, it will be considered that it is possible to trip the reactor before vacating the control room itself; that offsite power and the automatic start of the diesel generators are lost for 72 hours; and that the automatic actuation of the valves and pumps which are given credit to achieve the cold-shutdown condition from the panel for remote shutdown in case of a fire (or, where appropriate, the panels for remote shutdown in case of a fire) does not take place when their cables or circuits might be affected by the fire the caused the main control room to be vacated. In addition to the preceding, for the case of the vacation of the control room due to a fire inside the control room itself or in another fire area that causes functional losses that make said vacation necessary, it shall be guaranteed that it is possible to achieve the cold-shutdown condition during the first 72 hours from the start of the fire that caused the main control room to be vacated.

3.2.13 The fire protection programme shall ensure that the effects of a potential fire on the safety functions and the likelihood of an unacceptable offsite discharge of radioactivity, during power operation and during other operation modes, including the situation when all the fuel is in the pond, are minimized.

3.2.14 The cables of safety-related systems and components must be qualified to pass a flame spread test. A valid alternative for cables which are installed and lack said qualification as of the date of publication of this Council Instruction is to establish appropriate compensatory measures, based on flame-retardant paints or automatic extinction systems, which are duly justified in the fire risk analysis.

3.3 Fire risk analysis.

3.3.1 A fire risk analysis that proves that fire safety objectives are fulfilled, design bases are complied with, active and passive fire protection systems have been properly designed and administrative controls have been properly implemented must be conducted and kept up to date.

3.3.2 The fire risk analysis shall be conducted in a deterministic manner and shall at least cover:

1. A single fire in a place where there is permanent or transitory fuel used in standard operations, such as power operation, refuelling activities, maintenance activities or

modifications, and its spreading to a barrier which, in the event it is not properly justified, must be a barrier having a fire resistance of 3 hours.

2. The consideration of the combination of a fire and other initiating events caused thereby (e.g. the loss of offsite power).

3. The consideration of the loss of offsite power for those fire areas to which that indicated in Article 3.2.6 applies.

4. The analysis of the associated circuits that might adversely affect safe shutdown.

5. The identification of SSCs important to safety in the field of fire protection. Said SSCs important for safety in the field of fire protection shall at least include SSCs needed to achieve and maintain the safe-shutdown condition in case of a fire, as well as others which may prevent or negatively affect said capability to achieve and maintain the safe-shutdown condition; SSCs which perform safety functions, as well as others which may prevent or negatively affect the performance of said safety functions; and SSCs whose malfunction may cause an offsite activity release.

3.3.3 Licensees must perform a safe-shutdown analysis that demonstrates, from the identification of the redundant safe-shutdown trains considered in the power plant, that, under a postulated fire in any fire area of the plant, it is possible to achieve and maintain safe shutdown and to have recovered, within the first 72 hours following the start of the fire, all 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 every fire area and must prove that the requirements included in Article 3.2 of this Council Instruction are fulfilled.

3.3.4 The fire risk analysis must prove that the possible consequences and effects of both the intentional and spurious actuation of fire extinction systems has been taken into consideration.

3.3.5 The fire risk analysis shall be completed with a level-1 fire probabilistic analysis at power operating mode.

3.3.6 For nuclear power plants taking advantage of that indicated in Article 3.2.8, this fire risk analysis may also be carried out according to the “risk-informed and performance-based” methodology which has been favourably assessed by the CSN.

3.4 Fire protection systems.

3.4.1 Every fire area and/or zone containing SSCs (including the cables) important to safety must be fitted out with local fire detection and alarm means and with an alarm and indication of the location of the fire for control room personnel, except in those fire areas which, given their special characteristics – it being duly justified in the fire risk analysis, have the CSN’s favourable assessment in this respect. These means must be fed by a main electric current supply and another alternative, independent, autonomous power supply by means of batteries with 4 hours of lifetime and such that it is possible, within this 4-hour period, to connect the power supply to a 24-hour power supply by means of a diesel generator or a battery. In addition, power will be supplied over cables resistant to flame spread.

3.4.2 Fixed or portable, manual or automatic fire suppression or extinction systems must be installed, as is justified in the fire risk analysis. These systems must be designed and located such that their failure, rupture or spurious or inadvertent operation does not hinder the ability of SSCs important to safety to perform their functions.

3.4.3 Water for fire protection shall be distributed by means of a main exterior ring which is exclusively dedicated to this service. Said ring shall be provided with isolation valves in sections, locked in their open position, whose purpose will be to isolate part of the main ring for maintenance or repair, without this entailing the loss of water supply to the primary and backup extinction systems which require it and serve areas containing equipment important to safety. In addition, the ring will be provided with a dual water connection to buildings containing safety SSCs.

3.4.4 The fire protection ring must be capable of supplying the hydrants outside the buildings, the equipped fire hoses protecting the inside of the buildings of the plant and the fire suppression systems.

3.4.5 The HVAC system must be designed so as to allow a fire area to be isolated from the others in case of a fire and such that the loss of air supply to a defined fire area does not affect the proper operation of safety components located in other areas of the power plant. The ventilation system designed to remove potentially radioactive smoke or gases must be evaluated in order to ensure that an inadvertent operation, or simple failures, thereof will not violate the radiological control during the evacuation of said smoke or gases.

3.4.6 The elements of the ventilation system (ducts, fans or filters) located outside fire areas must have the same fire resistance as these areas or be capable of isolating them with fire dampers of the same fire resistance.

3.4.7 Filters important to safety containing combustible material must be protected by means of adequate detection and extinction systems; the fire risk analysis will take into consideration any filter that contains combustible materials and is a potential fire risk for components important to safety. In those enclosures where a total gas flooding extinction system is used, the air inlet and outlet locks must maintain enough tightness to achieve the right gas concentrations.

3.4.8 Even though fires or fire protection-system failures concurrent with design-basis accidents or the most severe natural phenomenon have not been postulated, in the event of a safe-shutdown earthquake (SSE), there must be an extinction system (seismic subsystem) capable of supplying water to equipped fire hose in those fire areas containing equipment necessary to shutdown the plant in a safe manner (either located indoors or with supply).

3.4.9 Autonomous emergency lighting units equipped with individual batteries with a lifetime of, at least, 8 hours must be installed in areas where operator manual actions are carried out in case of a fire and along the path from the appropriate origin thereof to these SSCs. Additionally, the access and escape routes of all fire areas of the power plant containing SSCs important to safety will have autonomous emergency lighting units equipped with individual batteries with a lifetime of, at least, 4 hours.

3.4.10 A two-way emergency communication system that is independent from the normal system and has a range covering all plant areas containing SSCs important to safety shall be provided.

3.4.11 Reactor coolant pumps must be fitted with an oil collection system if the containment is not inerted during normal operation. The oil collection system must be designed and installed such that its failure does not cause a fire during the normal or the design-basis accident condition and to withstand a safe-shutdown earthquake. Said system must be capable of collecting the lubricating oil from any leak in the lubrication systems of the reactor coolant pumps. Leaks must be collected and drained to a vented tank that is capable of holding all the oil in the lubrication system. A flame suppressor must be installed in the vent if the oil's flash point involves a backfire risk.

3.4.12 Specific fire protection means suitable for fire areas which, given their characteristics, involve particular fire risks or a special impact on safety, such as the primary and secondary containments, the control room and adjacent rooms, cable distribution rooms, computer rooms, electrical equipment rooms, the remote and alternative shutdown panel, safety-related battery rooms, the turbine hall, diesel generator areas, diesel generator fuel storage areas, areas containing safety-related pumps, transformer areas, fresh nuclear fuel areas, the spent fuel pond, radioactive and decontamination waste areas, safety-related water tanks, file storage areas, the cooling towers, acetylene and oxygen storage areas, ion-exchange resin storage areas, hazardous chemical storage areas, and radioactivity-containing material storage areas, must be used.

3.4.13 The fire detection and extinction systems will meet the requirements of Appendix A of this Council Instruction. Alternative means to those required in Appendix A may be accepted, provided they are properly justified in the fire risk analysis and have the CSN's favourable assessment.

3.5 Quality assurance programme.

3.5.1 A quality assurance programme applicable to the design, acquisition, assembly, testing and the administrative controls for fire protection systems of areas important to the safety of the facility shall be developed and implemented. The quality assurance programme must be in agreement with Council Instructions applicable to quality assurance.

3.6 Maintenance and administrative controls.

3.6.1 Procedures must be established for controlling and minimizing the amount of combustible material and ignition sources that might affect SSCs important to safety as well as for setting up the necessary inspections, maintenance and testing of active and passive fire protection components (fire-resistant barriers, detection and extinction systems, etc.).

3.7 Fire-fighting organization and fire brigade.

3.7.1 The licensee must set up, within the fire protection programme, the organization that shall carry out the actions derived from fire-fighting and the fire risk analysis. In order to comply with the requirements related to fire protection (maintenance, control of combustible material, training, testing, exercises and drills, design modifications, etc.), the people responsible for complying with such requirements must be identified within this organization.

3.7.2 A properly equipped and trained fire brigade must be set up. Emergency procedures that clearly define the duties, responsibilities and actions of the people in charge of fire-fighting (fire brigade) in response to a fire at the plant must be established and kept updated. A fire-fighting strategy that covers any area where a fire might affect SSCs important to safety must be developed and kept updated, including the necessary training.

3.7.3 The applicable fire-fighting strategies, which at least include the covered fire risk, the extinction systems to be used, the components necessary for safe shutdown and the safety functions which might be affected by the fire, other potential, associated risks (toxic, radiological, or any other that might affect the fire brigade's tasks), access and escape routes, and the basic instructions needed to undertake the extinction of the fire, must be defined for each fire area.

3.7.4 Fire drills shall be conducted at the power plant such that the brigade may practice as a team. These drills must be carried out at regular intervals not exceeding three months and such that every brigade member takes part, at least, in two drills per year. At least one drill per year must not be previously announced, which must be conducted on a rotating basis such that a different brigade shift takes part in it every year. In addition, one drill per year must be carried out by the second intervention or support fire brigade. Likewise, the external fire-fighting support organization must participate in at least one of the annual drills.

3.7.5 There must be an off-site organization available (e.g. local fire departments) to support the power plant in fire-fighting. Appropriate coordination between plant personnel and said off-site personnel shall be provided to ensure the latter become familiar with the means and risks of the plant.

3.7.6 The requirements about organization, minimum knowledge, equipment, physical condition and training of the fire brigade must be documented, and the aptitude of its members shall be approved by a competent person.

3.8. Operation procedures and operator aids.

3.8.1 Post-fire safe-shutdown procedures must be established for those areas where an alternative or dedicated shutdown is required, taking into account a possible 72-hour loss of offsite power.

3.8.2 Operator aids that include the relevant actions and information so that the operations shift can handle the operation of the power plant during a fire in the safest manner must be developed taking into account the information from the different fire analyses. These aids shall be designed and validated in accordance with human factor criteria guaranteeing they will be used in a manner that is complementary, coordinated and consistent with the other operation procedures applicable in these scenarios. In keeping with their design criteria, the scope of operations personnel training programmes shall include, training in the use of operation procedures and aids for operating scenarios coinciding with fires.

Fourth. *Exemptions*

Nuclear power plant licensees may request to be temporarily exempted, in part or in whole, from observing any of the requirements of this Instruction by properly justifying the reasons for their request and indicating the alternative manner in which the established criteria shall be observed.

Fifth. *Infractions and sanctions*

The present Nuclear Safety Council Instruction is binding in accordance with that established in Article 2.a) of Law 15/1980, of 22 April, creating the Nuclear Safety Council. Failure to comply shall be sanctioned in accordance with the provisions of Chapter XIV (Articles 85 to 93) of Law 25/1964, of 29 April, on Nuclear Energy.

Sole Additional Provision

For the case of new nuclear power plants, it shall be deemed from the first stages of design that Condition 1) of Article 3.2.5 shall not be taken into account among the fire protection requirements for being capable of achieving and maintaining safe shutdown and minimizing the likelihood of off-site radioactive releases, such that, outside the containment building, the redundant safe-shutdown trains, including their associated circuits, must be located in different fire areas. In addition, their design must minimize or eliminate the use of alternative or dedicated shutdown systems, except for the case of the main control room. Likewise, the execution of operator manual actions in case of a fire shall be avoided, and the use of fire-resistant covering in electrical raceways shall be minimized.

First Transitory Provision

A period of adaptation of one year from the publication of this Council Instruction is set for that established in Articles 3.3, 3.4.8, 3.7.4 and 3.7.6 to come into force.

Second Transitory Provision

A period of adaptation, until 31 December 2015, is set to correct deviations from the requirements of Articles 3.2.4, 3.2.5 and 3.2.7 – referred only to associated circuits – that meet the following two requirements:

– They have been reported to the CSN within the first calendar year from the publication of the Nuclear Safety Council's Instruction IS-30, of 19 January 2011, on the requirements of the fire protection programme at nuclear power plants, and

– They are included in an adaptation programme to correct the identified deviations, according to the magnitude of the modifications to be implemented, that is sent to the CSN before 30 April 2013.

A specific treatment shall be applied to these deviations previously reported to the CSN until 31 December 2015, within the framework of the programme for monitoring findings and indicators that might be derived from the adaptation of the plant to these requirements, provided that their risk significance is not high (red findings) or that they are not malicious acts.

Third Transitory Provision

A period of adaptation of three years from the publication of this Council Instruction is set for the coming into force of that established in Article 3.2.5 for those cases, of which the CSN has been informed within three months from the publication of this Instruction, where having recourse to the provisions of Condition 1.d) of Article 3.2.5 is formally requested, within one year from its publication, and the conditions which are set by the CSN for its favourable assessment are fulfilled. A period of adaptation of two years from the date on which said unfavourable assessment by the CSN is notified is set for the coming into force of that established in Article 3.2.5 for those cases which the CSN has been informed of within the previously stipulated period of time and have not been favourably assessed.

Fourth Transitory Provision

A period of adaptation until 31 December 2016 is set for that established in 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 to come into force, provided that an adaptation programme to correct those deviations which are identified in compliance with the provisions of these Articles that is in keeping with the magnitude of the modifications to be implemented is sent to the CSN within 18 months from the publication of this Council Instruction.

Sole Repealing Provision

The Instruction IS-30, of 19 January 2011, on the requirements of the fire protection programme at nuclear power plants, and any other rule of equal or lower level that is opposed to the provisions of this Council Instruction are expressly repealed.

Sole Final Provision

The present Council Instruction shall come into force on the day following that of its publication in the "Official State Gazette" (BOE, 14/03/2013[M7]).

In Madrid, on the 21st of February of 2013.–Fernando Marti Scharfhausen, the President of the Nuclear Safety Council.

APPENDIX A

Fire detection and extinction system requirements

A.1 *Fire detection*

The frequencies used by linear heat detectors shall not affect the actuation of the protection relays of other plant systems, something which shall be demonstrated by means of pre-operational and periodic tests.

Fire alarms shall be unique and differentiated such that they are not mistaken for any other plant alarm system.

Primary and secondary power supply systems must be provided for the detection system and for the electrical operation of the control valves of the extinction system.

A.2 *Fire extinction water supply system*

Two separate water supply sources must be provided. Until the raw water supply runs out, salt water must not be used.

The supply of fire protection water must be calculated on the basis of the greatest expected consumption in a 2-hour period, but it may not be lower than 1,136 m3. This flow rate must be conservatively based on 1,900 l/m for hand-operated hoses and the greatest demand of any sprinkler [M8]or sprayer system in the power plant. Said water flow rate must be calculated by assuming the most unfavourable in-service path.

If tanks are used, there must be at least two tanks of 100% the capacity required by the system, each of them holding 1,136 m3. The tanks must be interconnected such that the pumps may suck from one or both of them. The main water supply must be capable of filling one of the tanks in 8 hours at the most.

Common tanks for the fire protection system and for service or sanitary water may be used. If so, the minimum necessary volume for fire protection water must be guaranteed, the connection for other services being arranged such that said minimum volume cannot be used by said services. Administrative controls, including outlet valve interlocks, are unacceptable as the only means to ensure this minimum volume.

Lakes, rivers or water ponds of sufficient capacity can be classed as a single fire protection water supply source but require separate, redundant suctions in one or more intake structures. Said separation must be such that a failure in a suction does not affect the other.

When the use of the power plant's ultimate heat sink as a fire protection water supply source is allowed, the following conditions must also be fulfilled:

a) The required fire protection water capacity shall be in addition to that needed for the ultimate heat sink's own functions.

b) A failure of the fire protection system must not degrade the sink's functions.

When other systems are used as one of the two fire protection water supply systems, they must remain permanently connected to the main supply system, their alignment being automatic. Pumps, controls and power supplies of said systems must meet the same requirements as those set for the pumps of the main fire protection system. The use of other fire protection water systems must not be incompatible with the functions which are required for the plant's safe shutdown. The failure of said systems shall not compromise the function of the main fire protection system.

The minimum requirements for the design and installation of the main fire protection water distribution ring are the following:

a) The type of piping shall be chosen such that it prevents the build-up of scale with the proper water treatment.

b) Means suitable for pipe inspection and cleaning shall be provided.

c) Isolation valves must carry a visual position indicator, such as an indicator post, the purpose of which is to isolate part of the main ring, for maintenance or repair tasks, without simultaneously cutting off the supply of water to the primary and backup extinction systems that serve areas containing structures, systems or components (SSCs) important to safety.

d) Isolation valves to isolate the outer hydrants of the main ring must be installed in order to be able to repair the hydrants without having to cut off the water to automatic and manual extinction systems serving areas where there are SSCs important to safety.

e) The main fire protection pipe must be separated from the service and sanitary pipe, except for that indicated above.

f) The supply system, the pumping system and the exterior ring may by common for power plants with more than one unit, i.e. it may be shared by several groups provided there are interconnected. Isolation valves must be provided and arranged such that the exterior ring of one unit may be isolated without interrupting the service to the other units. In this type of facility a common water supply may be used. Separate main rings must be provided in sites with several groups far apart from each other.

The installation of fire protection pumps, when required, must fulfil the following criteria:

a) The pumping equipment must consist of a sufficient number of pumps ensuring 100% of the required flow rate and pressure capacity assuming the failure of the pump with the largest capacity (e.g. three 50% pumps or two 100% pumps) and/or the loss of offsite power. Said requirement may be fulfilled by means of one of the following alternatives:

1) Using one or more electric motor-driven pumps and one or more diesel motor-driven pumps.

2) Using two or more pumps driven by seismic category-I, Class-1E electric motors connected to redundant, Class-1E emergency buses.

b) The individual connections to the main exterior ring from fire protection pumps shall be separated by shutoff valves. Every pump, its motor and its controls must be separated from the other fire protection pumps by fire-resistant barriers having a fire resistance of 3 hours.

c) In the case of diesel motor-driven pumps, the fuel storage tank shall be located such that it does not pose a fire risk to SSCs important to safety or the fire protection system itself.

d) An alarm signal due to the operation of the pumps, the unavailability of motors, a failure to start-up, and low water pressure in the main exterior ring shall be received in the control room.

The installation of hose boxes inside buildings must be sufficient to supply an effective flow of water to any inside location where fixed combustible material might compromise SSCs important to safety.

Hydrants connected to the main ring through isolation valves shall be provided in outdoor areas at least every 75m. Sheds fitted with hoses, fittings and other auxiliary equipment shall be provided; they must be installed as required and separated no more than 300m. Mobile hose transportation means and their associated equipment may be provided as alternative means, in which case they must carry material equivalent to three hose sheds.

Hydrants shall be provided with threaded connections compatible with those used by the external organization which give support to the power plant in case of a fire.

A.3 *Sprinkler, spray, foam and equipped fire hose systems*

Safety systems must be isolated and kept separate from combustible materials. When this is not possible due to the nature of the safety system or of the combustible material, a special protection to prevent a fire from affecting the safety system's function must be envisaged. This protection may include the combination of an automatic extinction system with a type of construction capable of containing a fire which were to consume all existing combustible materials.

Suppressions systems made up of sprinklers, spray, foam and equipped fire hoses shall be used, as established in the fire risk analysis. In general, suppression systems shall be used as the main system and the equipped fire hoses as backup, it being possible to use another extinction means as the main system in those places where water damages to the contained equipment must be avoided.

Administrative controls shall be placed to regulate the deactivation or inhibition of these systems.

Each building's system for supplying water to sprinklers, spray, foam and equipped fire hoses shall be connected to the exterior ring such that a rupture in the line or one simple failure cannot put the main and backup extinction systems out of service. Alternatively, the main and backup systems of the same building may be fed from the same header, provided the latter is independently fed through both ends. When the piping and fittings used in said headers – including the first valve of sprinkler systems – are part of a hose system which has been seismically analyzed, they must meet the seismicity requirements applicable to the hose system. Said headers are considered an extension of the main exterior ring.

Each sprinkler, spray, foam and equipped fire hose system shall be provided with either a protruding spindle isolation valve or an isolation valve having a position indicator and with either a valve-closed indication in the control room or an administrative control. All fire protection system valves must be periodically tested and checked so as to verify their position.

Fire hoses shall be situated such that any place where SSCs important to safety might be exposed to a fire is covered by the water jet of at least one hose. To this end, 45mm-diameter equipped fire hoses having a maximum length of 30m and spaced no more than 50m from each other shall be provided in all buildings containing SSCs important to safety.

The hose feeding pipe shall have a diameter of at least 65mm when it feeds one hose and of 100mm when it feeds more than one hose.

In order to facilitate the fire fighting, equipped fire hoses must be situated as indicated in the fire risk analysis. Alternative equipped fire hoses must be provided in areas where a fire might block access to the fire hose which is normally used in said areas.

The supply of water to, at least, the hose system protecting the equipment needed for safe shutdown shall be guaranteed in case of a safe-shutdown earthquake (SSE). The piping system that supplies water to said hoses must be analyzed for loads caused by the SSE and supported so that it maintains its functional integrity during and after said event. Likewise, the water supply must also be analyzed; it may be obtained by means of a manual connection to another seismic category-I supply source, such as the essential service water systems or another available system, such that the functions of this source are not degraded. In this case, pipes and valves must, at least, fulfil the requirements of ANSI B31.1 “Power Piping” and be designed as per the same standards as the seismic category-I system. The connection must be capable of providing a flow rate of, at least, 34m3/h.

The type of nozzles to be used in equipped fire hoses covering the different fire areas must be based on the fire risk analysis, the jet position being invalidated in places where there is equipment that might be damaged by the water jet. Spray-only nozzles (or standard lances in mist position) shall be used to cover fire areas where a water jet might fall on electrical equipment so as to thereby prevent the jet from causing unacceptable damage. Equipped fire hoses which are installed to cover fire areas where there is electrical equipment shall be provided with nozzles prepared to act on said electrical equipment.

Hoses must be subjected to hydrostatic testing on a periodical basis. Hoses stored in outdoor cabinets must be tested on a yearly basis. Hoses located inside buildings must be tested every three years.

Foam extinction systems equipped with sprinklers or open nozzles must be used for risks which, given their nature, require it, such as those entailed by combustible or flammable liquids. The use of low expansion foam systems, high expansion foam generators or aqueous film-forming foam (AFFF) systems, including “deluge” AFFF systems, must be considered where applicable.

SSCs important to safety which do not require protection by means of water suppression systems but might be affected by the water ejected upon opening the latter must be protected by means of shields or screens. Appropriate drains shall be installed in areas containing SSCs important to safety to avoid potential damages due to the discharge of said water systems. If a gas system is installed, either the drains must be provided with adequate seals or the extinction system must be designed to compensate for leaks through said drains.

Water mist systems may be used as extinction systems in those areas where it is considered convenient by the fire risk analysis.

Headers and equipped fire hoses shall be installed inside the non-inerted containment. Said headers and equipped fire hoses must be connected to a supply of high quality water that is different from the supply to the main ring if the specific design of the plant does not allow the water in said ring to enter the containment. In BWR power plants, equipped fire hoses shall be installed outside the dry well enclosure and have an hose length – not exceeding 30m – suitable for reaching any point inside the containment with the water jet. The fire protection pipe’s penetration into the containment must meet the primary containment isolation criterion and belong to seismic category I and quality group B.

An equipped fire hose must be installed immediately outside the control room and cable distribution rooms. Those false ceilings and floors in the crane operator which house cables must be protected by means of automatic extinction systems unless all cables have been laid inside either steel ducts with a diameter measuring 10cm or less or fully enclosed trays provided with an automatic extinction system inside thereof.

The main fire extinction system in cable distribution rooms; the lubricating oil tank; clean and dirty turbine oil tanks; diesel generators; diesel generator lubrication systems; and above-ground diesel generator fuel storage tanks shall be an automatic suppression system.

Equipped fire hoses and fire extinguishers will be used as the extinction system in fresh nuclear fuel areas, spent fuel pond areas, safety-related battery rooms and the remote shutdown panel.

A.4 *Carbon dioxide fire extinction systems*

When automatic carbon dioxide systems are used, a pre-trigger alarm system, having an actuation delay that allows people to exit the areas to be protected, will be provided. Methods allowing – under administrative measures – to locally deactivate the installation must be provided.

The following shall be analyzed:

a) The minimum concentration of CO2, the distribution, the absorption time, and the control of the ventilation.

b) The asphyxiation by and toxicity of CO2.

c) The likelihood of cooling-induced, secondary thermal shock damage.

d) The ventilation and relief requirements during the injection of CO2 in order to prevent pressurization versus sealing to avert a loss of agent.

e) The location and selection of the detectors that will activate the CO2 system.

A.5 *Extinction systems by flooding with clean-agent gases*

Fire extinction systems alternative to halon (clean agents) shall be provided with a local system – subjected to administrative controls – to block the discharge of the automatic systems. Administrative controls shall be placed to regulate the deactivation or inhibition of these automatic systems.

System maintenance and testing protocols shall include checking the amount and the pressure of the agent contained in clean-agent cylinders/containers.

The following shall be analyzed:

a) The required minimum clean-agent concentration, the distribution, the flooding time, and the control of the ventilation.

b) The toxicity and anoxia of the gas.

c) The extinction concentration.

d) The toxicity and corrosiveness of potential by-products of the thermal decomposition of the gas.

e) The ventilation and relief requirements during the injection of clean agent so that the overpressure caused by its discharge versus sealing does not cause a loss of agent.

f) The clean agent’s effectiveness and design concentration to protect against the risk.

g) The location and selection of the detectors that will activate the CO2 system.

A.6 *Portable fire extinguishers*

Portable fire extinguishers shall be installed in areas containing SSCs important to safety that require it as per the fire risk analysis, particularly in normally occupied places where human intervention can fight the fire from the start, and in areas containing materials with low fire spread which are provided with a detection system.

The fire extinguishing agent shall be suited to the fire risk in each area; its effectiveness and the potential damage it may cause to safety equipment in the area must be assessed, particularly in the case of dry powder.

A.7 *Cable raceways*

Areas containing raceways bearing cables important to safety shall have a fire detection and extinction system providing coverage thereabove. The cables of systems and components important to safety must be designed to withstand getting wet by the water of the fire protection system without there being any electrical failures.

Equipped fire hoses shall be provided inside the containment building as the primary fire extinction system above those trays which otherwise do not require automatic systems.

Outside the containment building, the following measures shall be taken:

The primary extinction system of safe-shutdown cable trays which are not protected with barriers having a fire resistance of 3 hours shall be an automatic extinction system. Equipped fire hoses may be used as the primary extinction system for these trays only in cases where the fire risk analysis shows that said trays are not exposed to a fire risk external thereto. To this end, a fire risk external to the trays for the safe shutdown of a train will be understood to be any other piece of equipment or component – excluding the cables of the train under consideration – which is housed in the same fire area and might generate or spread a fire above said trays.

Safety-related cables which cannot possibly be separated from their redundant cables by barriers having a fire resistance of 3 hours must be protected with an automatic extinction system.

Except trays bearing cables providing systems needed to achieve and maintain safe shutdown with signalling, control or power and trays containing safety cables not separated from their redundant cables by barriers having a fire resistance of 3 hours, trays bearing cables important to safety that fulfil any of the following three conditions must be protected with a suppression system consisting of either sprinklers, spray, water and foam, CO_2, water mist or clean gases, the actuation of which, when appropriate, may be either manual or automatic:

i) They are cable trays which are inaccessible for manual fire fighting.

ii) The following two conditions are simultaneously met: on the one hand, the equivalent number of standard 600mm-wide trays (safety-related and safety-unrelated trays) in a given fire area is greater than six. Hence, trays over 600mm in width must be considered to be two trays, and over 1,200m in width, three trays, regardless of how full they are. On the other hand, the fire risk analysis does not properly justify that the fire load in the fire area where these trays are installed is sufficiently low for the fire brigade to be able to confine and put out a fire in said fire area by means of equipped fire hoses.

iii) There is no detection system covering the cable trays.

A fire suppression system consisting of either sprinklers, spray, water and foam, CO_2, water mist or clean gases, the actuation of which, when appropriate, may be either manual or automatic, must be provided as the primary extinction system for trays bearing cables important to safety not contemplated in the preceding paragraphs of this section. Alternatively, equipped fire hoses may be used.