European Nuclear Safety Regulators Group
ENSREG

2nd Topical Peer Review – 'Fire Protection'

Country Review Report

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1. Brief overview of the candidate installations

The following installations were finally selected and included in the national assessment report (NAR).

Installation category	Number of installations	Name of candidate installations
Nuclear power plant	3	Almaraz NPP Cofrentes NPP Vandellos 2 NPP
Research reactor		-
Fuel reprocessing facility		-
Fuel fabrication facility	1	Juzbado
Fuel enrichment facility		-
Dedicated spent fuel storage *Note: please, indicate the type „wet" or „dry".*		-
Installations under decommissioning		-
On-site radioactive waste storage		-
Total	**4**	

2. Regulatory framework

The NAR mentions that the regulatory "*framework has a hierarchical structure, starting with International Treaties (Conventions), then following top to bottom with Laws, Royal Decrees, mandatory regulations and Instructions [*issued by CSN*], and ending with Guides that contain acceptable technical approaches to comply with the regulations. Moreover, the competent Ministry and the CSN establish Limits and Conditions applicable to the license granted, and Complementary Technical Instructions for each installation, as a way to establish technical requirements about specific matters not included in other regulations".*

The NAR indicates that "*Fire protection requirements are introduced in Royal Decree 1400/2018. The CSN has also issued Complementary Technical Instructions (CTI) which are also technical requirements directed to license holders in order to cover additional topics to the license limits and conditions. In relation to Fire protection, there are several CTI that have been issued with similar requirements to all licensees*". In particular, "*CSN issued After Fukushima four Complementary Instructions to all the NPP: CTI 1, CTI 2, CTI 3 and CTI 4. CTI 1 and 3 specifically related to Fukushima events in which a fire may be caused by a natural phenomenon either directly of after an explosion and CTI 2 and 4 covering the loss of major areas (covering man-made hazards beyond design bases) being a large fire one of the enveloping scenarios. Similar CTI with an adapted scope to NPP CTI 1 and 3 were also issued to Juzbado FCF*".

The NAR indicates that "*the CSN has issued Council Instruction (Instruction IS-30) dealing with the requirements of the fire protection programme at nuclear power. In drawing up this, consideration was given to the work performed by WENRA taking into account the «reference levels»*."

The NAR does not clearly state if the WENRA SRLs SV are binding. In response to the question of the TPR Team[1], Spain's answer was "*…all the WENRA reference levels in chapter S (Protection against internal fires) have been transposed into legally binding national regulation in Spain. These reference levels gave origin to the Instruction IS-30 of the CSN about the Fire Protection Program at Nuclear Power Plants, instruction which was first issued on January 2011 and is currently in revision 2, dated November 2016.*"

The NAR mentions *"the consideration of different kinds of foreign regulations (IAEA, NEA, Europe, etc) is considered a strength […] The process carried out in the development of regulations and guides and the incorporation of updated international standards and guidance is documented in the justification included in the publication of different standards as for example."*

3. Findings and significant improvements of approaches on the installations from the national self-assessment

Nuclear power plants

The following **strengths** related to fire protection were reported in the NAR for **all Spanish NPPs**:

- The entry into force of IS-30 has meant, from a methodological point of view, the adoption of complete and systematic methodologies of analysis, by integrating deterministic and probabilistic approaches, thereby dealing with the concept of fire protection in an integral way in order to achieve its objectives. In this regard, the analysis methodologies applied are considered to be among the best international standards of reference.
- The development of Fire Safety Analyses is generally considered a major step forward, in order to provide them with a broad and multidisciplinary scope, both from the point of view of regulatory compliance and to identify possible areas for improvement in the regulated installations.
- The requirement for seismic FP systems in operating power plants and the development of flooding analyses covering both FP actuation and rupture is an indication of the concern for the combination of seismic + fire and fire + flood events and their consideration by current regulations.
- Fire prevention has been greatly reinforced in recent years in all Spanish plants. Spain does not consider that, once the improvement actions due to the IS-30 adaptation processes have been implemented as well as those derived from the latest periodic safety reviews, there are any areas for improvement in fire prevention at the Spanish plants.
- All the Spanish plants have a computerised system for the management of temporary storage areas.
- An adequate implementation of active fire protection systems in Spanish nuclear power plants, with elements such as the seismic FP system constituting an outstanding strength of the system design.

[1] 'The NAR in §1.2 presents the regulatory framework. If not yet clearly mentioned in the NAR, could you indicate whether the WENRA SRLs for NPPs, and RRs (if relevant for your country), which are used as reference for this topical peer review on 'fire protection' (as per the Technical specification) are binding or not in your country? If they are not binding, what is the status of the SRLs (non-binding, guidance, advisory..)?'

- Availability at all sites of a professional fire brigade of at least 5 people with the sole function of preventing fires and responding to fire scenarios.
- Analysis and improvement of passive barriers (blankets) with fire resistance not certified in accordance with GL 86-10 Supplement 1.
- Approval through specific testing of fire resistant barriers without fire resistance test certification.
- Comprehensive review and complete inventory process of fire resistant barriers in the various nuclear power plant buildings. Corrective actions in the absence of adequate separation (operator actions, cable routing, reconfiguration of fire areas also through HVAC systems).
- New innovative elements developed by the licensees related to:
    - Integrated risk-informed FP management processes.
    - Carrying out scheduled and monitored fire watches using computerised tools.
- Cutting and welding work procedures, procedures for the control of combustible materials storages, procedures for periodic surveillance of fire-resistant structures are identified as good practices by the regulator.
- Optimisation of surveillance watches used as compensatory measures through the use of electronic devices.
- The design modifications and improved procedures required to guarantee safe operation in the event of any postulated fire scenario, including scenarios beyond the design basis, have been implemented at the Spanish plants.

The following **weaknesses** related to fire protection were reported in the NAR for **all Spanish NPPs**:

- No participation in the development of the operational experience databases (FIRE) and incorporation of the lessons learned that may be derived from this database as an additional source to those already analysed.
- Excessive dependence on American standards that slows down the purchasing processes necessary to resolve non-functionalities and implement improvements relating to passive protection.

The following **lessons learned** related to fire protection were reported in the NAR for **all Spanish NPPs**:

- All Spanish NPPs are audited by insurance company NEIL, which issues recommendations concerning fire protection (installation of specific protections in the turbine building's oil system, implementation of splash guards on the flanged connections of oil systems in the Turbine building).
- A process of monitoring the inspection procedures for fire-resistant seals at the different nuclear power plants has been in place.
- The Spanish nuclear power plants set up a working group made up of plant engineering staff, with the aim of carrying out a study of the impact of the change from US to European standards. An analysis of the regulations on FP Passive Protections was carried out.
- Once the improvement actions due to the IS-30 adaptation processes have been implemented (considering the guidelines of Chapter 3 of NFPA-805 in the applicable plants), as well as those derived from the latest periodic safety reviews, it is not considered that there are any areas for improvement in fire prevention at the Spanish plants.

The following **improvements** related to fire protection were reported in the NAR for **all Spanish NPPs**:

- In terms of fire watch procedures, a substantial improvement has been made through the use of electronic devices for better monitoring and planning. This improves the monitoring carried out by the regulator of the effective implementation of surveillance and its planning.
- Exhaustive reviews of the fire barriers have been carried out, verifying aspects of design, condition and testing, aimed at guaranteeing the sectorisation of fire areas and motivated by various operational experiences.

ALMARAZ NPP

The following **strengths** related to fire protection were reported in the NAR for **ALMARAZ NPP**:

- The Almaraz NPP organisation promotes the correct monitoring of the emergency preparedness programme and continuous improvement in this field through the integrated Emergency Management and FP section (which also includes the accident management programme) and the Emergency Preparedness and Management Committee.
- Provision and signalling of connections for Extensive Damage Mitigation Guidelines (EDMG) strategies: Several connections are available for the implementation of each EDMG strategy, identified with pink colour.

No **weaknesses** related to fire protection was reported in the NAR for **ALMARAZ NPP**.

The following **lessons learned** related to fire protection were reported in the NAR for **ALMARAZ NPP**:

- During the Peer Review WANO (2020) and the OSART mission (2018) no areas for improvement have been identified.
- In CSN inspections, in the area of fire prevention, the findings focus on aspects of safety culture that are reinforced at management level: illegal storages, open doors without administrative control.
- Prevention-related procedures in areas of Integrated fire risk management, Management of system functionality losses and FP barriers, Fire risk work permits, Management of storage areas, Fire risk work permits, Management of storage areas, Large fires suppression and other have been reviewed in recent years (outside the process of adaptation to NFPA 805).
- Almaraz NPP, has carried out a more detailed comparison between North Anna NPP (Almaraz's reference plant) FP procedures and the procedures that Almaraz shift would use in case of fire to deal with the fire itself and the possible loss or unavailability of equipment as a result of it.

The following **improvements** related to fire protection were reported in the NAR for **ALMARAZ NPP**:

- In the framework of the NFPA 805 transition project:
    - Procedures in related areas have been generated or revised;
    - In relation to the analysis of radioactive releases, detection has been improved in the fire areas located in the controlled area that are not usually visited;
    - improvements related to fire suppression were implemented:
        - Automatic pre-action sprinkler system on the FP diesel pump.
        - Modification of the hydrant near one of the diesel tanks to prevent the main (water system with foam concentrate) and back-up (hydrant) systems from being out of service due to maintenance simultaneously.
        - Modification of the hydrant near a start-up transformer to prevent the main (water spray system) and backup (hydrant) from being out of service due to maintenance simultaneously.

        - Installation of Novec 1230 gas suppression systems in cables in the raised floor and false ceiling of the computer room in the control room, as well as in vertical conduits between the raised floor and false ceiling of the control room.
        - Double FP connection in containment and in the essential services gallery.
        - Incorporation of actuation signals in various FP systems.
        - The water supply to the FP System inside the containment building was changed from the demineralised water (DW) system to the fire protection (FP) system loop.
    - improvements related to passive protection were implemented:
        - Replacement of doors with certified ones.
        - Installation of fire-resistant dampers in ventilation systems.
        - Installation of passive protections on dampers and ventilation ducts.
        - Installation of additional barriers to prevent communication between areas.
        - Installation of FR barriers between FP pumps and other pumps in the intake structure.
        - Separation of pumps from the seismic FP system.
        - Replacement of ceramic blankets with approved passive protections on cable trays in the safeguards and auxiliary buildings.
        - Installation of approved passive protections for protection of various cables in different fire zones, depending on the results of the fire PSA.
        - Rerouting of cables as an alternative to passive cable protection.
        - Improvements in cable ducts in false ceilings with the use of conduits.
- Installation of an alternative shutdown panel.
- Rerouting of H2 lines to eliminate associated risks in auxiliary and safeguards buildings.
- Improvement of procedures (control of combustibles and hot works Pre-Fire Plans and an auxiliary fire procedure).
- Installation of RCPs passive seals and automatic trip and protection of the I&C cables from the thermal barrier to eliminate RCP seal LOCA scenarios.
- Protection and cable rerouting of the pressuriser PORVs.
- Passive protections against loss of both CCW trains.
- Emergency lighting with 24h autonomy (to cover also post-Fukushima requirements) was installed in 2015 on evacuation routes and at locations where local emergency actions are required.
- A dedicated wireless communication system, independent of the public address system, was implemented in 2015 to reach the safety important SSC areas of the plant.
- A protective canopy has been installed to protect the EDMG equipment that is stored outdoors, so weather protection was considered as a means to improve its availability and thus the plant's response capacity in case of need.
- Derived from the Almaraz NPP PSR, the following results were identified in relation to FP:
    - The inclusion of scenarios derived from the transition to NFPA 805 in the simulator exercises is considered a strength;
    - The already implemented incorporation of RCP passive seals and automatic trip was committed as an improvement action.

COFRENTES NPP

The following **strengths** related to fire protection were reported in the NAR for **COFRENTES NPP**:

- The plant has an advanced training area, where the brigade and all plant personnel are trained.
- Resourcing of FP and reinforcement of external support through partnership agreements.
- The fire protection brigade has expanded its fleet of vehicles of various purposes in order to be able to deal with fires and major disasters.

No specific **weaknesses** related to fire protection were reported in the NAR for **COFRENTES NPP**.

The following **lessons learned** related to fire protection were reported in the NAR for **COFRENTES NPP**:

- Following the 2019 WANO Peer Review, the Fire Protection Water System Health report was produced. Maintenance work scheduling has been improved in order to group maintenance work orders on the same system, leaving systems inoperable as little as possible, thereby improving plant safety.
- According to the evaluations of the insurance company NEIL, the Fire Risk Analysis is revised to incorporate the fire-resistant separation wall between the main and standby transformers, the implementation of which was completed in March 2021.
- As a result of the processes of adaptation to new regulations, as well as improvements derived from external inspections, several improvements have been carried out.
- Particular attention is paid to the maintenance processes in view of the long-term operation and the consequent ageing of fire water materials and components.

The following **improvements** related to fire protection were reported in the NAR for **COFRENTES NPP**:

- PSR-derived improvements:
    - The Fire Risk Analysis is revised to incorporate the gas suppression system, activated by an incipient detection system, in the control panels of the Diesel generators of the three divisions;
    - Inclusion of instrumentation that could be lost in the event of fire in the fire action procedure was performed;
    - A gas suppression system, activated by an incipient detection system, has been installed in the control panels of the diesel generators of the three divisions;
    - Improvement of the FP system (Installation of an additional connection to feed the FP truck, Installation of an additional fire hydrant a vehicle exit) in outdoor areas within the restricted area;
    - Installation of a system to protect generator control panels by means of a gas suppression system that is activated by an incipient detection system.
- IS-30 Implementation:
    - Documentation and analyses related to Safe Shutdown and other related aspects were modified;
    - An exhaustive review of its FP system to comply with the requirements of the aforementioned instruction. The Fire Risk Analysis was revised to incorporate the design modifications, concerning the separation of redundant safe shutdown trains – three modifications were implemented in order to keep at least one of the trains free of damage;
    - Separation of redundant safe shutdown trains, replacement of fire dampers, improvement of emergency lighting on access and escape, installation of independent emergency communication system were performed;

    - Spurious Impact on Control Room Fire Safe Shutdown and Associated Circuit Analysis documents were produced to demonstrate alternative or dedicated shutdown capability for the Control Room;
    - On the identification of safety-related SSCs in the field of FP, the document Identification of safety-related SSCs in the field of fire protection was issued;
    - Adjustment of overcurrent relays in a specific cabinet of the safeguard bars;
    - Two switches were installed in the MCCs so that the test valves of the HPCS and RCIC can be kept de-energised when the system is not under test and the HPCS OUT OF SERVICE and RCIC SYSTEM OUT OF SERVICE alarm is not present in the control room respectively, and the status lamp for overload or loss of voltage in any MOV of the HPCS /RCIC is not lit.
- Measures arising from the studies of associated circuits and multiple spurious operations were carried out.
- Enhancement of the suppression system in diesel generator rooms.
- Update of several procedures in the recent years.
- Following a recommendation from insurance company NEIL, a fire-resistant separation wall has been installed between the main and standby transformers.

VANDELLÓS II NPP

The following **strengths** related to fire protection were reported in the NAR for **Vandellós II NPP**:

- Flame-retardant cables qualified in accordance with IEEE 383/1974.
- Specific fire procedures indicating the local actions to be taken in the event of a fire in certain fire areas.
- Compliance with IS-25 has required the development of Level 1 and 2 Fire PSAs and Level 1 and 2 LPSD Fire PSAs.
- Maintenance and prevention plans to minimise the consequences of an external fire.
- Procedures have been modified to avoid the discharge of the fire system in unplanned situations.

The following **weaknesses** related to fire protection were reported in the NAR for **Vandellós II NPP**:

- Three access doors to rooms protected by gas suppression systems without periodic condition monitoring.
- The outdoor areas are not properly addressed in fire safety of the plant, the improvements are needed related to this issue.

The following **lessons learned** related to fire protection were reported in the NAR for **Vandellós II NPP**:

- Several lessons learned in the framework of the post-Fukushima actions.
- In the last two WANO Peer Reviews, no AFIs related to the areas of Fire Protection and Fire Safety were identified. Best practices related to these areas were also not identified.
- In the NEIL assessment that took place in November 2021, no risk scenarios were identified; however, some observations were made that have led to actions in the Problem Identification and Resolution Programme.
- As a result of operational experience, two areas for improvement have been identified within the scope of the 3rd PSR.
- In 2019, a compilation of the documents supporting the homologation of all sealing types was carried out. It was identified that some of them installed during the construction of the plant required further documentary support in order to verify their fire resistance according to current regulations. As a result of negative fire tests, detailed review of the certificates

for each type of sealing device installed was performed. It was identified that the 3M Pass Through devices (intumescent collars) installed in 8 penetrations of the CAT-Diesel building did not comply as R180, but had a certificate of compliance of 2 h for integrity (F rating) and 1.5 h for insulation.

- Safe power shutdown analysis: As a result of the deterministic analysis, fire areas were identified that, in order to comply with the separation criteria, required design modifications to be made (installation of passive protections or a combination of passive protections with automatic detection and suppression systems) or the modification/generation of operating procedures for the performance of operator manual actions (OMAs). In addition, for three fire areas with deviations related to R180 fire barriers, a regulatory approval of equivalent compliance measures has been requested:
    - In the fire area corresponding to the main steam relief valves, the application has relied on FDS calculations to rule out the propagation through penetrations used by three armoured trays, so that the separation between the areas corresponding to each of the three main steam relief valves can be considered equivalent to three-hour fire barriers. In addition, fire-stops have been installed on these trays;
    - The fire area corresponding to the condensate water tank in outdoor areas and without fire combustibles and ignition sources was not favourably approved and a modification was required to separate the redundant train level instruments and their electrical conduits by means of a R180 barrier. The RWST is also affected by a similar design modification;
    - In the fire area corresponding to the containment, a request was made on the basis of the characteristics of the containment building itself, with separating walls and intermediate separations. The CSN considered that the design was aligned with the guides in SG 1.19.
- Flooding analysis due to FP systems piping breaks or actuation of automatic or manual FP systems: A modification has been made taking into account the FP system pipe breaks and its effects, including circumferential breaks, spraying, loss of external power supply and the occurrence of a seism.
- The self-assessment processes and the quality audit programme have contributed to the continuous improvement of the facility.
- The analysis of the outdoor areas within the protected area of Vandellós II NPP does not fully follow the recommendations of RG 1.189 Rev. 3, so an analysis was carried out in those areas. In conclusion, no areas have been identified with significant fire loads that could lead to fire exposure of safety relevant SSCs. In areas where there are relevant fire loads, it was verified that SSCs that are safety relevant in the FP domain are not affected.

The following **improvements** related to fire protection were reported in the NAR for **Vandellós II NPP**:

- The main design modifications carried out as a result of the FHA carried out for the adaptation to IS-30 are listed below:
    - De-energisation of motorised valves during power operation;
    - Installation of passive protections;
    - Installation of automatic Novec 1230 suppression system;
    - Improvement of the electrical independence of the control room;
    - Modification of communication's means;
    - Installation of autonomous blocks with batteries with 8 h of additional autonomy;
    - Improvement of FP water supply;
    - Fire detection installation with coverage over safety important SSCs;
    - Installation of passive protection in an electrical box in the control building;
    - Protection of cables to enable the steam generator relief valves to be closed in the event of spurious opening due to fire;

    - Protection of pressure transmitter cables in containment to prevent spurious safety injection signal due to fire;
    - Cable protection of the charging pump aligned to train A in the train A cable distribution room of the control building;
    - Installation of fire-stops in the turbine penetration enclosures on the train N cable trays corresponding to the Steam Generator relief valves;
    - Installation of an additional hydrant in the Turbine Penetrations area to meet the criteria on the maximum allowed distance between hydrants;
- As outcome of NEIL inspections:
    - Procedures for periodic pressure and flow testing of the fire protection system outside the restricted-access area;
    - Procedure for weekly inspection of portable air conditioning equipment in the hot laboratory were improved;
    - Install a system to contain or collect and drain oil from the auxiliary turbine lubrication systems (CJ) and alternator oil (CD) and water from the fire sprays associated with the equipment of both systems.
- A design modification is planned in 2024 to separate the redundant level transmitters from the refuelling water storage tank by means of an R180 wall.
- Improvements resulting from comprehensive reviews of barriers to ensure sectorisation of fire areas and from related operational experience.
- PSR-derived improvements:
    - Analysis of outdoor areas according to RG-1.189;
    - Design modification, expected to be implemented in 2024, to separate the redundant level transmitters from the RWST by means of an R180 wall;
    - Leak isolation valve installed on floor drain line between turbine building fire areas
    - An impact protection barrier was installed between the hydrogen cylinder battery and the Control Building;
    - No chemical substances control procedure is available for areas outside the power block. Revisions of the applicable procedures were issued including the instructions for surveillance of toxic, asphyxiating, flammable and/or explosive substances in outdoor areas;
    - Procedures for actuation on systems in the event of a major fire outside the facility. Revision 4 of the applicable procedure has been issued including actions needed to minimise the impact of fumes;
    - Extensive Damage Mitigation Guidelines, whose adoption in the last period together with the development of the Flex Support Guidelines has provided alternatives to prevent core damage or minimise its consequences in events beyond the design basis;
- The comparative analysis of the design and operational practices against the guidelines of RG 1.189 Rev. 3 and SG 1.19 Rev. 0 leads to areas for improvement which go beyond the requirements of IS-30 and which will result in additional improvements.

Fuel fabrication facilities

Juzbado Fuel Factory

The following **strength** related to fire protection was reported in the NAR for **Juzbado Fuel Factory**:

- The conclusions of the Integrated Safety Analysis (ISA) and the Accident Analysis included in the Safety Study show that the risk analysis carried out in the installation has allowed the correct implementation of fire protection in the installation. ISA has enabled an integrated

and comparative analysis of the different risks in the installation and the identification of the most important basic safety elements.

The following **weaknesses** related to fire protection were reported in the NAR for **Juzbado Fuel Factory**:

- Although training provided in relation to fire prevention in work practices is considered adequate, this programme should be updated to include the contents of training and prevention actions.
- Fire regulations for this type of installation are strongly based on industrial regulations and the prevention of occupational hazards, although it is necessary to take into account the differentiating aspects of radiological risks.

The following **lessons learned** related to fire protection were reported in the NAR for **Juzbado Fuel Factory**:

- Event combination analyses have led to design improvements such as the re-routing of the hydrogen lines and the construction of the seismic water tank for FP, both of which are considered a strength in firefighting.
- Several incidents at facility and other facilities led to improvements:
    - Updates to the plan in relation to seals;
    - Reviews of internal procedures governing activities such as the treatment of penetrations and fire dampers;
    - Interlock the H2 line pressure switch and the gas shut-off valve;
    - Installation of an industrial type hoover with specified requirements in the area of the active scanner and replacement of the vacuum cleaners for the collection of zircalloy dust in the production line by others with the requirements established for the operations;
    - Modification of the positioning of duct detectors according to the manufacturer's recommendations and replacement of problematic ones with new ones;
    - Purchase of plasma cutting equipment in the ceramic zone;
    - Administrative Measures: Reviews of internal procedures governing activities such as the performance of surveillance requirements, execution of fire watches and maintenance activities;
    - Design modifications to protect the impacted sprinkler, to improve the operation of the UO2 static oxidation furnace, to include a new river water intake pipeline, and installations of valves and light signals in areas where they may be risk of suffocation.
- As part of the processes of on-going improvement and analysis of the standards that is going to be carried out during the PSR (PSR process will start in 2025), the licensee of Juzbado will be requested by the regulatory authority to study specific standards available, including IAEA guidelines, in order to develop a fire protection programme that consolidates and addresses with a global approach all the analyses currently being performed by the licensee and the measures already adopted from the point of view of prevention and passive and active protection.

The following **improvements** related to fire protection were reported in the NAR for **Juzbado fuel factory**:

- New flammable gas detection subsystem with a new gas control unit and detectors to comply with ATEX regulations.
- Refurbishment of the gas storage area and control panel for the modernisation of all instrumentation.

- Change of position of the purge valves to eliminate a hazardous area and to cancel the end of line of the old densification furnace and place them in the ATEX classified area.
- Modification of the PWR and Gd area gas line ends, placing a check valve in N2 piping as an improvement identified in the ISA, improving safety.
- Modification of the route of the gas pipes outside the building so that they do not run through the interior of the building.
- Replacement of propane in the sintering and densification furnaces by ignition resistors in order to reduce the level of fire and explosion risk in the installation.
- Modification on the location of FHC to improve the handling and utilisation possibilities.
- Replacement of a firefighting vehicle.
- Replacement of suppression stations in the fire protection system to modernise the system.
- Seismic- water supply to the fire protection system to prevent the fire water tanks from emptying in the event of an earthquake resulting in a rupture of the water supply network.
- Coverage by the fire protection system for new installations.
- New detection and evacuation system to modernise it.
- Generator sets room new fire suppression in order to ensure the effectiveness of the suppression systems in case of fire.
- New cabin temperature probes, to replace those located in some cabins in the ceramic area with certified detectors for Fire Protection.
- Pressure and flow switch control stations for replacement and redesign.
- Refurbishment of the fire suppression system in the pump room in order to improve the suppression systems (water and CO2) that cover the Pump Room of the FP system. This improvement stems from the Systems Review of the FP system.
- Installation of a new dedicated seismic fire water reservoir capable of operating after a 0.17g earthquake.
- Removal of the foam suppression system from the steam boilers as the boilers have been dismantled (still in implementation).
- Replacement of the fire control panel.
- Replacement of the diesel pump of the fire protection system.
- Revision of buried carbon steel connections between the main loop and the control stations in Fire Water Supply System.
- Modification of the 4" branch line in General Suppression System from the New Component Warehouse to accommodate supply flow and pressure.
- Modification of the sprinkler system in the Fire Pump Room to make the detection and suppression of the rooms independent.
- Modify the CO2 suppression system in the Fire Pump Room to make the detection and extinguishing of the rooms independent.
- Modify the CO2 suppression system in the generator room to increase its suppression capacity.
- Updates to the plan in relation to seals.
- Reviews of internal procedures governing activities such as the treatment of penetrations and fire dampers.
- Design modifications to install optical and acoustic stop signals at drum crossings.
- Sealing of pipe penetrations in walls.
- Automatic double-hinged doors in ceramic. This improves the movement of nuclear material between the different manufacturing areas, improving the quality of the product moved and reducing risk situations by eliminating unnecessary stops for the opening of doors, without

reducing fire resistance and maintaining the fire resistance of the doors. This modification is ongoing.

4. Peer-review conclusions

4.1 Attributes of the NAR and the information provided

The candidate installations are the ones which were the subject of the Board's review prior to the national self-assessment, plus the one (Juzbado fuel fabrication facility) recommended by the Board. The recommendation of the Board to consider Vandellos I NPP which is under decommissioning was addressed with adequate justification. The recommendation of the Board (consideration of on-site NPP waste storage) was adequately addressed in the NAR.

The information provided in the NAR allowed a meaningful peer review in particular, for the identification of peer review findings.

The outcomes of the self-assessment appropriately mentioned the findings, which were well-illustrated and clearly described.

Adequate information was provided in reply to the written questions.

Additional information and updates provided in reply to written questions and in the national presentations in the country review workshop were taken into account in the definition of the findings below in section 4.2.

4.2 Peer review findings

The self-assessment revealed some weaknesses in the fire protection of the nuclear installations. The findings in the table below were acknowledged as areas for improvement by the TPR Team:

Areas For Improvement mentioned in the NAR as weaknesses and acknowledged as such by the TPR Team	
AFI (1)	**Nuclear installation: All NPPs** Licensees to make a better use of fire operational experience databases, such as 'FIRE'.
AFI (2)	**Nuclear installation: Juzbado FCF** Need for consideration of the radiological risks in the FHA.

The TPR team recommends that Spain addresses these areas for improvement in the National Action plan.

During the country review workshop, the findings identified during the peer review phase were discussed. Based on these discussions, the TPR team concluded on the following findings:

Areas of Good performance
Nuclear installation: Almaraz NPP and Cofrentes NPP

AGP (1)	**Finding**	Implementation of effective flooding protection of critical equipment from the harmful effects of firefighting water extinguishing system.
	Justification	Consistent with the expectations of SSG-64, the effects of flooding are well understood. The potential effects of flooding are considered and subsequently prevented or mitigated.
Nuclear installation: Cofrentes NPP		
AGP (2)	**Finding**	Detailed arrangements for the management of hot works are in place (covering e.g. scope of works, supervision, necessary firefighting equipment).
	Justification	Extensive and detailed arrangements are in place for hot works: permit preparation, sign off, surveillance and post-work checks. They contribute to the prevention of fire events.
Nuclear installation: Vandellos 2 NPP		
AGP (3)	**Finding**	New fire-fighting procedures and training have been implemented as a result of the lessons learnt from conventional industry.
	Justification	Lessons learnt from firefighting practices in conventional buildings based on the experience shared from firefighters of the Generalitat de Catalunya.

Definition of the types of findings

According to the TPR II Terms of Reference, the country group workshop discussions should lead to conclude on the findings categorised as an 'area of good performance' or 'area for improvement'. These are defined therein as follows:

A National area of good performance which should be understood as an arrangement, practice, policy or programme related to fire protection that is recognized by the TPR Review Team as a significant accomplishment for the country and has been undertaken and implemented effectively in the country and is worthwhile to commend.

A National area for improvement which should be understood as an aspect of fire protection identified by the TPR Peer Review Team where improvement is expected, considering the arrangement, practice, policy or programme generally observed in other participating countries. It may also be self-identified by the country itself (i.e. self-assessment) where improvement is appropriate.