CONSEJO DE SEGURIDAD NUCLEAR

Spanish National Action Plan on Ageing Management

Topical Peer Review 2017

September 2019

Index

Abbreviations used in this report....6
1. Introduction....8
2. Findings resulting from the self-assessment....9
2.1. Overall Ageing Management Programmes (OAMPs)....10
2.1.1. State finding n°1 (area for improvement or challenge) from the self-assessment.....10
2.1.2. Country position and action on finding n°1 (licensee, regulator, justification)....10
2.2. Electrical cables....10
2.2.1. State finding n°1 (area for improvement or challenge) from the self-assessment.....10
2.2.2. Country position and action on finding n°1 (licensee, regulator, justification)....10
2.3. Concealed pipework....10
2.3.1. State finding n°1 (area for improvement or challenge) from the self-assessment.....10
2.3.2. Country position and action on finding n°1 (licensee, regulator, justification)....11
2.4. Reactor pressure vessel....11
2.4.1. State finding n°1 (area for improvement or challenge) from the self-assessment.....11
2.4.2. Country position and action on finding n°1 (licensee, regulator, justification)....11
2.5. Concrete containment structure and pre-stressed concrete pressure vessel....11
2.5.1. State finding n°1 (area for improvement or challenge) from the self-assessment.....11
2.5.2. Country position and action on finding n°1 (licensee, regulator, justification)....11
3. Country specific findings resulting from the TPR....12
3.1. Overall Ageing Management Programmes (OAMPs)....12
3.1.1. TPR expected level of performance: finding 1....12
3.1.2. Country position and action (licensee, regulator, justification)....12
3.2. Concealed pipework....12
3.2.1. TPR expected level of performance: finding 1....12
3.2.2. Country position and action (licensee, regulator, justification)....12
3.3. Reactor pressure vessel....12
3.3.1. TPR expected level of performance: Volumetric inspection for nickel base alloy penetration....12

3.3.2. Country position and action (licensee, regulator, justification). 13
3.3.3. TPR expected level of performance: Non-destructive examination in the base material of beltline region. 14
3.3.4. Country position and action (licensee, regulator, justification). 14
3.4. Concrete containment structure and pre-stressed concrete pressure vessels 17
3.4.1. TPR expected level of performance: finding 1...18
3.4.2. Country position and action (licensee, regulator, justification). 18
4. Generic findings related to Electrical cables 18
4.1. Good practice: characterize the state of the degradation of cables aged at the plant 18
4.1.1. Country implementation...18
4.1.2. Country planned action if relevant. 20
4.2. TPR expected level of performance: documentation of the cable ageing management program 21
4.2.1. Country implementation...21
4.2.2. Country planned action if relevant. 22
4.3. TPR expected level of performance: methods for monitoring and directing all AMP-activities..22
4.3.1. Country implementation...23
4.3.2. Country planned action if relevant. 24
4.4. TPR expected level of performance: Systematic identification of ageing degradation mechanisms considering cable characteristics and stressors...25
4.4.1. Country implementation...25
4.4.2. Country planned action if relevant. 25
4.5. TPR expected level of performance: prevention and detection of water treeing 26
4.5.1. Country implementation...26
4.5.2. Country planned action if relevant. 27
4.6. TPR expected level of performance: consideration of uncertainties in the initial EQ 28
4.6.1. Country implementation...28
4.6.2. Country planned action if relevant. 29
4.7. TPR expected level of performance: determining cables' performance under highest stressors...30

4.7.1. Country implementation. 30
4.7.2. Country planned action if relevant. 30
4.8. TPR expected level of performance: techniques to detect the degradation of inaccessible cables 30
4.8.1. Country implementation. 30
4.8.2. Country planned action if relevant. 31
5. All other Generic Findings 31
5.1. Overall Ageing Management Programmes (OAMPs) 31
5.1.1. Good practice: External peer review services. 31
5.1.2. TPR expected level of performance: Data collection, record keeping and international cooperation. 33
5.1.3. TPR expected level of performance: Methodology for scoping the SSCs subject to ageing management. 37
5.1.4. TPR expected level of performance: Delayed NPP projects and extended shutdown. 38
5.1.5. TPR expected level of performance: Overall Ageing Management Programmes of research reactors. 39
5.2. Concealed pipework 40
5.2.1. Good practice: use of results from regular monitoring of the condition of civil structures. 40
5.2.2. Good practice: performance checks for new or novel materials. 42
5.2.3. TPR expected level of performance: inspection of safety-related pipework penetrations. 43
5.2.4. TPR expected level of performance: scope of concealed pipework included in AMPs. 47
5.2.5. TPR expected level of performance: opportunistic inspections. 48
5.3. Reactor pressure vessel 50
5.3.1. Good practice: Hydrogen water chemistry. 50
5.3.2. Good practice: Implementation of a shield. 51
5.3.3. TPR expected level of performance: Volumetric inspection for nickel base alloy penetration. 52
5.3.4. TPR expected level of performance: Non-destructive examination in the base material of beltline region. 53

5.3.5. TPR expected level of performance: Environmental effect of the coolant. 53

5.3.6. TPR expected level of performance: Suitable and sufficient irradiation specimens. ...56

5.4. Concrete containment structure and pre-stressed concrete pressure vessel 57

5.4.1. Good practice: monitoring of concrete structures. 57

5.4.2. Good practice: assessment of inaccessible and/or limited access structures. 58

5.4.3. TPR expected level of performance: monitoring of pre-stressing forces. 60

6. Status of the regulation and implementation of AMP to other risk significant nuclear installations 61

6.1. Board recommendation...61

6.2. Country position and action (fuel cycle facilities, installations under decommissioning, waste facilities, etc.) 62

7. Table: Summary of the planned actions...62

REFERENCES 68

Abbreviations used in this report

Abbreviations	Definition
ACI	American Concrete Institute
AMP	Ageing Management Programme
AMR	Ageing Management Review
ANAV	Ascó and Vandellós Nuclear Power Plants licensee
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATWS	Anticipated transient without scram
BMI	Bottom Mounted Instrumentation
BWR	Boiling Water Reactor
BWRVIP	Boiling Water Reactor Vessel and Internals Project
CEN	Comité de Energía Nuclear
CHUG	Checkworks Users Group
CNAT	Almaraz and Trillo Nuclear Power Plants licensee
CSN	Spanish Nuclear Safety Council
CUF	Cumulative Usage Factor
DBA	Design Basis Accident
DEC	Design Extension Conditions
EAF	Environmental Assisted Fatigue
ECCS	Emergency Core Cooling System
EQ	Environmental Qualification
EPRI	Electric Power Research Institute
ECT	Eddy Current Test
FP	Fire Protection
GALL	Generic Ageing Lessons Learned
GS	CSN Safety Guide
GSI	Generic Safety Issue
IAEA	International Atomic Energy Agency
IGALL	International Generic Ageing Lessons Learned

Abbreviations	Definition
IGSCC	Intergranular Stress Corrosion Cracking
IS	CSN Instruction
LOCA	Loss of Coolant Accident
LR-ISG	License Renewal Interim Staff Guidance
LTO	Long-Term Operation
MRP	Pressurized Water Reactor Materials Reliability Program
NAcP	National Action Plan
NAR	National Assessment Report
NDE	Nondestructive evaluation
NRC	Nuclear Regulatory Commission
OAMP	Overall Ageing Management Programme
OE	Operating Experience
PTS	Pressure Thermal Shock
PWR	Pressurized Water Reactor
PWSCC	Primary Water Stress Corrosion Cracking
RG	US NRC Regulatory Guide
R&D	Research and development
R&D&i	Research and development and innovation
SBO	Station Blackout
SCC	Stress Corrosion Cracking
SGMP	Steam Generator Management Programme
SSC	Structures, Systems and Components
TLAA	Time-limited Ageing Analysis
TS	Technical Specifications
UNESA	Spanish electrical companies association
UT	Ultrasonic Test
VT	Visual Test
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators Association

1. Introduction

In accordance with the Council Conclusions of the 18th March 2019 and the ENSREG decision of the 25th March 2019, countries that participated in the 1St Topical Peer Review (TPR) process should deliver their National Action Plans (NAcPs) for Nuclear Power Plants and Research Reactors by the end of September 2019.

Directive 2014/87/EURATOM recognises the importance of peer reviews as a tool for the on-going improvement of nuclear safety. For this reason it provides as follows in its article eight:

> *The member States shall ensure the following in a coordinated manner:*
>
> *a. that a national assessment be carried out, based on a specific issue relating to the nuclear safety of nuclear facilities located in their respective territories;*
>
> *b. that all member States be invited to the national assessment peer review mentioned in letter a), along with the Commission, to attend as an observer;*
>
> *c. that adequate measures be adopted for the tracking of the respective results of the peer review process;*
>
> *d. that reports on the process be published, along with the main results when these become available.*

The member States shall ensure the existence of provisions allowing the first topical peer review to be initiated in 2017, with subsequent peer reviews performed at least once every six years.

The subject chosen for this first review has been the management of nuclear power plant ageing.

In compliance with this mandate, the CSN drew up by the end of 2017 the National Assessment Report (NAR), including analysis of the Overall Ageing Management Programme applicable to the Spanish nuclear power plants on the basis of the regulations in place in Spain, as well as its specific application for the systems, structures and components selected in the specification, which were the following four areas of focus:

1. Electrical cables
2. Concealed piping
3. Reactor pressure vessels
4. Concrete containment structures.

The areas of focus “calandria” and “pre-stressed concrete pressure vessel” are not applicable to Spain due to the existing NPP designs.

In accordance with the general process defined by ENSREG, between January and April 2018, the NAR reports prepared by the different participating countries (19 countries) were reviewed. The number of questions to Spain was 134, out of a total of 2329 questions asked. After this review, and considering the answers provided by the different countries, the established expert groups identified a series of preliminary findings, which would be discussed during the workshop held in Luxembourg between May 14 and 18, 2018, scheduled within the general TPR process.

As a result of the Workshop, the TPR Steering Committee (Board) issued the final report of the TPR that was approved in the plenary of ENSREG on the 04th of October of 2018. Next to the final report, a report was published, gathering the "findings" identified by countries for the general area of ageing management and for all the thematic areas selected in the TPR, with the exception of cables.

It is stated in the Directive 2014/87/Euratom recital 23, 3rd paragraph:

> *Member States should establish national action plans for addressing any relevant findings and their own national assessment, taking into account the results of those peer review reports.*

More recently, at the last meeting of the ENSREG Plenary (25th of March, 2019) it was agreed that all countries participating in the TPR should prepare their national action plans (NAcPs) following a standard format across all participating countries, which should be sent before the end of September 2019.

This NAcP is intended to enable progress to be monitored against the range of findings emerging from the TPR and it will be also used in future TPR follow-up activities by ENSREG, such as communicating results of implementation in December 2023.

In order to draw up the NAcPs, the CSN has requested each of the Spanish nuclear power plants to produce a report responding to the aforementioned standard format by the 31st of August. This request materialised through the sending of letters to each licensee [1].

As a result, the licensee of each of the nuclear power plants has performed a detailed analysis of the findings and has subsequently submitted a report on this analysis to the Spanish Nuclear Safety Council (CSN)

In keeping with the schedule approved by ENSREG, the CSN considered that these reports should be submitted prior to August 31st 2019, these having been received by way of the letters [2].

On the basis of the reports submitted by the licensees, the CSN has drawn up the National Action Plan that has been approved by the Council during its plenary meeting on 25th September 2019.

2. Findings resulting from the self-assessment

This section is dedicated to the findings from the self-assessment as expressed in the National Report (NAR).

In the following subchapters, areas for improvements and challenges identified in the National Assessment Report chapter 02.7 for OAMP and chapters 0X.3 "Regulator's assessment and conclusion on ageing management of XX" are addressed. X is the NAR section number for cables, concealed pipework, RPV and concrete containment.

2.1. Overall Ageing Management Programmes (OAMPs)

In the Spanish National Assessment Report, no areas for improvement nor challenges were identified.

Spanish self-assessment is in line with the conclusions obtained during the workshop, since in the report published gathering the "findings" identified by countries one good practice and three good performance were considered to Spain in the chapter 02 "Overall Ageing Management Programmes (OAMPs)".

2.1.1. State finding n°1 (area for improvement or challenge) from the self-assessment.

Left intentionally blank.

2.1.2. Country position and action on finding n°1 (licensee, regulator, justification).

Left intentionally blank.

2.2. Electrical cables

2.2.1. State finding n°1 (area for improvement or challenge) from the self-assessment.

In the Spanish NAR, it was stated the following:

The surveillance of cables located inside metallic ducts or cable trays and consequently not accessible for visual inspection should be improved.

2.2.2. Country position and action on finding n°1 (licensee, regulator, justification).

In the Spanish NAR, it was stated the following:

These issues might be the subject of future research activities aimed at determining effective ageing surveillance techniques for this type of cables.

Spanish self-assessment is in line with the challenge obtained during the workshop addressed in chapter 4.8 "Techniques to detect the degradation of inaccessible cables", where country position is addressed.

2.3. Concealed pipework

2.3.1. State finding n°1 (area for improvement or challenge) from the self-assessment.

In the Spanish NAR, it was stated the following:

As regards buried piping embedded in concrete, or piping penetrating walls, for which any ageing effect in their external surface has not been identified as a result of the AMR process, the CSN considers that licensees must perform an in-depth analysis of this issue.

2.3.2. Country position and action on finding n°1 (licensee, regulator, justification).

In the Spanish NAR, it was stated the following:

Spanish plants will verify, through visual inspections, the non-existence of aging effects, through visual examinations of the pipe in the transition area where the pipes penetrates the concrete.

Spanish self-assessment is in line with the finding obtained during the workshop addressed in chapter 5.2.3 “TPR expected level of performance: inspection of safety-related pipework penetrations”, where country position is addressed.

However, according to the additional information provided by the licensees, in the chapter 5.2.3, due to the type of concrete used in the Spanish NPPs, no active degradation mechanisms is postulated based on the GALL report (NUREG-1801 rev. 2), and no actions are planned.

2.4. Reactor pressure vessel

In the Spanish National Assessment Report, no areas for improvement nor challenges were identified.

2.4.1. State finding n°1 (area for improvement or challenge) from the self-assessment.

Left intentionally blank.

2.4.2. Country position and action on finding n°1 (licensee, regulator, justification).

Left intentionally blank.

2.5. Concrete containment structure and pre-stressed concrete pressure vessel

In the Spanish National Assessment Report, no areas for improvement nor challenges were identified.

2.5.1. State finding n°1 (area for improvement or challenge) from the self-assessment.

Left intentionally blank.

2.5.2. Country position and action on finding n°1 (licensee, regulator, justification).

Left intentionally blank.

3. Country specific findings resulting from the TPR

This section is dedicated to the country specific findings resulting from the Topical Peer Review [NB: findings related to cables were not allocated by the TPR].

In the subsections below, the country position for each finding is presented through a summary of the actions that are planned to address it.

3.1. Overall Ageing Management Programmes (OAMPs)

No areas for improvement have been allocated to Spain in the chapter "Overall Ageing Management Programmes (OAMPs)".

Therefore, the information related to the other generic findings allocated to Spain in this chapter as "good practice" or "good performance" are addressed in chapter 5 of this report.

3.1.1. TPR expected level of performance: finding 1.

Left intentionally blank.

3.1.2. Country position and action (licensee, regulator, justification).

Left intentionally blank.

3.2. Concealed pipework

No areas for improvement have been allocated to Spain in the chapter "Concealed pipework".

Therefore, the information related to the other generic findings allocated to Spain in this chapter as "good performance" are addressed in chapter 5 of this report.

3.2.1. TPR expected level of performance: finding 1.

Left intentionally blank.

3.2.2. Country position and action (licensee, regulator, justification).

Left intentionally blank.

3.3. Reactor pressure vessel

In this chapter, two (2) areas for improvement have been allocated to Spain, related to the reactor pressure vessel. These are the following:

3.3.1. TPR expected level of performance: Volumetric inspection for nickel base alloy penetration.

Nickel alloy components are sensitive to primary water stress corrosion cracking (high tensile stresses, corrosive environment and susceptible material) in PWR plants. There has been Operational Experience of leakage in Bottom Mounted Instrumentation (BMI) penetrations and failure of those components. As noted by the TPR, it is necessary to implement volumetric in-service inspections to detect the occurrence of a crack as soon as possible.

Therefore, it is planned to implement an inspection programme based on the requirements established in MRP-372 rev. 1.

3.3.2. Country position and action (licensee, regulator, justification).

Licensees

Almaraz NPP

Currently, periodic visual examinations required by ASME Code Case N-722-1 are being performed in BMIs.

Additionally, as a consequence of this TPR, the following inspections will be carried out:

- Volumetric inspection (UT and ECT) from the inner diameter during the refuelling outages R127 (March 2020) and R226 (March 2021) for unit 1 and 2, respectively, before LTO.
- Visual inspection of the J-weld, complementary to the main UT-ET inspection, during refuelling outages R128 (October 2021) and R227 (November 2022) for unit 1 and 2, respectively.

Ascó and Vandellós II NPPs

Currently, periodic visual examinations required by ASME Code Case N-722-1 are being performed in BMIs.

Additionally, as a consequence of this TPR, ANAV has planned a volumetric inspection of the BMI welds before LTO:

- Ascó unit 1 in the refuelling outage R129 (2023).
- Ascó unit 2 in the refuelling outage R228 (2023)
- Vandellós II before LTO (2028).

Cofrentes NPP

Not applicable (BWR design).

Trillo NPP

This NPP RPV by design (German) does not have base penetrations.

Regulator

Almaraz, Ascó and Vandellós II NPPs: CSN considers acceptable the licensees’ proposals of performing volumetric and visual inspections in order to know the state of the nickel base alloy penetrations.

Trillo NPP, by design, does not have base penetration and Cofrentes NPP is a BWR type so this finding it is not applicable.

Justification

CSN considers that, if no evidence of cracks is detected as result of the proposed inspections near to the 40 years of operation, performing the one-time inspection provides reasonable assurance of the state of these penetrations.

Nevertheless, in case of detecting any defect as a result of the inspections performed as a consequence of this TPR, an additional inspection plan would be implemented.

As it is mentioned in the NAR, table 05.9 chapter 5, every two (2) refuelling outages the bare metal of the vessel BMI penetrations are visually examined in accordance with the requirements of the ASME Code Case N-722-1.

Action

In order to comply with the requirements established in MRP-372 Rev. 1, Almaraz, Ascó and Vandellós II NPPs will carry out volumetric and visual inspections.

See chapter 7, Table “Summary of the planned actions”.

3.3.3. TPR expected level of performance: Non-destructive examination in the base material of beltline region.

Comprehensive NDE is performed in the base material of the beltline region in order to detect defects.

3.3.4. Country position and action (licensee, regulator, justification).

Recently, some NPPs with RPV made from forged rings, have detected defects in the base material of their RPV (hydrogen flaking). Despite the fact that these defects were not related to any active degradation mechanism, many efforts have been devoted these last years in order to demonstrate that the structural integrity of the RPV is fully maintained. The origin of hydrogen flakes was due to the manufacturing process. The diagnosis of hydrogen flaking, initiated during manufacturing in macro-segregated areas, was confirmed after thorough investigation, based on a root cause analysis of all potential causes. It was also concluded that the identified indications were stable.

The licensees reference the WENRA document compiling the activities carried out by the Member States, following the recommendations related to the inspection findings in the RPVs of Belgian reactors (Tihange 2 and Döel 3). In particular, the following is stated:

In this document, WENRA acknowledges that RPVs made from plates are much less prone to the "flaking" phenomena, and therefore this kind of vessels is excluded from the scope of the recommendations to inspect its base material. As an example, the document states: "Plate material is generally considered much less prone due to smaller ingot sizes and higher degrees of deformation during the rolling operation compared to forging. This results in a less sensitive microstructure. Therefore, components made from plates are outside the scope of further analyses and are not addressed in the recommendations by WENRA referred to below."

Regarding the analyses carried out by the U.S. nuclear industry in response to the findings in the RPVs of Belgian reactors (activities within the EPRI Materials Reliability Program, included in documents MRP-367 and MRP-430), it must be taken into account that no recommendations were identified for the base material of RPVs made from plates.

Furthermore, no instances of nuclear plants with RPVs made from plates have been found in which a base material inspection in the beltline region was carried out as a result of the experience from Belgian reactors.

Licensees

The beltline materials in the Westinghouse design PWR vessel (Almaraz I & II, Ascó I & II and Vandellós II NPP) are made from welded plates. Therefore, since the manufacturing process is different from that of the materials in the affected plants, and these defects do not appear in service, the PWR-W licensees consider that the Operating Experiences are not applicable and no further actions are needed.

In the case of KWU PWR vessel (Trillo NPP), the beltline is made by forged rings of 20 MnMoNi 55 (a material similar to ASME SA-508, class 3). This vessel base metal has been already inspected with satisfactory results. The inspection was closed in the presence of the Regulatory Body (CSN).

In the case of the Cofrentes NPP RPV, none of the circumstances that could cause the existence of such indications in the beltline base material of the ferrules are presented:

Circumstances that makes a RPV prone to have indications.	Cofrentes NPP justification.
PWR design RPV.	Cofrentes NPP is a BWR design, and its RPV has lower thickness.
Forge manufacturing.	Cofrentes NPP RPV is made of plates welded axially.
Rings made of carbon steel SA-508.	Cofrentes NPP is made of carbon steel SA-533.
Inspections and tests made during manufacturing and prior to the start-up inconclusive or with inadequate records.	In Cofrentes NPP there have been 3 volumetric inspections of the base material performed with different techniques and procedures and performed by 3 different companies and no indications have been detected.

Therefore, according to the analysis performed, it can be concluded that volumetric inspections to the whole beltline base material are not necessary.

Regulator

All available documentation about the manufacturing of the reactor, scope and results of pre-service and in-service (UT) was checked with an acceptable outcome. However, taking into account that this material could theoretically be affected by hydrogen flakes, although the manufacturing process is different to D&T, Trillo NPP inspected the base metal area during the RO in spring 2018, by UT techniques with capability to detect these flaws with satisfactory results.

For the rest of the NPPs the shells have been manufactured by material plates, specified by ASTM SA-533 Grade B, Class 1, which are joined by means of longitudinal and circumferential welds.

In case of Santa María de Garoña NPP, at the end of 2014, different samples of base material from all RPV rings were examined by UT from the inside with both straight beam and angle beam (45º), using recording and acceptance criteria, according to manufacturing code (ASME III). No remarkable indications similar to flakes were found. Currently Santa María de Garoña NPP is in the definitive shutdown situation.

Justification

According to the WENRA report “Updated Report Activities in WENRA countries following the Recommendation regarding flaw indications found in Belgian reactors (2017)” [4] it is stated that:

Plate material is generally considered much less prone due to smaller ingot sizes and higher degrees of deformation during the rolling operation compared to forging. This results in a less sensitive microstructure. Therefore, components made from plates are outside the scope of further analyses and are not addressed in the recommendations by WENRA referred to below.

All Spanish NPPs except Trillo NPP, have their RPV made by plates, so they were considered not susceptible to hydrogen flakes. Trillo NPP has performed the inspection of the base metal during refuelling outage in spring 2018 with satisfactory results.

However, according to TPR Final Report, the CSN considers necessary to take some additional action in order to study potential defects that might affect the base material of the vessel, requiring the licensees to carry out such analysis and a technical justification, taking into account the manufacturing documentation, the operating experience, the results of the inspections and the international state of art.

Action

This action is required to all Spanish NPPs with exception of Trillo NPP.

Step 1: Carry out an analysis of the potential defects that could affect the base material of the “beltline” of the reactor vessel and, on the basis thereof, submit to the CSN a technical justification for the non-affectation of the integrity of the vessel by such defectology, which may be based, among others, on manufacturing documentation, results of inspections performed, operational experience and the international state of art.

The analysis must be completed one year before the scheduled date for the planned inspection of the vessel for compliance with the applicable requirements in the current inspection interval, unless there is substantiated justification of the feasibility of the deadlines, in accordance with the planning of cycles and specific refuelling of the plants.

Step 2: If such technical justification would not allow the possible affectation of the vessel base material to be excluded, licensee shall submit an inspection plan of the base material (beltline zone) to be performed preferably at the next scheduled inspection of the vessel referred to in Step 1, or duly justified alternative scheduling.

See chapter 7, Table “Summary of the planned actions”

3.4. Concrete containment structure and pre-stressed concrete pressure vessels

No areas for improvement have been allocated to Spain in the chapter “Concrete containment structure and pre-stressed concrete pressure vessel”.

Therefore, the information related to the other generic findings allocated to Spain in this chapter as “good practice” or “good performance” are addressed in chapter 5 of this report.

3.4.1. TPR expected level of performance: finding 1.

Left intentionally blank.

3.4.2. Country position and action (licensee, regulator, justification).

Left intentionally blank.

4. Generic findings related to Electrical cables

In the subsections below, Spanish position for each finding related to electrical cables is detailed, and a summary presented of the actions that are planned to address it.

4.1. Good practice: characterize the state of the degradation of cables aged at the plant

Cables are aged within the actual power plant environment and tested to assess cable condition and determine residual lifetime.

4.1.1. Country implementation.

Licensees

<u>Ascó and Vandellós II NPPs</u>

Since the start of commercial operation, Ascó NPP and Vandellós II NPP have been running "On going Condition Monitoring Programmes on cables", focused on monitoring and evaluating the physical condition of electrical cables aged at the plant. These programmes are based on a series of inspections and tests conducted on environmentally qualified cable samples located in plant areas with severe environments (plant deposits), inside and outside of containment. In this way, ageing of the cable sample materials can be periodically assessed. Below is a summary detailing the most relevant tasks of this Programme:

At Vandellós II NPP, the scope of its on-going programme, applies to safety-related cables in harsh environment. The Programme objective is to monitor the degradation conditions of installed cables, and comparing them with the results of a set of tests applied to artificially aged cables. This programme is based on the analysis of evolution of cable materials condition, using different types of electrical and mechanical tests. This is done by assessing the results and trends of destructive and non-destructive tests, conducted on the cable samples that are removed from the deposit at different time intervals during operation

Main aspects of the Programme, performed in Vandellos II NPP are the following:

- Cable samples were installed in plant deposits (inside and outside of containment), from April to November 1988. The types of cable samples were representative of the cable plant population and include: Class 1E, medium and low-voltage power, control, instrumentation and special cables (mineral insulation cables were excluded).
- Cable sample locations selected according to different criteria:

- Ambient temperature during normal plant operation higher or equal to 104° F (40°C).
- High radiation dose rate during normal plant operation (e.g., equal to or greater than 28 Rad/hour).
- Possibility of temperature increases in some plant operation modes or due to valve or pump leaks.
- Concentration of existing cables of all types.
- Existence of field instrumentation (radiation, temperature, humidity monitors) near cables
- Accessibility, and easy installation of cable samples in the existing trays.

- Monitoring of environmental conditions on cable sample locations, was applied.
- Initial Testing were applied to generate design data (baseline) to be used as a reference in the subsequent cable test
- Removal and testing of cable samples is performed at specified intervals, every 5 or 10 years.
- Characterization Tests performed on the samples:
  - Mechanical tests and measurement of physical characteristics: cable diameter, Insulation thickness, and Elongation at Break tests on cable insulation.
  - Electrical tests: Insulation Resistance (IR) and polarisation index.
  - Dielectric test: cable samples rolled in mandrels and submerged in water applying 80 V/mm of insulation thickness, during 5 minutes.

At Ascó NPP, the existing "Condition Monitoring programme" has been conducted since the beginning of plant operation, aiming at monitoring the degradation of cables aged inside the plant. The programme includes monitoring and testing activities on samples of cables installed in existing trays, together with energised and in-service cables. Samples are selected from amongst the 1E (Environmentally Qualified) medium and low-voltage power, control and instrumentation cables, located in harsh environments areas inside the plant.

Different types of electrical tests (insulation resistance, polarization index and leakage current) are conducted periodically and its results are correlated with reference values taken in previous tests and inspections.

The programme consists in the periodic testing (yearly) of two MV cables (6.9 kV) located outside of containment, and of 28 low-voltage (380 kV) and I&C cables located inside containment, every refuelling outage

Tests performed are insulation resistance measurement and Leakage current - direct voltage for 1, 3 and 10 minutes. The test voltages depend on the type of cable tested (MV, LV power, control or instrumentation).

Almaraz, Trillo and Cofrentes NPPs

Each of these NPP have developed and implemented a complete set of cable ageing management activities, according to requirements of the Spanish regulations (IS-22). A summary of these activities is presented in the Spanish NAR of the TPR.

Various activities are carried out by these NPPs to monitor and evaluate the ageing condition of its installed cables. Those activities are included in 3 types of AMP, that are based on the 10 attributes of the corresponding AMP, XI-E1, XI-E2 and XI-E3, defined in the GALL report.

- AMP type 1: “Electrical Cable Monitoring”
- AMP type 2: "Instrumentation Cable Monitoring"
- AMP type 3: "Inaccessible Power Cable Monitoring"

Monitoring of the condition of the cables, in accordance with the above AMPs, is based on inspections of accessible cable sections for assessing the condition of the cable through visual and tactile inspection. Additionally, mechanical tests if required, and electrical tests, are performed to check the insulation capability in both, accessible and inaccessible sections, such as cables in trays or in conduits.

Almaraz, Trillo and Cofrentes NPPs do not have “cable deposits” inside the plant so, they have not developed such formal programmes to determine the condition of cables aged within the actual plant environment and to assess its residual lifetime.

Almaraz, Trillo and Cofrentes NPPs considered that the above activities are enough to assess the ageing degradation of the installed cables, and manage its residual lifetime.

4.1.2. Country planned action if relevant.

Licensees

Almaraz, Trillo and Cofrentes NPPs

According to the activities currently performed, licensees considered that no further actions are needed.

Ascó and Vandellós II NPPs

As previously indicated, these licensees are currently running “On going Condition Monitoring Programmes” on cables located in plant deposits so, no further action is needed.

Regulator

As previously described, Vandellós II and Ascó NPPs, have implemented formal on-going programmes on cable samples aged in plant deposits.

Due to no cable deposits exist in Almaraz, Trillo and Cofrentes NPPs, such formal on-going programmes on cables, have not been performed in the past. However, naturally aged cable samples from these plants removed from service, have been tested in the Phase 2 of the Coordinated Research Program PCI-ES-24, developed in 2003 by the CSN and UNESA (Spanish Electricity Industry Association). These samples were tested with different techniques (mechanical, chemical and electrical) obtaining correlation factors between the test results and the degradation of the aged cables.

Additionally, and for developing the industry Research Program ES-27, that is currently being carried out in Spain by CEN, cable samples taken from Almaraz, Trillo and Cofrentes NPPs, have been currently removed from service and will be aged and LOCA tested, to check its qualified condition.

For the above reasons, CSN considers that Spanish NPPs have performed different tests and activities on aged cables samples removed from service, that provide information for assessing the degradation condition and the residual lifetime of the cables

Additionally, Spanish NPPs follow the proposed AMPs in GALL report, fulfilling the Spanish ageing management rule IS-22 (based on the American regulations).

As a consequence, CSN considers that no additional actions are to be required related to this good practice.

4.2. TPR expected level of performance: documentation of the cable ageing management program

The AMP is sufficiently well-documented to support any internal or external reviews in a fully traceable manner.

4.2.1. Country implementation.

As detailed in this Expected Level of Performance, there are many ways that the plants have adjusted to document the cable ageing management programmes.

Licensees

For all the Spanish NPPs and with slight differences, the information detailed below is included in the set of documents regarding AMPs or in their supporting documents:

- Identification or types of cables (scope and selection)
- Manufacturer Documentation
- Insulation and covering materials

- Cable Type Characteristics
- Applicable degradation mechanism
- Diagnostic methods
- Corrective actions
- Operating Experience
- Measurement methods
- Periodic Results Reviews

Each AMP Manual summarises the most relevant information of the ageing management programme and provides indications about the application, frequency and monitoring of the results of the inspections and surveillance that constitute it.

If any critical data is not documented, conservative positions are adopted in relation to it. Documentation generated within the framework of cable ageing management and contained in the documentation above, is periodically reviewed to keep it updated in accordance with the national regulatory aspects or plant requirements.

In addition, each cable AMP is complemented with a periodic monitoring report of the results of implementing the review, testing and monitoring activities that constitute it, which includes a review of the most recent operating experience and the modifications that the programme has undergone during the period in question. This report is prepared every three years.

Therefore the Spanish NPPs considered that the structure and content of the documentation prepared within the framework of the Lifetime Management Plan in each plant contains the necessary and sufficient information to fully implement cable ageing management.

4.2.2. Country planned action if relevant.

Licensees

Taking into account what has been previously indicated, no actions are planned by Spanish licensees related to this subject.

Regulator

According to the above information CSN agree that no further actions are needed in the Spanish NPPs related to this "Expected Level of Performance".

4.3. TPR expected level of performance: methods for monitoring and directing all AMP-activities

Methods to collect NPP cable ageing and performance data are established and used effectively to support the AMP for cables.

4.3.1. Country implementation.

Licensees

Almaraz and Trillo NPPs

The inspections and tests to be carried out on the cables at Almaraz and Trillo NPPs, based on the programme activities, as well as their results, are included in the corresponding monitoring reports.

There is also a Database that includes the scope of the programmes, containing the necessary data on the cables in question, as well as the associated monitoring activities, frequency, applicable procedure and results of the inspections and tests (directly or by reference to the monitoring report). In addition, the results of application of these activities are included in each AMP monitoring report.

Ascó and Vandellós II NPPs

At Ascó NPP and Vandellós II NPP, the inspections and tests to be conducted on cables according to the activities required by the programmes, as well as their results, are included in the Technical Management Database (GESTEC), just like all other electric and non-electric components.

This Database integrates and relates the component tags with the associated activities, frequencies, applicable procedures and inspection or test results (directly or by referring to the results report). Additionally, ANAV's in-plant Operating Experience modules are interrelated with the GESTEC component tags.

Having other different databases in parallel to GESTEC to include only certain types of components (cables) is not considered to be necessary or convenient, given that the organisation functions with work orders exclusively generated by GESTEC, in accordance with the organisation's Quality Assurance processes.

Therefore, there are adequate resources and means to assure that the management programmes' activities are scheduled, performed and documented, and they are integrated in the corporate Technical Management system (GESTEC). Accordingly, compliance with the requirements of the AMPs and the Quality Assurance requirements is ensured, and the information required to implement the periodic monitoring reports for each programme is provided.

Cofrentes NPP

At Cofrentes NPP, cabling inspections and tests, as well as their results, are included (similarly to other electrical and non-electrical components) in the Maintenance Management Database (SAP-GESMAN), in line with programme activities.

This Database integrates and connects, among others, electrical components with cables connected to linked monitoring activities, frequencies, applicable procedures and inspection and test results (directly or by referring to the results report). Additionally, applicable results from these activities are included within the follow-up report performed for each cable AMP.

Cofrentes NPP has a cable layout database which was recently expanded to include cable ageing management aspects, such as cable features and materials, environmental conditions in cable locations, as well as monitoring activities and their results. This database, currently being reviewed and validated, is expected to serve as a control tool that supports future cable ageing management at Cofrentes NPP.

In short, Cofrentes NPP currently has processes and means to ensure activities within cable-related management programmes are properly coordinated by the integrated Maintenance Management system (SAP-GESMAN), enabling programme activities to be scheduled, implemented and their results documented so that accurate programme feedback can be obtained. However, cables are often not recorded as an individual database input component; instead, they are associated to the main instrument or electrical equipment they supply or are connected to. To address this issue, the cable layout database was expanded so that cables can appear as individual input components, with the aim to provide more accurate information on the activities and condition of cables included within the programme scope.

4.3.2. Country planned action if relevant.

Licensees

<u>Almaraz and Trillo NPPs</u>

No action is planned, as previously indicated.

<u>Ascó and Vandellós II NPPs</u>

No actions are planned, taking into account what has been previously indicated.

<u>Cofrentes NPP</u>

As an improvement action, Cofrentes NPP proposes the placing into service of an operational cable database that includes relevant ageing management information for each cable, as well as results obtained during individual cable monitoring activities. The tentative database implementation programme foresees full database operability in late 2020. See chapter 7, Table “Summary of the planned actions”.

Regulator

CSN agree that Spanish NPPs follow the proposed AMPs in GALL report, fulfilling the Spanish ageing management rule IS-22 (based on the American regulation). On the other hand, all plants have developed databases, to manage the information related to cable ageing.

For the above reasons CSN considers that Spanish licensees' answers are in line with what is expected from the TPR, and therefore no further actions are to be required related to reach this Expected Level of Performance.

4.4. TPR expected level of performance: Systematic identification of ageing degradation mechanisms considering cable characteristics and stressors

Degradation mechanisms and stressors are systematically identified and reviewed to ensure that any missed or newly occurring stressors are revealed before challenging the operability of cables.

4.4.1. Country implementation.

Licensees

The identification of the ageing degradation mechanisms and effects applicable to electrical cables at the Spanish NPPs are not based only on the stressors described in the original cable qualification processes.

Just like for all other mechanical, electrical and structural components, internal and external operating experience on cables is periodically and systematically reviewed with the aim of evaluating the causes of any event that may occur. If new failure modes are identified, after technically evaluating the severity of the assessed events, the need to change the activities is analysed.

One of the objectives of the operating experience analysis for lifecycle management is to identify component ageing degradation and/or failure mechanisms. This enables the comprehensiveness of the existing analyses to be confirmed or reveals the need to update existing documentation and activities for the effects to be identified before the affected components lose their function.

4.4.2. Country planned action if relevant.

Licensees

No actions are planned by Licensees for any of the Spanish NPPs, taking into account what has been previously indicated.

Regulator

CSN considers that licensees' answers are in line with what is expected from the TPR due to:

1. The cable AMP implemented at the Spanish NPPs are based on the model AMPs defined in GALL report, where the 10th attribute is "operating experience".
2. The Spanish ageing management rule IS-22 requires in the article 4.1 the following:

*The activities and conclusions related to ageing management, as well as the necessary organisational aspects, are incorporated in an Overall Ageing Management Programme (OAMP) that the licensee must review periodically, at a maximum every 4 years, according to changes in regulations, physical design modifications of the plant, **results of the review of operating experience** and industrial research programmes related to ageing management.*

Due to all aforementioned reasons, CSN considers that no further actions are to be required related to this Expected Level of Performance.

4.5. TPR expected level of performance: prevention and detection of water treeing

Approaches are used to ensure that water treeing in cables with polymeric insulation is minimised, either by removing stressors contributing to its growth or by detecting degradation by applying appropriate methods and related criteria.

4.5.1.Country implementation.

Licensees

This Expected Level of Performance describes the importance of implementing preventive measures for detection of water treeing degradation in submerged cables.

Almaraz and Trillo NPPs

Almaraz and Trillo NPPs apply the ageing management programme AMP "Monitoring of Inaccessible Power Cables" to manage the effects of ageing in power cables that may be submerged for a prolonged period of time (inaccessible).

As a preventive measure to avoid the appearance of “water treeing” in medium voltage cables carried through buried conduits, all electrical conduits outside buildings are inspected, reviewed, cleaned and repaired annually, evaluating the state of the manholes and conduits. Additionally the condition and operation of the waste-water/drainage systems and the existence of water, dirt and deterioration in the conduits, is periodically checked.

The cables AMP, also contains a series of periodic inspection requirements that take into account the techniques described above, which enable water treeing like defects to be detected in the cables tested.

As the programme currently contains preventive measures and tests to detect the specified mechanisms, it is considered that the programme is valid without additional changes.

Ascó and Vandellós II NPPs

At Ascó NPP and Vandellós II NPP, there is a specific AMP for managing ageing effects on power cables that may be submerged for an extended period of time (inaccessible).

This programme contains preventive measures to avoid these cables from being exposed to high humidity levels for an extended period. Thus, after rain episodes, absence of water, cleanliness and the general conservation state of cables is checked, in service duct openings, banks and seals, amongst other components. In the event of water being detected, it is removed and then dried. Additionally, class 1E electrical ducts and galleries are visually inspected (directly or indirectly) on an annual basis, checking for presence of water and mechanical damage. If necessary, the relevant actions are implemented to reduce humidity in contact with the cables.

Additionally, the already mentioned programme for inaccessible and potentially submerged cables contains a series of periodic inspection requirements which include, amongst other techniques, the implementation of tests such as Polarisation Index (IP) and, if appropriate, Time Domain Reflectometry (TDR), which enable water treeing type defects to be detected in tested cables.

Since the programme currently includes preventive measures and tests to detect loss of Insulation Resistance due to treeing, the programme is deemed to be appropriate without additional changes.

Cofrentes NPP

Cofrentes NPP has a specific cable AMP to manage ageing-related effects affecting power cables submerged over long periods of time (inaccessible). This programme contains preventive measures aimed at preventing these cables from being exposed to high humidity levels. Operations procedure instructions are followed to inspect external trenches and periodically (every 15 days) confirm proper performance of dewatering pumps in external mechanical and electrical galleries and water boxes, ensuring them remain water-free and, in turn, protecting their components from degradation.

On the other hand, this AMP for potentially-submerged cables includes a set of periodic inspection requirements involving, among other, the implementation of tests such as the Polarization Index to detect cables affected by water treeing.

Since this programme already includes preventive measures and tests, for detection of the aforementioned mechanisms, the programme is rendered valid without the need for additional changes.

4.5.2. Country planned action if relevant.

Licensees

No actions are planned by any of the Spanish NPPs, taking into account what has been previously indicated.

Regulator

Spanish NPPs are applying the aforementioned AMPs, based on the model AMP.XI.E3 included in NUREG-1801 rev 2, that manages water treeing formation and that requires as preventive action periodic inspections at least annually. For this reason CSN considers that those licensees' answers are in line with what is expected from the TPR, and therefore no additional actions are to be required related to this Expected Level of Performance.

4.6. TPR expected level of performance: consideration of uncertainties in the initial EQ

The accuracy of the representation of the stressors used in the initial Environmental Qualification is assessed with regard to the expected stressors during normal operation and Design Basis Accidents.

4.6.1. Country implementation.

Licensees

This Expected Level of Performance requires to check, whether the sources of uncertainties in the original environmental qualification processes, pose a risk to cable safety with regard to operation during and after a design basis accident. In this sense, specific processes of the ageing and accident simulation phases are identified, for which there might be non-conservative assumptions.

In Spain, the NPP industry project ES-27 "Monitoring and evaluation of the condition of electric cables in Spanish NPPs" has been running for several years, with the objective of checking the qualified condition of a sample of cables with Environmental Qualification requirements that, as representative of large families of electric cables, have been in service and installed at the plants since commissioning.

After the selected cables have been removed, a series of precautions are planned during the testing phase in order to reduce uncertainties in the processes as much as possible in a manner consistent with recent documentation issued as part of this framework. The most relevant considerations planned for this are the following:

- Given the difficulty of implementing combined accelerated ageing (thermal and radiological), it will be executed sequentially, first radiologically and subsequently thermally (as specified in document IAEA NP-T-3-6 "Assessing and Managing Cable Ageing in Nuclear Power Plants).
- Low ageing acceleration factors will be applied. Unlike several tests which formed part of the original qualification processes, the dose rates and ageing temperature will be relatively low, so that the degradations induced in the electric cables will be as realistic and as close as possible, to the most unfavourable conditions of the cables installed in plant.

- Very low activation energy values of the materials to be aged are adopted (≤ 1.1 eV), so that the ageing caused is higher than that actually experienced by the cables in the field.
- In the post-LOCA test phase, the chamber will be supplied with air so as not to prevent cable oxidation processes.

It should also be noted that, as the ongoing project is common to all plants, the accident profiles embrace all of them, so that the pressure and temperature conditions in LOCA as well as the radiation doses in ageing and accident conditions are greater than expected in the plants in general.

4.6.2. Country planned action if relevant.

Licensees

The plan to address this Expected Level of Performance is to continue with the ES-27 project in order to:

- Obtain cable-samples that have been installed and naturally aged in the plant during operation, and subject them to subsequent accelerated ageing, at different times up to the end of 60 years, as well as the corresponding inspections and tests in the different steps.
- After the samples have been aged up to 60 years subject them to LOCA test and conduct the inspections and functional tests applicable to check the qualified condition during the remaining operation time.

If the functionality of the cables is verified during and after the LOCA defined for the test, it can be reasonably assumed that the original qualification process, in accordance with IEEE 383-74, maintains safety margins that cover the uncertainties associated with the testing processes carried out during commissioning.

Regulator

CSN is in process of participating actively in this R&D project. Nevertheless, up to now CSN has been participating only as observer, being informed by the evolution of the R&D project with periodical meetings with the NPP industry. In the final specification on how the tests are going to be performed, the planning estimates around 48 months to have the final results. That is, approximately by the end of 2024.

Since Spanish NPPs industry is developing a R&D project with the aim of reducing uncertainties and is in line with what is expected from the TPR, CSN considers that the aforementioned R&D project is enough to reach this Expected Level of Performance, at least at a national level. See Chapter 7, Table “Summary of the planned actions”.

4.7. TPR expected level of performance: determining cables' performance under highest stressors

Cables necessary for accident mitigation are tested to determine their capabilities to fulfil their functions under Design Extension Conditions (DEC) and throughout their expected lifetime.

4.7.1. Country implementation.

Licensees

No answer is applicable until the aim of this Expected Level of Performance will be clarified. In this respect, according to the Spanish representatives in the TPR Workshop cable sessions, no reference has been found in the documentation material regarding this Expected Level of Performance.

4.7.2. Country planned action if relevant.

Licensees

Response is not applicable until the purpose and scope of this Expected Level of Performance will be clarified.

Regulator

According to the design basis of Spanish NPPs, electrical cables shall be qualified to fulfil their safety functions, under the worst expected environmental condition resulting from DBA. In the case of cables, these worst conditions correspond to the LOCA accident.

CSN agrees with licensees that it is not clear what is the aim and scope of this Expected Level of Performances, since "design extension conditions" have not been defined.

4.8. TPR expected level of performance: techniques to detect the degradation of inaccessible cables

Based on international experience, appropriate techniques are used to detect degradation of inaccessible cables.

4.8.1. Country implementation.

Licensees

The cable AMPs at Spanish NPPs take into account different documentary sources to determine the techniques to be used in the electrical cable programmes.

Specifically, for the inaccessible cables, the following inspection techniques are applied in the Spanish NPPs cable ageing programs:

- For medium-voltage cables:
  - Insulation resistance
  - Dielectric loss

  - Polarisation index
  - Time Domain Reflectometry (indication verification)
  - Partial discharges test
- For low-voltage cables:
  - Insulation resistance
  - Polarisation index
  - Impedance test.

It is also worth highlighting the joint project of the Spanish NPPs in collaboration with the CSN, on cable ageing in phase 1, PCI ES-13 project "Monitoring and surveillance of the ageing of electric cables at nuclear power plants" which prepared an "Electrical Cable Surveillance Guide" in Oct-2003.

Therefore, the combination of the previously mentioned techniques is considered adequate in Spain, to detect the postulated defects in inaccessible cables.

4.8.2. Country planned action if relevant.

Licensees

No actions are planned, taking into account what has been previously indicated.

Regulator

CSN considers acceptable the licensees' answers since they are already using the techniques mentioned in the explanation of this finding in the TPR report. According to that CSN considers that no further actions are needed to reach this Expected Level of Performance.

5. All other Generic Findings

This section is dedicated to the generic findings made by the Topical Peer Review [NB: findings related to cables were not allocated by the TPR].

5.1. Overall Ageing Management Programmes (OAMPs)

5.1.1. Good practice: External peer review services.

External peer review services (e.g. SALTO, OSART-LTO, INSARR-Ageing) are used to provide independent advice and assessment of licensees' ageing management programmes.

5.1.1.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PRACTICE.

Licensees

<u>Almaraz and Trillo NPPs</u>

The situation of the Almaraz and Trillo NPPs regarding this point was described by the CSN in the comments phase to the ENSREG report, in question ES-75.

Ascó and Vandellós II NPPs

Early in 2019, ANAV received the first IAEA pre-SALTO mission ("Pre-SALTO Peer Review Mission for Asco and Vandellos Nuclear Power Plants") in a Spanish nuclear power plant.

This mission, common to Ascó and Vandellós II, comprised a technical evaluation by a group of international experts of the process, implementation and documentation related to ageing management and Long-Term Operation. The evaluation derived from the preSALTO mission concluded that, in general, the aspects reviewed are adequate, at an advanced stage and comply with the internationally recognised practice. Be that as it may, a series of improvement actions were drawn, which will be considered according to the established planning.

Cofrentes NPP

Similarly to the other Spanish nuclear power plants, is a member of WANO, organization providing a number of services, one of which stands out: International Peer Review missions involving a comprehensive review of all aspects relating to plant operation, maintenance and organization. The review process that takes place during a WANO mission is based on the Performance Objectives and Criteria (PO&C), a document edited by WANO and describing excellence targets in every functional and cross-functional plant area.

Up to now, Aging Management has not been an aspect included in the objectives of these Peer Reviews, even if during previous missions some ageing management programme aspects were reviewed. However, the new PO&C version currently being drafted does include an AMP chapter that will support the review of all these aspects.

In relation to other Peer Review initiatives more specific for Ageing Management, Cofrentes NPP has participated in several SALTO and OSART-LTO international missions by sending experts, namely in electrical and instrumentation areas.

5.1.1.2. Country position.

Licensees

Almaraz and Trillo NPPs

No action is planned.

Ascó and Vandellós II NPPs

With respect to ANAV, the TPR considers that participating in this type of external assessments is a good practice.

Cofrentes NPP

Cofrentes NPP Management has not yet made the decision to request one of these non-WANO Peer Review missions.

Regulator

As it has been explained in the Spanish NAR and in question ES-75 made during the NARs review process:

- Almaraz NPP received an OSART mission where LTO was one of the areas reviewed.
- Ascó and Vandellós II NPPs are going to receive a SALTO mission. The Pre-SALTO mission was performed in the late 2018.

Additionally, five (5) out of the seven (7) NPPs have received of external peer reviews about LTO issues. Therefore, no further actions are planned by the CSN.

Action

Due to all information stated above, no further actions are planned.

5.1.2. TPR expected level of performance: Data collection, record keeping and international cooperation.

Participation in international R&D projects, experience exchange within groups of common reactor design and the use of existing international databases are used to improve the effectiveness of the NPPs OAMP.

5.1.2.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

Licensees

Almaraz and Trillo NPPs

The situation of the Almaraz and Trillo NPPs regarding this point is described in section 02.3.2 of the Spanish NAR on Ageing Management of the Spanish NPPs.

Ascó and Vandellós II NPPs

ANAV participates in different national and international projects related to ageing management, such as:

- Participating in the international NEA/OECD project on "Component Operational Experience, Degradation and Ageing Programme (CODAP)", in collaboration with the CSN. In this respect, certain operating experiences derived from SSC ageing processes are included into this database and, furthermore, operating experiences in this database are assessed to provide feedback to the Lifecycle Management Plan of each plant.
- Participating in the IAEA (International Atomic Energy Agency) "International Ageing Lessons Learned Programme" (IGALL) initiative. The IGALL project is supported by four working groups, three of them for the disciplines (civil structures, mechanical and electrical and instrumentation and control) with a fourth one (Steering Committee) that harmonises the results of the previous three and prepares final reports. The IGALL objective is to develop guides to support safety reports related to Nuclear Power Plants'

Ageing Management and Long-Term Operation programmes. Generally, the IGALL report is updated and its level is enhanced periodically, at least every five years.

- Furthermore, international advances in cable maintenance management, particularly those carried out by EPRI, NRC, DOE-National Laboratories, NUGENIA and IAEA are followed on a sectoral basis.

Additionally, ANAV cooperates with EPRI in a sectorial framework. Specifically, it participates in the EPRI Nuclear Programme as a full member. This participation enables access to projects and products considered to be the "basis" for the Action Plans, indicated below, and which constitute the abovementioned Nuclear Programme:

- Material degradation and ageing.
- Fuel Reliability.
- Spent fuel and high activity waste management.
- Non-Destructive Testing (NDT) and characterisation of materials, in order to carry out:
  - Research and development of non-destructive testing and examination technologies in order to address related issues with plant materials and characterise the condition of their components.
  - Activities and technical support associated with pre-service and in-service inspections to satisfy regulatory requirements.
  - NDT techniques to support and guide strategic decisions on leaving components in operation, repairing them or replacing them, and when to perform these operations.
  - Support and technical resources to facilitate maintenance and training of qualified personnel on NDT techniques.
- Equipment reliability.
- Safety and risk technologies, and their applications.
- Low-activity waste and radiation management.

Within EPRI's Nuclear Programme, a significant number of "supplementary" projects are additionally developed. Action plans on materials intend to improve knowledge and overcome technological challenges. For example, the objectives of the "Material degradation and ageing" and "NDTs and material characterisation" action plans focus on:

- Environmentally assisted cracking mechanisms of the primary circuit structural materials in light water reactor service conditions.
- Integrated and proactive approach to manage the degradation of reactor coolant system's materials in light water reactors.
- Effects of the light water reactor water chemistry variables.

The corresponding EPRI programmes established to address and develop the previously mentioned aspects in PWR reactors are the following:

- Primary System Corrosion Program.
- SGMP- Steam Generator Management Program.

- MRP - Materials Reliability Program.
- Water Chemistry Program. This includes: ChemWorks Users Group, PWR Primary Zinc Application Users Group and Chemical Control.

Other aspects worth noting with regards to ANAV's participation in international groups and databases are:

- ANAV belongs to the PWR Technical Strategy Group, which grants access to all chemistry guides.
- ANAV participates in different workshops, some of them promoted by EPRI, within the field of chemical control and management.
- ANAV participates in the Welding and Repair Technology Center programme.
- ANAV organises workshops on materials with EPRI (generally every two years), where the latest projects are reviewed, mainly related to reactor vessel internals, metal fatigue, SCC, and issues related to primary chemistry.

Cofrentes NPP

Cofrentes NPP participates in a number of operating experience exchange forums under the scope of international R&D programmes. Cofrentes NPP report on Chapter 02 of the TPR technical specification submitted to the Regulator (CSN) describes the participation in international project activities. The “annual ageing activities report” sent to the CSN includes updated information and a detailed description of project participation. These programmes are briefly recorded below:

- Life Management and Materials Group of CEN-FORO NUCLEAR. Participates in several projects, among others:
  - Project for Non-Destructive Exams (NDE) testing validation.
  - Participation in meetings of various groups within ENIQ (European Network for Inspection Qualification)
  - EPRI’s R&D programs on NDE: Inspection of austenitic steel casting, phased array developments, NDE in concrete, tanks and spent fuel casks, etc.
  - NEA's CODAP project, in collaboration with the Spanish Regulator (CSN).
  - Monitoring and evaluation of electrical cabling condition in Spanish NPPs, as abovementioned.
  - Project for analysis of irradiated concrete from the dismantling of José Cabrera NPP, a project temporarily put to a halt, has attracted the interest of some international agencies (EPRI, DOE, NRC).
  - MEACTOS (“Mitigating Environmentally Assisted Cracking Through Optimization of Surface Condition”) project, led by CIEMAT (Spain’s Public Research Agency for Energy, Technology and Environment).
- EPRI Nuclear Programme, including activities within the following areas:
  - Material Management.

- Strategic Initiatives.
- Fuels and Chemistry.
- Plant Performance and Management.

  Cofrentes NPP considers of special relevance the BWR Vessel and Internals Project (BWRVIP), on which the station's ageing management programme for these components is based.

- IAEA. International Generic Lessons Learned Report (I-GALL).

  Cofrentes NPP participation in the I-GALL project fell within Spain's representation, led by the Spanish Nuclear Safety Council (CSN). More specifically, Cofrentes NPP sent two active members to the IGALL project, one of them as a project Steering Committee member and the other as leader of the WG-2 and, consequently, member of the project Clearing Group that coordinates the project deliverables.

  Cofrentes NPP continues to participate in this international programme with a representative who acts as WG Electrical chairman.

5.1.2.2. Country position and action.

Country position

As it was explained in the Spanish NAR chapter 02.3.2 pages 27 to 30, in Spain there is an association of the main electricity companies, UNESA (now CEN), which includes those companies that own nuclear power plants. Through this association, the nuclear power plant owners and the CSN, as the regulatory authority, established in 2009 the programme named "Collaboration *agreement on between the CSN and UNESA for R&D in relation to nuclear safety and radiological protection*".

Different R&D projects have been carried out within the framework of this collaboration agreement and dealing with the assessment of nuclear power plant SCC ageing (see Table 02.1, chapter 02.3.2).

The Spanish plants are also active members, through UNESA, in the base activities of the Electric Power Research Institute (EPRI) nuclear area, which include several research programmes, such as Long-term Operation, Primary Systems Corrosion and Plant Engineering that carry out research into the assessment and mitigation of the ageing of different types of SSCs at nuclear power plants. In addition, the plants are involved in various supplementary R&D&i programmes, such as the Boiling Water Reactor Vessel and Internals Project (BWRVIP), the Pressurised Water Reactor Materials Reliability Program (MRP), the Non-destructive evaluation (NDE), the Steam Generator Management Program (SGMP), the Nuclear Maintenance Application Center (NMAC), the Checkworks Users Group (CHUG), etc., which, among other aspects, cover research into the ageing of components not covered by the previously mentioned EPRI base nuclear programme.

In addition to the aforementioned projects, as has been pointed out in section 02.2 of this report, and without being required by IS-22, the Spanish plants have participated along with the CSN in the first two phases of the IAEA's IGALL programme in which many AMPs have been developed, this having provided the Spanish plants with an additional reference for the development of their own AMPs.

Action

Taking into account all the information mentioned above, all Spanish NPPs understood that fulfil with the TPR expectation related to international interaction regarding SSC ageing.

Spain will continue participating in the R&D projects related to ageing management as it has been participating up to now.

5.1.3. TPR expected level of performance: Methodology for scoping the SSCs subject to ageing management.

The scope of the OAMP for NPPs is reviewed and, if necessary, updated, in line with the new IAEA Safety Standard after its publication.

5.1.3.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

5.1.3.2. Country position and action.

Licensees

Almaraz and Trillo NPPs

The Almaraz and Trillo NPPs situation regarding this point is described in section 02.3.1 and 02.4 of the Spanish National Assessment Report on Ageing Management of the Spanish Nuclear Power Plants.

Ascó and Vandellós II NPPs

ANAV's Lifecycle Management Plans have been periodically updated since being implemented, and they reflect the recent physical and documentation status of each nuclear unit. ANAV's ageing management plan intends to analyse the physical scope of components annually, and in compliance with the applicable Spanish regulations, it will be formalised at intervals of 4 years or less.

Cofrentes NPP

Issuance of the new IAEA Guide SSG-48 is relatively recent (late 2018). In the case of Spanish nuclear power plants, CSN instruction IS-22, rev.1, establishes the methodology for determining the scope and screening of SSCs subject to ageing management, as well as the applicable criteria.

It is Cofrentes NPP understanding that IAEA Guide instructions that differ from IS-22 instructions in terms of scope and screening process, should be assessed and defined by the Spanish regulator (CSN) before they are reviewed by the licensees.

Regulator

In the Spanish NAR section 02.3.1 is described how the scoping and screening of SSC is performed in accordance with the Spanish ageing management rule IS-22, which is totally binding for the Spanish NPPs.

As it was explained in the Spanish NAR chapter 02.2 page 11, the methodology used for the development of the Spanish plant Overall Ageing Management Programme is based fundamentally on the American methodology described in 10 CFR 54.

Action

The CSN considers that this aspect is according to the current licensing bases, as well as conceptually with the IAEA guidelines, so no further action is planned.

5.1.4. TPR expected level of performance: Delayed NPP projects and extended shutdown.

During long construction periods or extended shutdown of NPPs, relevant ageing mechanisms are identified and appropriate measures are implemented to control any incipient ageing or other effects.

5.1.4.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

Licensees

Almaraz and Trillo NPPs

Currently no delayed NPP projects and extended shutdown conditions apply to the Almaraz and Trillo NPPs. Both NPP have neither experienced such extended shutdown conditions in the past.

Ascó and Vandellós II NPPs

The ageing mechanisms and effects considered in ANAV's Lifecycle Management Plans are all those potentially applicable. Therefore, changes in the operational mode of systems are unlikely to derive in new degradation processes not previously considered.

In this respect, in the potential case of an extended shutdown taking place, ageing management would focus on ensuring or reinforcing the inspections and tests of certain Ageing Management Programmes that could have an impact, in order to accommodate the new condition in the equipment performance. Furthermore, mitigation measures would be taken where required.

In line with the practice of other nuclear power plants that have experienced this situation, ANAV would propose the creation and implementation of an action plan for the preservation of systems during extended shutdown, including measures to mitigate and monitor the effects of the degradation expected in those extended shutdown circumstances. These analyses would be conducted during the actual operational scenario, once the plant boundary conditions were determined.

Cofrentes NPP

Since the AMR has considered all potentially applicable mechanisms (significant), ageing management during extended shutdowns would focus on ensuring or reinforcing inspections (at a AMP level) and implementing mitigation measures when possible, especially in systems most affected by operational changes. In stations experiencing this situation, such as Sta. Mª de Garoña, the approach was to prepare and implement a system preservation action plan during long-term shutdowns, including measures to mitigate and monitor expected degradation effects resulting from extended shutdown.

5.1.4.2. Country position and action.

Licensees

Taking into account all of the above, no additional activity related to the identification of relevant degradation effects in extended shutdown periods in accordance with this Expected Level of Performance is deemed to be currently necessary.

Regulator

In the article one "subject and scope of application" of Spanish ageing management rule IS-22 establishes:

> *The requirements established in this Instruction are applicable to all the operating conditions of a nuclear plant.*

All the operating conditions of a nuclear plant covers from initial start-up to definitive shutdown. "Extended shutdown" is included in this period, so IS-22 is totally binding and therefore relevant ageing mechanisms should have been previously identified and appropriate measures should have been implemented to control any incipient ageing or other effects.

Regarding "delayed NPP projects" it is neither included in IS-22, since it is not in the intention of the Spanish electric supply system strategy to build new NPPs in the near or long term future.

Action

Due to all information stated above, no further actions are planned.

5.1.5. TPR expected level of performance: Overall Ageing Management Programmes of research reactors.

A systematic and comprehensive OAMP is implemented for research reactors, in accordance with the graded approach to risk, the applicable national requirements, international safety standards and best practices.

5.1.5.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been NOT CONCERNED.

In Spain there is not any research reactors, so this finding is not applicable to Spain.

5.1.5.2. Country position and action.

No action is planned, since in Spain there is not any research reactor.

5.2. Concealed pipework

5.2.1. Good practice: use of results from regular monitoring of the condition of civil structures.

In addition to providing information on soil and building settlement, the results from regular monitoring of the condition of civil structures are used as input to the ageing management programme for concealed pipework.

5.2.1.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been BLANK.

In the final version of the TPR report this good practice was not identified for Spain. Spanish plants monitor the condition of civil structures through the control of the settlement of buildings and structures. There is a specific AMP about surveillance of civil structures.

Licensees

Almaraz and Trillo NPPs

At Almaraz NPP, there is a programme "Structural Surveillance" that, within the structures monitoring activities, includes the control of settlements of the main buildings and structures of the Plant. Within this programme, quarterly topographic controls of 37 control points are carried out, which include the main buildings of the Plant (Containment, Fuel Building, Safeguards, Electric and Turbines). Periodic evaluation of the monitoring and trend analysis data is carried out and the surveillance procedures of applicable structures establish limit values and acceptance criteria for their evaluation. This programme provides detailed information for the evaluation of the condition and evolution of the structures of the Plant.

At Trillo NPP there is an equivalent programme that includes the control of settlements of the buildings and main structures of the plant. It includes 127 control points in which settlement control is carried out periodically from quarterly to annual frequency. It includes all the significant structures of the Plant, from main buildings to buried pipe galleries.

The information is evaluated monthly and an annual report is issued where trends are analysed and measured values are compared with limits and criteria established in structure monitoring procedures.

Ascó and Vandellós II NPPs

With regards to Ascó NPP, there is an AMP that includes a surveillance manual for soil settlement effects (Soil Movement Monitoring Manual). This programmes sets forth a series of activities, including monitoring of control points, parameters for measurement and analysis, calculation methods for control magnitudes and established values for precaution and critical limits. Based on the values measured and the trends observed, the condition of structures and components potentially affected by soil settlement is verified. Ascó NPP has AMP on surveillance of structures and a specific programme of AMP plant on surveillance against land surveys.

With regards to settlement control at Vandellós II NPP, the activities of the procedure "Monitoring of Structures" is integrated in a specific AMP. They include a programme with a series of activities associated with monitoring survey control points for recently constructed structures associated with the Technological Safeguards Cooling Water System (EJ system) and the turbine pedestal. In the initial years of operational life it was demonstrated that the remaining structures did not experience this type of movements. Based on the values measured and the trends observed, the condition of the previously mentioned structures is verified.

Cofrentes NPP

To date, no significant results were obtained from the periodic building settlement measurements and detection of building support cracks. Having said that, this good practice will be taken into consideration during upcoming reviews of AMP manuals for piping systems.

This improvement action will be proposed as an action to be included in the next manual revision. A two-year period is foreseen.

5.2.1.2. Country position

Licensees

Spanish NPPs perform surveillance of the condition of civil structures and building based on settlement. The AMP “Structures Monitoring”, based on AMP-XI.S6 of GALL Report, and other procedures implemented provide measures and allow trending, so the condition of structures and components potentially affected by soil settlement is verified. For these reasons, this Expected Level of Performance is considered to be satisfied.

Regulator

The CSN considers that Spanish NPPs correctly monitor the condition of civil structures.

Action

Cofrentes has decided to plan an action in this issue to fulfil this good practice. See chapter 7, Table “Summary of the planned actions”.

No further actions are planned for the rest of the Spanish NPPs due to all information stated above.

5.2.2. Good practice: performance checks for new or novel materials.

In order to establish the integrity of new or novel materials, sections of pipework are removed after a period of operation and inspected to confirm the properties are as expected.

5.2.2.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been BLANK.

Licensees

<u>Almaraz and Trillo NPPs</u>

This good practice is not considered applicable to CNAT. In CNAT the characteristics of the materials to be used for buried or inaccessible pipes are defined in the corresponding specifications of nuclear and non-nuclear safety class pipes. Materials other than those initially defined in these specifications have not been installed in recent years. If the use of new materials is defined, the current specifications will be reviewed, including the evaluation of their suitability for the environmental and operating conditions. The installation of new material in accordance with current specifications is selected in accordance with the applicable environmental and operating conditions and the potential degradation mechanisms are known in accordance with industry experience and controlled by current AMPs. Therefore, processes for extracting sections of new pipes to confirm their properties after a period of operation are not considered necessary.

<u>Ascó and Vandellós II NPPs</u>

At ANAV, the materials employed for buried and inaccessible pipework are those allowed by construction codes depending on the service expected in each line (safety class or non-safety class). No materials have been identified in buried or inaccessible pipework for which there is no known correspondence with the postulated degradation, according to the reference documentation based on industry experience. Furthermore, there are no novel materials in these systems or materials with unknown ageing behaviour. The management programmes established for these components, together with the analyses implemented for reviewing Operating Experience are considered to be sufficient to assess the materials' susceptibility to degradation, based on the environments in which they are located.

<u>Cofrentes NPP</u>

This good practice is being applied in Cofrentes NPP since mid-2000, when replacement of significant Essential Service Water System (P40 system) piping sections began, from carbon steel to stainless steel. Multiple sections of flanged piping made of this material were installed in the system. Such sections were periodically removed and analysed, carrying out material lab inspections to determine their performance when exposed to system water, with chloride level in the high tolerance range of this material. By means of this practice, satisfactory performance of stainless steel in the system was confirmed. The piping subject to this practice is not specifically considered “concealed” piping, but a similar practice would be applied in case of new materials implemented in concealed piping.

5.2.2.2. Country position

Licensees

To concealed piping this Good Practice is not currently applicable to Spanish NPPs and so additional measures are not necessary. In the event of material changes in the future, the design modification safety assessment processes will have to demonstrate compliance with the systems' intended functions, in accordance with the Design Bases. If necessary, actions will be issued to demonstrate adequate behaviour of used materials.

Regulator

The CSN considers that performance checks for new or novel materials is not necessary for Spanish plants, and if necessary, the licensees would make the pipe replacements following the specifications of the design and evaluating the new materials according to the operating and environmental conditions and potential ageing mechanisms, and would perform the corresponding performance checks for those novel or new materials.

Action

No additional action is planned.

5.2.3. TPR expected level of performance: inspection of safety-related pipework penetrations.

Inspection of safety-related pipework penetrations through concrete structures are part of ageing management programmes, unless it can be demonstrated that there is no active degradation mechanism.

5.2.3.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

Licensees

<u>Almaraz and Trillo NPPs</u>

Pipes that pass through a penetration at the plants are not in direct contact with the concrete of the structures, except in some very specific cases. Usually there is an intermediate structure, e.g. a wall or an anchor structure in the penetration. Typically, two types of penetrations can be distinguished:

- with seals where there is a structural component with different functions (protection against fires, floods, etc.), or elastomeric elements (that allow movements of the pipe within the penetration),
- and without seals (there is an air gap between the pipeline and the bushings).

The most common is that pipes that pass-through penetrations have joints and seals that fill the gap between the line and the bushing. In all other cases, the environment to which the outer surface of the pipes would be exposed is air. In any case, they would be managed within the framework of the external surfaces programme.

In general, the external surfaces of lines within penetrations can be classified as interfered areas, and visual inspections are not possible without breaking or altering other components. Likewise, it is considered that the sealing itself or the confinement of the section included within the penetration significantly reduces contact with air and other contaminants, so that the propensity for the different modes of degradation will be less than outside the penetration.

As part of the external surfaces AMP, it is considered that the condition of components within penetrations is similar to that of inspected components, which are under similar conditions (system, material, environment, internal fluid, etc.), and which are accessible and inspected. In this way, the inspections of components in similar or more severe environments are taken into account to provide information about the condition of the interfered components. Similarly, it is specified that, if degradations in inspected components are discovered, it must be determined by Engineering evaluation whether the degradation conditions are applicable to any interfered component and to determine, if necessary, the actions to be taken to check the condition of these components. Likewise, the structures monitoring AMP would also provide indications of irregularities in the steel-concrete interface of the inaccessible area.

In the case of typical configurations with steel in direct contact with concrete, mechanisms that require management would not be applicable, in accordance with the reference documentation, so that no further actions would result. Therefore, it is as explained in Section 2.2.4 of Appendix E of the EPRI 1010639 “Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools”, Revision 4:

2.2.4 Embedded

Non-Class 1 mechanical piping components may be routed through concrete floors, slabs, or walls. The external surfaces of these components are firmly encased in the concrete of the floor, slab, or wall. Similar to structural reinforcing steel, the external surfaces of such piping components are embedded and the impact of a concrete environment on ageing effects must be addressed. For non-Class 1 mechanical piping components that simply pass through a concrete floor or wall (e.g., from one room or elevation to another), the indoor environment, described in Section 2.2.1, is the more limiting environment and impact of concrete on ageing effects need not be addressed.

That is, for complete pipelines in contact with concrete (and by analogy with structural steel), concrete should be considered as an environment and evaluated. In this respect, NUREG-1801 establishes the need to evaluate the following for pipe type elements to ensure that there are no effects on the carbon steel pipeline:

- Attributes of the concrete are consistent with ACI 318 or ACI 349 (low water-to-cement ratio, low permeability, and adequate air entrainment) as cited in NUREG-1557 and
- Plant OE indicates no degradation of the concrete

In specific cases where concrete is in contact with carbon steel, this analysis has been performed and it has been verified that the conditions have been fulfilled to ensure that there are no effects on the steel.

Usually, embedded pipelines at power plants (eg., leak detection pipelines and the suction from pumps and return from the spent fuel pool) are made of stainless steel, and therefore do not present ageing effects that require management or require any additional evaluation, in accordance with NUREG-1801.

In the case of mechanical components in contact with concrete in a localised area (penetrations), which is the case dealt in this finding, EPRI indicates that the indoor air mix in the accessible part of the pipeline analysed is more limiting, and therefore it is not necessary to consider the impact of concrete on the line as it has no applicable effects.

Ascó and Vandellós II NPPs

At ANAV, line sections included in structural penetrations are not excluded from the ageing management scope. The external side of pipelines through penetrations is included in the scope of the External Surfaces Programme, as there is no mechanical steel in contact with concrete. Usually, lines that pass through penetrations have seals filling the gap between the line and the wall bushing. For all other cases, the external surface of the lines would be exposed to air. Depending on the type of system they belong to and the nature of the fluid they contain, several programmes can apply on the internal side.

In accordance with the External Surfaces Programme, pipe sections included within penetrations would be classified as "concealed", since it is not possible to conduct visual inspections without breaking or altering other components. Additionally, this programme considers the condition of these components to be similar to that of inspected components that are in similar conditions (system, material, environment, internal fluid, etc.) but are accessible. Thus, inspections carried out on components in similar or more severe environments are relied on to know the condition of concealed components. It is also noted that the actual sealing or confinement of the section inside the penetration significantly reduces contact with air and other contaminants and, thus, susceptibility to different degradation modes will be lower than outside of the penetration. Similarly, the External Surfaces Programme specifies that, if degradations are detected in the inspected components, an engineering assessment should determine if the degradation conditions apply to any concealed component and, if necessary, the actions to be taken to verify the condition of these components should be determined. Additionally, there are other Ageing Management Programmes, such as the Containment Leakage Programme, which also provides information on the condition of concealed components for these specific penetrations.

Apart from that, and as a generic analysis, for safety-related pipelines in direct contact with concrete (embedded), in penetration type configurations in concrete structures, section 2.2.4 of Appendix E of EPRI "Non-Class 1 Mechanical Implementation Guideline and Mechanical Tools", Revision 4, indicates that the indoor air mix in the accessible part of the pipeline analysed is the more limiting, and so it is not necessary to consider the impact of concrete on the line, given that it has no applicable effects, as said before.

To summarise, the condition of pipeline surfaces in structural penetrations when not accessible is indirectly assessed by means of the condition of nearby accessible surfaces. Only when there are signs of degradation in these surfaces, would the removal of structural isolation elements between the line and the concrete be planned in order to access the inaccessible metal surface.

This inspection method is assumed to be adequate, given that accessible surfaces are more susceptible to impurity build-up and are subjected to greater concentrations of oxygen and moisture, and thus they are not only much greater dimensionally, but also more susceptible to the postulated mechanisms.

<u>Cofrentes NPP</u>

Apart from the above, in the specific cases of Cofrentes where concrete is in contact with carbon steel (ECCS suction piping from the Suppression Pool), analyses carried out confirmed that conditions were in compliance and that steel was not affected.

5.2.3.2. Country position and action

Licensees

As stated above, the Spanish NPPs perform periodic inspections of accessible surfaces with specific inspections, together with sampling inspections of insulated pipe sections are considered representative and covering the condition of pipes within the penetrations.

Regulator

According to the information provided by the licensees, due to the type of concrete used in the Spanish NPPs, no active degradation mechanism is postulated based on the GALL report.

Due to the information explained above, CSN considers that licensees ensure:

- through visual inspections of the accessible surfaces, together with sampling inspections of insulated pipe sections, the condition of the transition area where the pipes penetrate the concrete, is confirmed.

- and considering the quality and quantity of water of the concrete fulfils the requirements of ACI-318 and ACI-349, that no degradation mechanisms are being developed in the piping embedded in concrete.

Action

Due to all information stated above, no further actions are planned.

5.2.4. TPR expected level of performance: scope of concealed pipework included in AMPs.

The scope of concealed pipework included in ageing management includes those performing safety functions, and also non-safety-related pipework whose failure may impact SSCs performing safety functions.

5.2.4.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

Licensees

Almaraz and Trillo NPPs

The CNAT situation regarding this point is described in section 04.1.1 of the Spanish National Assessment Report on Ageing Management of the Spanish Nuclear Power Plants.

Ascó and Vandellós II NPPs

At ANAV, the buried and inaccessible pipework programmes include safety-related and non-safety related lines, as the results of the Ageing Management Review of each plant.

Cofrentes NPP

The criterion applied to this Expected Level of Performance is the same generally applied to Life Management Program scope and screening at Cofrentes NPP. That means it was also applied to the scope of concealed pipework

5.2.4.2. Country position and action

Licensees

The ageing management programmes include safety-related and nonsafety related buried and inaccessible pipework, and thus this Expected Level of Performance is considered to be satisfied.

Regulator

According to what is stated in the Spanish NAR chapter 02.3.1 “scope of the overall AMP”:

"The scope of the ageing management programme, specified in point four of this Instruction, shall include the following safety-related and safety-significant SSC's:

3.1. Safety-related (SR) elements that are required to continue operating during and after any design basis event that might occur, in order to guarantee the following functions:

- *The integrity of the reactor coolant pressure boundary,*
- *The capability to shut down the reactor and maintain it in safe shutdown conditions, or*
- *The capability to prevent or mitigate the consequences of accidents, such that off-site radioactive exposures are kept below the established limits.*

3.2 Safety relevant (NSR) elements whose failure might prevent satisfactory compliance with any of the functions identified in previous section 3.1.

***3.3 Safety important elements** to which credit is given in the safety assessments of the facility, relating the requirements on fire protection (FP), environmental qualification (EQ), pressurised thermal shock (PTS), anticipated transients without scram (ATWS) and station blackout (SBO) requirements.*

As 3.2 criterion of the Spanish ageing management rule (IS-22) establishes (marked in bold above), safety relevant elements (note that "safety relevant elements" are "non-safety-related elements") whose failure might prevent satisfactory compliance with any of the functions identified in criterion 3.1 (safety related elements) are included in the scope of the Overall AMP, and therefore concealed pipework that fulfils this criteria (both 3.1, 3.2 and 3.3) mentioned have to be also included.

In fact, in chapter 04.1.1 "Scope of ageing management for concealed piping" of the Spanish NAR in page 85 can be observed that fire protection system of all Spanish plants have concealed pipework and that are included within the scope of ageing management.

Action

Due to all information stated above, no further actions are planned.

5.2.5.TPR expected level of performance: opportunistic inspections.

Opportunistic inspection of concealed pipework is undertaken whenever the pipework becomes accessible for other purposes.

5.2.5.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

Licensees

<u>Almaraz and Trillo NPPs</u>

According to plant procedures, the external surface of buried pipes will also be inspected in any areas that becomes accessible due to maintenance or other reasons.

Ascó and Vandellós II NPPs

ANAV's Lifecycle Management Plans require opportunistic inspections in the Ageing Management Programmes related to buried pipelines.

Cofrentes NPP

As explained in Cofrentes NPP's report on Chapter 04 of the TPR technical specification submitted to the CSN, the surveillance programme for external piping (underground and overhead) is associated to plant maintenance activities granting access to these components for inspection purposes. Similarly, when these locations need to be accessed due to unscheduled maintenance, pipes are inspected (at least visually) and, in case of abnormal indications, a more detailed inspection using other techniques would take place.

5.2.5.2. Country position and action

Licensees

The need to perform inspections on any pipeline that becomes accessible for any reason is included in the buried pipeline programmes, thus this Expected Level of Performance is considered to be satisfied.

Regulator

As it has been explained in this National Action Plan and also in the Spanish NAR, the Spanish ageing management rule, IS-22, and the Spanish NPPs OAMPs follow the American methodology and are based on AMPs proposed in the GALL report.

In the GALL report there is an AMP proposed for "buried and underground piping and tanks", the AMP XI.M41 which has been revised by the LR-ISG-2015-01. In this LR-ISG there is a table (table XI.M41-2) that imposes the minimum number of inspections depending on the buried piping material and the preventive actions to the buried piping. However, in addition to this minimum number of inspections, it is the aim of the programme, and it is stated in the fourth attribute "detection of ageing effects" that:

> *Inspections of buried and underground piping and tanks are conducted during each 10-year period, commencing 10 years prior to the period of extended operation. Piping inspections are typically conducted by visual examination of the external surfaces of pipe or coatings. Tank inspections are conducted externally by visual examination of the surfaces of the tank or coating or internally by volumetric methods.* ***Opportunistic inspections are conducted for in-scope piping whenever they become accessible.*** *Visual inspections are supplemented with surface and/or volumetric nondestructive testing if evidence of wall loss beyond minor surface scale is observed.*

Taking into account all the aforementioned information and that, as all licensees have explained, the Spanish NPPs inspect the external surfaces of buried pipes when they become accessible for any reason, the CSN considers that the TPR Expected Level of Performance is fulfilled.

Action

Due to all information stated above, no further actions are planned.

5.3. Reactor pressure vessel

5.3.1.Good practice: Hydrogen water chemistry.

Hydrogen Water Chemistry (HWC) is used in BWRs which may be sensitive to Intergranular Stress Corrosion Cracking.

5.3.1.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PRACTICE.

Licensees

PWR NPPs

This point does not apply to Trillo, Almaraz, Vandellós II and Ascó NPPs.

Cofrentes NPP

As explained in Cofrentes NPP's report on Chapter 05 of the TPR technical specification submitted to the CSN, Cofrentes NPP adheres to Hydrogen Water Chemistry (HWC) protocols since March 1997. Since April 2010, the station also applies a more advanced mitigation method, involving the application of On-Line Noble Metals (OLNC) with injection of low hydrogen concentrations in the feedwater.

5.3.1.2. Country position.

Licensees

PWR Plants

This Expected Level of Performance does not apply.

Cofrentes NPP

It was explained in the Spanish NAR chapter 05.1.4.

Regulator

CSN considers acceptable the licensees' answers since the unique BWR design Spanish NPP (Cofrentes) is already using the hydrogen water chemistry and the rest of Spanish NPPs does not apply because are PWR design.

Action

Due to all information stated above, no further actions are planned.

5.3.2. Good practice: Implementation of a shield.

Shielding in the core of PWRs with relatively high fluence is implemented to preventively reduce neutron flux on the RPV wall.

5.3.2.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been BLANK.

Licensees

<u>Almaraz and Trillo NPPs</u>

Both units of the Almaraz NPP have a neutron shield in the core to reduce neutron flux on the RPV wall.

Trillo NPP has a downcomer wider (at least double) than other designs of PWRs with a similar power output. Since water acts as a shield for neutrons, this fact, together with low leakage cores design, provide an additional protection against vessel embrittlement due to neutron flux.

At Trillo NPP there is a foreseen cumulated neutron fluence (E>1MeV) at 32 EFPY one order of magnitude lower than other PWRs with different designs.

<u>Ascó and Vandellós II NPPs</u>

ANAV's vessels have neutron panels which reduce neutron irradiation in the reactor vessels. Therefore, this Good Practice was already implemented from design.

<u>Cofrentes NPP</u>

This Expected Level of Performance does not apply.

5.3.2.2. Country position.

Licensees

<u>Almaraz and Trillo NPPs</u>

Due to all information stated above, this Expected Level of Performance is considered to be satisfied. No action is planned, as previously stated.

<u>Ascó and Vandellós II NPPs</u>

ANAV's vessels already have fluence shielding panels.

<u>Cofrentes NPP</u>

This Expected Level of Performance does not apply.

Regulator

According to all Spanish PWR NPPs licensees' answers, they have shield in the core to preventively reduce neutron flux on the RPV wall.

Therefore, the CSN considers that the TPR Expected Level of Performance is fulfilled.

Action:

Due to all information stated above, CSN considers that the "Expected Level of Performance" is fulfilled and no further actions are planned.

5.3.3. TPR expected level of performance: Volumetric inspection for nickel base alloy penetration.

Periodic volumetric inspection is performed for nickel base alloy penetrations which are susceptible to Primary Water Stress Corrosion Cracking for PWRs to detect cracking at as early a stage as possible.

5.3.3.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been AREA FOR IMPROVEMENT.

Licensees

Almaraz and Trillo NPPs

Refer to section 3.3.2 of this report and to the content of the NAR (see chapter 5, section 05.1.3, page 119).

Currently, the periodic volumetric inspections of nickel base materials in Almaraz NPP vessels are:

Component	Code Case	Examination Methodology	Frequency
RPV Head Penetrations	N-729-4	UT and CCII from inside of each penetration	At least once per interval (10 years)
Cold and Hot Leg RPV Nozzle Welds	N-722-1 y N-770-2	Volumetric Examination (UT)	Hot Legs: Every 5 years Cold Legs: Every 2 periods without exceeding 7 years

According to the above, Almaraz NPP complies with the requirements of ASME XI and 10 CFR 50.55a. However, this standard does not require volumetric inspections of BMI to be conducted, they have not been carried out (only visual inspections of uncovered metal from outside, as per Code Case N-722-1).

In Trillo NPP, CRDs welding's are the only weldings in the scope. Due to the configuration of the area it is not possible to perform volumetric inspections. According to Code Case N-722-1 visual inspection of uncovered metal from outside is performed on CRD weldings at least once per interval (10 years).

Ascó and Vandellós II NPPs

Currently, the periodic volumetric inspections of nickel base materials in ANAV's vessels are:

Component	Code Case	Examination Methodology	Frequency
RPV Head Penetrations	N-729-4	UT and CCII from inside of each penetration	At least once per interval (10 years)
Cold and Hot Leg RPV Nozzle Welds	N-722-1 y N-770-2	Volumetric Examination (UT)	Hot Legs: Every 5 years Cold Legs: Every 2 periods without exceeding 7 years

According to the above, ANAV complies with the requirements of ASME XI and 10 CFR 50.55a. However, this standard does not require volumetric inspections of BMI to be conducted (only visual inspections of uncovered metal from outside, as per Code Case N-722-1), and therefore, they have not been carried out.

Cofrentes NPP

Not concerned.

5.3.3.2. Country position and action.

Since Spain has been allocated in this finding as "area for improvement", the complete information related to this finding is addressed in chapter 3.3.2 of this NAcP.

5.3.4. TPR expected level of performance: Non-destructive examination in the base material of beltline region.

Comprehensive NDE is performed in the base material of the beltline region in order to detect defects.

5.3.4.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been AREA FOR IMPROVEMENT.

Refer to section 3.3.4 of this NAcP.

5.3.4.2. Country position and action.

Since Spain has been allocated in this finding as "area for improvement", the complete information related to this finding is addressed in chapter 3.3.4 of this NAcP.

5.3.5. TPR expected level of performance: Environmental effect of the coolant.

Fatigue analyses have to take into account the environmental effect of the coolant.

5.3.5.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

Licensees

The fatigue monitoring programme is a preventive activity protecting the NPP against the thermal fatigue that affects reactor coolant pressure boundary components. The programme is based on the monitoring of operational reactor coolant system conditions (pressure, temperature, flowrate) under all operational plant scenarios, that is, stable operational conditions and transients, comparing actual results to design values with the aim to determine the fatigue-induced usage factor which, according to design requirements, is determined for Class 1 components.

Consequently, the fatigue monitoring programme at Spanish NPPs are surveilled at two levels:

- Follow-up of operational transients according to TS requirements.
- Follow-up of usage factor consumption for specific Class 1 components.

Based on the evaluation carried out in NUREG/CR-6260 and an additional risk analysis for 40 years operation, it was concluded in SECY-95-245 that it was not necessary to include the effect of the cooling environment on fatigue calculations during the design operation period. On the contrary, SECY-95-245 stated that the conservatism of the original calculations might not be high enough to obviate the effect of the cooling medium on fatigue resistance during the long term operation period and recommended its consideration in the license renewal process. Continuing on this theme, GSI-190, based on the potential increase in leakages in the pipes of plants that continue operating, established that environmentally assisted fatigue (EAF) should be considered in license renewals for extension of operations to 60 years.

For this reason in the case of Spanish plants currently operating within the first 40 years of their original licensing basis, it is not necessary to implement a fatigue calculation methodology that includes the environmental factor effect. Thus, NPPs within this category should just comply with their original design requirements until they enter in the LTO period.

Both NUREG-1800 Rev. 2 and NUREG-1801 Rev. 2 require the analysis of environmental assisted fatigue for ASME Class 1 components during LTO. The methodology adopted in NUREG-1800 Rev. 2 and NUREG-1801 Rev. 2 is based on the use of an environmental factor (Fen), to modify the CUF calculated using the fatigue design curves obtained based on tests made in air, and consists of two phases:

(i) selection of sentinel locations of Class 1 SSCs and
(ii) resolution of sentinel point locations.

Fatigue analyses carried out at Spanish NPPs take into account environmental factors, where applicable, in the calculations of the Cumulative Usage Factor (CUF) for Long-Term Operation, as defined in the following documents:

- NUREG/CR-5704 “Effects of LWR Coolant Environments on Fatigue Design Curves of Austenitic Stainless Steels”.
- NUREG/CR-6583 “Effects of LWR Coolant Environments on Fatigue Design Curves of Carbon and Low-Alloy Steel”.
- NUREG/CR-6909 “Effects of LWR Coolant Environments on the Fatigue Life of Reactor Materials Final Report”.

The effect of the environmental factor has already been taken into account in the task to resolve the fatigue TLAA at Almaraz I&II, Vandellós II, Cofrentes and Ascó I&II NPPs for the license renewal application.

At Trillo NPP this aspect will be taken into account when performing the task to resolve the corresponding TLAAs.

5.3.5.2. Country position and action.

Licensees

<u>Almaraz and Trillo NPPs</u>

No action is planned, as previously stated.

<u>Ascó and Vandellós II NPPs</u>

In current fatigue analyses, ANAV takes into account the environmental effect in applicable components. Thus, this Expected Level of Performance is considered to be satisfied.

<u>Cofrentes NPP</u>

Throughout Cycle 22, operational data from local feedwater nozzle instrumentation will be collected to discard the excessively conservative hypotheses used to calculate the foreseen 60-year usage factor, hence favoring compliance with all required acceptance criteria for LTO.

Regulator

NUREG/CR-6909 revision 1, establishes that:

> *Based on the risk assessment, a backfit to **incorporate environmental effects into the fatigue analyses of operating plants was not justified**.*
>
> *However, because the NRC studies were less certain that the conservatism in the original fatigue calculations could be used to account **for an additional 20–years of operation, the NRC staff recommended that environmental effects be considered by evaluating the sample locations** in the INEL study (NUREG/CR-6260, "Application of NUREG/CR-5999 Interim Design Curves to Selected Nuclear Power Plant Components," issued March 1995) **for plants pursuing license renewal**.*

Therefore, in Spain, following the NRC approach, for operating NPPs environmental effects have not been taken into account for fatigue analyses.

However, for the NPPs that have the intention to operate beyond 40 years, according to the information provided by the licensees, the environmental effect of the coolant have already been taken into account in those NPPs that have already resolved the Time Limited Ageing Analyses (TLAA). The NPPs, like Trillo NPP, that have not resolved them yet, they assure that it will be taken into account in preparation for LTO.

CSN considers acceptable the licensees' answers since they have already taken into account the environmental effect into the fatigue analyses for LTO as it is mentioned in the explanation of this finding in the TPR report [3], or they will consider it when they have to solve the TLAAs:

> *During the design and construction of early reactors, the importance of this effect was not fully appreciated. Indeed such environmentally assisted fatigue analyses have already been performed for many years by some countries;* ***several mention having recently performed or planning to perform those analyses, in their self-assessment, mostly in the framework of LTO assessment.*** *Finally, in some countries, environmentally assisted fatigue is covered through a screening criterion, such as usage a factor which is not to be exceeded, in their national standards.*

Action

Due to all information stated above, no further actions are planned.

5.3.6.TPR expected level of performance: Suitable and sufficient irradiation specimens.

For new reactors, suitable and sufficient irradiation specimens and archive materials are provided to support the reactor through its full operational life.

5.3.6.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been NOT CONCERNED.

Licensees

Almaraz and Trillo NPPs

Although this Expected Level of Performance is not applicable to Almaraz nor Trillo NPPs, the embrittlement surveillance programme is described in the chapter 5 of the NAR (see 05.1.3, page 122)

Ascó and Vandellós II NPPs

Despite the fact that this Expected Level of Performance is not applicable to ANAV, given that it only refers to new reactors, it is worth noting that, to date, 4 surveillance capsules have been irradiated and tested. This has enabled sufficient information to be gathered to demonstrate compliance with the fracture toughness limits of vessel materials established in the applicable standard.

Furthermore, each unit has two additional capsules that can be used, if necessary, to conduct subsequent tests.

Cofrentes NPP

Cofrentes applies the good practice of reconstructing irradiation samples. These are based on tested samples first withdrawn and then reinserted, once reconstructed, meaning the station has samples in all three irradiation reactor vessel capsules, more than enough for the foreseen 40 years of operation samples. If needed, additional samples could be used for long-term operation purposes.

5.3.6.2. Country position and action.

Licensees

Almaraz and Trillo NPPs

No action is planned.

Ascó and Vandellós II NPPs

ANAV considers, with regards to the current number of tested and available capsules, that the design has provided sufficient specimens to demonstrate information about the vessel materials for the plant's full operational life. Thus, this Expected Level of Performance is considered to be satisfied.

Cofrentes NPP

No action is planned as it is stated above.

Regulator

As it has been mentioned in the chapter 5.1.4 above, it is not in the intention of the Spanish electric supply system strategy to build new NPPs in the near or long term future.

Action

Due to it is not in the intention of the Spanish electric supply system strategy to build new NPPs in the near or long term future, no further actions are planned.

5.4. Concrete containment structure and pre-stressed concrete pressure vessel

5.4.1.Good practice: monitoring of concrete structures.

Complementary instrumentation is used to better predict the mechanical behaviour of the containment and to compensate for loss of sensors throughout the life of the plant.

5.4.1.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been BLANK.

Licensees

Almaraz and Trillo NPPs

Almaraz and Trillo NPPs Containment structures are “passive” structures, without elements such as a prestressing system, which could require special monitoring to verify their mechanical behaviour. With the configurations described in the Spanish NAR chapter 07.1.1, a specific monitoring system is not required to verify the mechanical behaviour, so this good practice is considered non-applicable to CNAT.

Ascó and Vandellós II NPPs

The Containment Pre-stress system at Ascó and Vandellós NPPs is ungrouted, which enables its condition to be periodically monitored according to what is indicated in US NRC RG-1.35.1. The results of these surveillances are evaluated in comparison with the tendon stress loss prediction models, verifying that the system capability will be higher than the one required by design for the period until the next surveillance. Because of this, additional sensors are not required to monitor the evolution of the system.

Cofrentes NPP

Cofrentes NPP's primary containment design details are explained in chapter 07.1.1 of the Spanish NAR.

Considering these features, the concrete containment building as such does not have instrumentation to monitor mechanical performance, and therefore complementary instrumentation is considered not needed.

5.4.1.2. Country position.

Licensees

Almaraz and Trillo NPPs

No action is planned; as explained, this Expected Level of Performance is not applicable to Almaraz nor Trillo NPPs.

Ascó and Vandellós II NPPs

The containment pre-stress system does not require instrumentation to monitor the tendon stresses. Thus, this Expected Level of Performance is not applicable.

Cofrentes NPP

Due to all the information above, this good practice is not applicable to Cofrentes NPP.

Regulator

As it has been mentioned by the licensees, the current monitoring of the pre-stressing system based on lift-off test, is considered appropriate and has shown a good behaviour.

Action

No further actions are planned.

5.4.2. Good practice: assessment of inaccessible and/or limited access structures.

A proactive and comprehensive methodology is implemented to inspect, monitor and assess inaccessible structures or structures with limited access.

5.4.2.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PRACTICE.

Licensees

Almaraz and Trillo NPPs

The CNAT situation regarding this point is described in section 07.1.3 of the Spanish National Assessment Report on Ageing Management of the Spanish Nuclear Power Plants.

Ascó and Vandellós II NPPs

Inaccessible surfaces are assessed based on accessible ones that are subjected to similar conditions, particularly when conditions are detected in the latter ones that could indicate the presence of or produce degradation of said inaccessible areas. Hence, when signs of or unacceptable degradation are found in examination category areas L-A (concrete surface, Table IWL-2500-1 Section XI ASME Code), inaccessible containment concrete areas have to be assessed if conditions exist in accessible areas that may indicate degradation of inaccessible areas.

Furthermore, whenever they are modified (maintenance activities, repairs, design modifications, other inspections, etc.) to be temporarily accessible, they must be inspected.

Cofrentes NPP

This good practice is not initially feasible at Cofrentes NPP as described in the TPR report. The plant has a Structure Inspection Guide that contains instructions aimed at making the most of any maintenance or modification intervention with the aim to enter inaccessible structures.

A significant example of this is the Existing Analysis of the New Revised Regulation, which led to an applicability analysis for revision 2 of Regulatory Guide RG 1.127 “Inspection of Water-Control Structures Associate with NPP”. As consequence of the analysis of this guide, Cofrentes NPP performed an assessment on the need to inspect inaccessible parts in the Ultimate Heat Sink (UHS), concluding that since the terrain was not aggressive for concrete, no specific inspection of inaccessible elements (buried) was required, although it also pointed to the need to benefit from the implementation of opportunistic inspections.

5.4.2.2. Country position.

Licensees

Inspection of inaccessible containment concrete surfaces is conducted in an opportunistic manner, whenever they become accessible for whatever circumstance, or they are carried out indirectly, by extending the condition of inspected and accessible surfaces.

Regulator

Means to assess the state of inaccessible or limited access structures are explicitly mentioned in CSN Safety Guide 1.18. Licensee have provisions in their plant procedure to deal with that, such as opportunistic inspections, assessment of similar accessible structures or the use of NDE.

Action

No further actions are planned.

5.4.3.TPR expected level of performance: monitoring of pre-stressing forces.

Pre-stressing forces are monitored on a periodic basis to ensure the containment fulfils its safety function.

5.4.3.1. Allocation by the TPR.

The allocation by the TPR to Spain in this finding has been GOOD PERFORMANCE.

Licensees

Almaraz and Trillo NPPs

This point does not apply to Trillo or Almaraz NPPs, as they do not have containments with a pre-stressed system (tendons).

Ascó and Vandellós II NPPs

At ANAV, unembedded containment tendons are pre-stressed with the aim of counteracting the internal pressure stresses that would occur in the containment building in the event of a design basis accident. A specific AMP has been planned to ensure that pre-stressing forces in the containment tendon system remain above the minimum required. The activities entail performing some periodic lifting force tests on a representative sample of the containment tendons and comparing the results obtained with some previously defined acceptance criteria that comply with RG-1.35.1 "Determining prestressing forces for inspection of prestressed concrete containments". The activities, which are required by ASME XI, are performed in compliance with the TS. Based on the tendon stress trend observed since the start of operations, performance until the end of LTO has been analysed, within the framework of the resolution of the TLAA which form those analyses.

Cofrentes NPP

Non applicable to Cofrentes NPP containment building.

5.4.3.2. Country position and action.

Licensees

Almaraz and Trillo NPPs

No action is planned, as previously stated. This Expected Level of Performance is not applicable to Almaraz nor Trillo.

Ascó and Vandellós II NPPs

ANAV considers that, with regards to monitoring pre-stressing forces in the containment tendons, this Expected Level of Performance is satisfied, taking into account the information above.

Cofrentes NPP

Non applicable to Cofrentes NPP containment building.

Regulator

As it has been mentioned before, the monitoring of the pre-stressing forces using lift-off test has shown good performance in the past, so no further monitoring systems are planned.

Action

No further actions are planned.

6. Status of the regulation and implementation of AMP to other risk significant nuclear installations

For the other nuclear installations (fuel cycle facilities, installations under decommissioning, waste facilities, etc.), information related to AMP status and its effectiveness, as well as planned development would be welcomed, where applicable.

During its meeting on 25th March 2019, ENSREG acknowledged that completion of Section 6 of the NAcP by September 2019 was not mandatory, recognising that these other nuclear installations were excluded from the original scope of the TPR.

ENSREG asked participating countries to complete Section 6 of the NAcP report on AMP for other significant nuclear installations on a voluntary basis during 2020, emphasising that submission of all other sections of the NAcP report are still required by September 2019.

6.1. Board recommendation

The Board recommends that countries explore the regulation and implementation of Ageing Management Programmes of other risk significant nuclear installations while developing and implementing National Action Plans to ensure they exist and are effective.

6.2. Country position and action (fuel cycle facilities, installations under decommissioning, waste facilities, etc.)

As it is stated above, this chapter is not mandatory, and therefore CSN have decided not to fulfil this chapter.

7. Table: Summary of the planned actions

This table contains the planned actions mentioned through the previous chapters for each reactor in Spain, the associated deadlines and the monitoring process by the CSN.

Table 7: Planned actions, deadlines and the monitoring process by the CSN

Installation	Thematics	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
ALMARAZ NPP	03. Electrical cables	***AL.EC-1*** ***Consideration of uncertainties in the initial EQ***	The plan to implement this Expected Level of Performance is to continue with the industry project ES-27 "Monitoring and evaluation of the condition of electric cables in Spanish NPPs" so that: - Age accelerated samples are available at different times of the operation up to the end of the Long-Term Operation (60 years), as well as the corresponding inspections and tests at different stages. - After the cables are aged to 60 years, the LOCA envelope accident is simulated and the applicable functional inspections and tests performed to check the current qualified condition and the remaining operating time. If the functionality of the cables is verified during and after the LOCA defined for the test, it can be reasonably assumed that the original qualification process, in accordance with IEEE 383-74, maintains safety margins that cover the uncertainties associated with the testing processes carried out during commissioning.	Approx. December 2024	CSN is in process of participating actively in this R&D project. So, the monitoring of this planned action will be performed according to the future project schedule activities
	05. RPV	***AL.RPV-1*** ***Volumetric inspection for nickel base alloy penetration***	In order to comply with the requirements established in MRP-372 Rev. 1, Almaraz NPP will carry out the following inspections: - Volumetric inspection (UT and ECT) from the inner diameter during refuelling outages R127 (March 2020) and R226 (March 2021) for unit 1 and 2, respectively. - Visual inspection of the J-weld, as a complement to the main UT-ET inspection, during refuelling outages R128 (October 2021) and R227 (November 2022) for unit 1 and 2, respectively.	- Volumetric inspection: Unit 1: R127 (March 2020). Unit 2: R226 (March 2021). - Visual inspection: Unit 1: R128 (October 2021). Unit 2: R227 (September 2022).	CSN Basic Inspection Plan
		AL.RPV-2 ***Non-destructive examination in the base material of beltline region***	Step 1: Carry out an analysis of the potential defects that could affect the base material of the "beltline" of the reactor vessel and, on the basis thereof, submit to the CSN a technical justification for the non-affectation of the integrity of the vessel by such defectology, which may be based, among others, on manufacturing documentation, results of inspections performed, operational experience and the international state of art. The analysis must be completed one year before the scheduled date for the planned inspection of the vessel for compliance with the applicable requirements in the current inspection interval, unless there is substantiated justification of the feasibility of the deadlines, in accordance with the planning of cycles and specific refuelling of the plants. Step 2: If such technical justification would not allow the possible affectation of the vessel base material to be excluded, licensee shall submit an inspection plan of the base material (beltline zone) to be performed preferably at the next scheduled inspection of the vessel referred to in Step 1, or duly justified alternative scheduling.	Analysis must be completed **one year before the planned date** for the inspection of the vessel for compliance with the applicable requirements in the current inspection interval. Vessel inspection: R128 (October 2021) and R227 (September 2022) for unit 1 and 2, respectively.	Assessment and Oversight and Control Integrated System

Table 7: Planned actions, deadlines and the monitoring process by the CSN

Installation	Thematics	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
TRILLO NPP	03. Electrical cables	***TRI.EC-1*** ***Consideration of uncertainties in the initial EQ***	The plan to implement this Expected Level of Performance is to continue with the industry project ES-27 "Monitoring and evaluation of the condition of electric cables in Spanish NPPs". See finding AL.EC-1 in this table.	Approx. December 2024	CSN is in process of participating actively in this R&D project. So, the monitoring of this planned action will be performed according to the future project schedule activities
ASCÓ NPP	03. Electrical cables	***AS.EC-1*** ***Consideration of uncertainties in the initial EQ***	The plan to implement this Expected Level of Performance is to continue with the industry project ES-27 "Monitoring and evaluation of the condition of electric cables in Spanish NPPs". See finding AL.EC-1 in this table	Approx. December 2024	CSN is in process of participating actively in this R&D project. So, the monitoring of this planned action will be performed according to the future project schedule activities
	05. RPV	***AS.RPV-1*** ***Volumetric inspection for nickel base alloy penetration***	Perform a volumetric inspection of all BMI inconel-600 welds before LTO	Unit 1: R129 (2023) Unit 2: R228 (2023)	CSN Basic Inspection Plan

Table 7: Planned actions, deadlines and the monitoring process by the CSN

Installation	Thematics	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
ASCÓ NPP	05. RPV	***AS.RPV-2*** ***Non-destructive examination in the base material of beltline region***	Step 1: Carry out an analysis of the potential defects that could affect the base material of the "beltline" of the reactor vessel and, on the basis thereof, submit to the CSN a technical justification for the non-affectation of the integrity of the vessel by such defectology, which may be based, among others, on manufacturing documentation, results of inspections performed, operational experience and the international state of art. The analysis must be completed one year before the scheduled date for the planned inspection of the vessel for compliance with the applicable requirements in the current inspection interval, unless there is substantiated justification of the feasibility of the deadlines, in accordance with the planning of cycles and specific refuelling of the plants. Step 2: If such technical justification would not allow the possible affectation of the vessel base material to be excluded, licensee shall submit an inspection plan of the base material (beltline zone) to be performed preferably at the next scheduled inspection of the vessel referred to in Step 1, or duly justified alternative scheduling.	Analysis must be completed **one year before the planned date** for the inspection of the vessel for compliance with the applicable requirements in the current inspection interval. Unit 1: R130 (fall 2024) Unit 2: R229 (spring 2025)	Assessment and Oversight and Control Integrated System
VANDELLÓS II NPP	03. Electrical cables	***VA.EC-1*** ***Consideration of uncertainties in the initial EQ***	The plan to implement this Expected Level of Performance is to continue with the industry project ES-27 "Monitoring and evaluation of the condition of electric cables in Spanish NPPs". See finding AL.EC-1 in this table.	Approx. December 2024	CSN is in process of participating actively in this R&D project. So, the monitoring of this planned action will be performed according to the future project schedule activities
	05. RPV	***VA.RPV-1*** ***Volumetric inspection for nickel base alloy penetration***	Perform a volumetric inspection of all BMI inconel-600 welds before LTO	Before 2028	CSN Basic Inspection Plan

Table 7: Planned actions, deadlines and the monitoring process by the CSN

Installation	Thematics	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
VANDELLÓS II NPP	05. RPV	***VA.RPV-2*** ***Non-destructive examination in the base material of beltline region***	Step 1: Carry out an analysis of the potential defects that could affect the base material of the "beltline" of the reactor vessel and, on the basis thereof, submit to the CSN a technical justification for the non-affectation of the integrity of the vessel by such defectology, which may be based, among others, on manufacturing documentation, results of inspections performed, operational experience and the international state of art. The analysis must be completed one year before the scheduled date for the planned inspection of the vessel for compliance with the applicable requirements in the current inspection interval, unless there is substantiated justification of the feasibility of the deadlines, in accordance with the planning of cycles and specific refuelling of the plants. Step 2: If such technical justification would not allow the possible affectation of the vessel base material to be excluded, licensee shall submit an inspection plan of the base material (beltline zone) to be performed preferably at the next scheduled inspection of the vessel referred to in Step 1, or duly justified alternative scheduling.	Analysis must be completed **one year before the planned date** for the inspection of the vessel for compliance with the applicable requirements in the current inspection interval. Vessel inspection: RO29 (fall 2028)	Assessment and Oversight and Control Integrated System
COFRENTES NPP	03. Electrical cables	***CO.EC-1*** ***Methods for monitoring and directing all AMP-activities***	Having an operational database for cables that includes relevant information on aging management for each cable.	End of 2020	CSN Basic Inspection Plan
		CO.EC-2 ***Consideration of uncertainties in the initial EQ***	The plan to implement this Expected Level of Performance is to continue with the industry project ES-27 "Monitoring and evaluation of the condition of electric cables in Spanish NPPs". See finding AL.EC-1 in this table.	Approx. December 2024	CSN is in process of participating actively in this R&D project. So, the monitoring of this planned action will be performed according to the future project schedule activities
	04. Concealed Piping	***CO.CP-1*** ***Use of results from regular monitoring of the condition of civil structures***	Adding building support results into PGE for piping systems	End of 2021	CSN Basic Inspection Plan

Table 7: Planned actions, deadlines and the monitoring process by the CSN

Installation	Thematics	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
COFRENTES NPP	05. RPV	***CO.RPV-1*** ***Non-destructive examination in the base material of beltline region***	Step 1: Carry out an analysis of the potential defects that could affect the base material of the "beltline" of the reactor vessel and, on the basis thereof, submit to the CSN a technical justification for the non-affectation of the integrity of the vessel by such defectology, which may be based, among others, on manufacturing documentation, results of inspections performed, operational experience and the international state of art. The analysis must be completed one year before the scheduled date for the planned inspection of the vessel for compliance with the applicable requirements in the current inspection interval, unless there is substantiated justification of the feasibility of the deadlines, in accordance with the planning of cycles and specific refuelling of the plants. Step 2: If such technical justification would not allow the possible affectation of the vessel base material to be excluded, licensee shall submit an inspection plan of the base material (beltline zone) to be performed preferably at the next scheduled inspection of the vessel referred to in Step 1, or duly justified alternative scheduling.	Analysis must be completed **one year before the planned date** for the inspection of the vessel for compliance with the applicable requirements in the current inspection interval. Vessel inspection: RO23 (November 2021)	Assessment and Oversight and Control Integrated System

REFERENCES

[1] Letters sent to licensees requesting information to perform the NAcP:

- CSN/C/DSN/AL0/19/29
- CSN/C/DSN/AS0/19/15
- CSN/C/DSN/COF/19/20
- CSN/C/DSN/TRI/19/14
- CSN/C/DSN/VA2/19/33

[2] Letters received from licensees with their NAcP proposals:

- ANA/DST-L-CSN-4078 / CNV-L-CSN-6878 (reference NAcP report for Ascó NPP and Vandellós II NPP).
- Z-04-02/AT-CSN-000132 (reference NAcP report for Almaraz and Trillo NPPs: CI-IN-004877).
- Z-04-02/AT-CSN-000133 (Additional NAcP report for Almaraz and Trillo NPPs).
- 1999983302377 (reference NAcP report for Cofrentes NPP).

[3] HLG_p(2018-37)_160_1st_Topical_Peer_Review_Report, 28-10-2018.

[4] Updated Report Activities in WENRA countries following the Recommendation regarding flaw indications found in Belgian reactors (2017), 2 November 2017. WENRA.