Authority for Nuclear Safety and Radiation Protection

National Action Plan on Ageing Management

National Report of the Kingdom of the Netherlands

The Netherlands, September 2019

List of content

1 Introduction

According to the Euratom directive on nuclear safety (2014/87/Euratom) every 6 years a Topic shall be chosen for a Topical Peer Review (TPR) by the regulatory authorities of the EU Member States. Ageing Management (AM) was the Topic chosen by ENSREG for the first TPR in 2017. Based on a WENRA-specification, the Netherlands produced its National Assessment Report by the end of 2017.

In 2018 a Peer Review process was carried out consisting of a written question and answering phase, followed by a Peer Review meeting of one week in Luxemburg in May 2018. In October 2018 ENSREG adopted the Summary Report and the Country Specific Findings. It was agreed that each participating country produce a National Action Plan (NAcP) by 30th of September 2019, using a predefined format. The NAcP describes the findings from the National Assessment Report, from the Summary Report and the Country Specific Findings and is intended to provide transparency.

The present NAcP includes actions related to the nuclear installations that participated in the TPR, i.e. the Borssele NPP, the High Flux Reactor (Petten) and the Higher Education Reactor (TU Delft). An additional chapter on the Ageing Management for other relevant nuclear installations will be included later, but no later than in 2020, as agreed by ENSREG.

2 Findings resulting from the self-assessment

The findings from the self-assessment have been documented in the National Assessment Report from 2017. Resulting actions are included below.

2.1 Overall Ageing Management Programmes (OAMPs)

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

The licences of the research reactors HFR and HOR will be extended to include a requirement to apply the IAEA standard SSG-10 on Ageing Management and specifically for the HOR to require external peer reviews that include Ageing Management. This will be done at an appropriate moment. In practice SSG-10 is already used at both HFR and HOR and a peer review for the HOR has been agreed to be carried out in 2020.

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

At present the licence conditions of both research reactors HOR and HFR do not require an Overall Ageing Management Programme (OAMP) based on IAEA SSG-10. In practice the OAMPs have been (HOR) or are being (HFR) developed and implemented based on SSG-10. At an appropriate moment (expected ultimately in 2023) the ANVS will include this as a condition in the licences of both research reactors.

Currently the licence of the HFR requires that every five years an IAEA INSARR[1] (or comparable) mission is carried out. In practice the ANVS has asked to include the subject of ageing management in the standard scope. A similar licence condition will be introduced for the HOR at an appropriate moment (expected ultimately in 2023). In fact the next INSARR mission at the HOR has already been agreed to take place in 2020, and will include a follow-up mission some years later. The mission will happen in relation with the 10-yearly Periodic Safety Review (PSR) and the findings of the mission will be included in the improvement plan resulting from the PSR. The ageing management program is part of the advanced reference material for the mission.

2.1.3 State finding n°2 (area for improvement or challenge) from the self-assessment

The HFR has not yet completed its OAMP. In chapter 9, paragraph 4 of the 2017 National Assessment Report TPR AM, also a number of issues are mentioned that need to be addressed with the completion of the OAMP, including embedding the OAMP into the integrated management system. Also the lessons learned from the CSO[2]-mission in Belgium must be included in the OAMP to prevent similar findings.

2.1.4 Country position and action on finding n°2 (licensee, regulator, justification)

HFR stated that it strives to complete the OAMP, both in the management system and in practice, before the CSO-mission due in 2020.

At the request of Belgium (FANC) and The Netherlands (ANVS), IAEA developed a so-called CSO (Continued Safe Operation) mission for research reactors, based on the experience gained from the SALTO missions for NPPs. In 2017 a pilot CSO-mission was carried out in Belgium at the BR-2 reactor. The CSO-mission to the HFR in the Netherlands will be in 2020, with a follow-up some years later. During the INSARR

[1] Integrated Safety Assessment of Research Reactors, INSARR
[22] Continued Safe Operation, CSO

follow-up mission in April 2019 the methodology for scoping and screening of the reactor structure, systems, and components (SSCs) for ageing management for continued safe operation of the HFR was also reviewed. The aim of the CSO-mission is to determine and further improve the maturity of the OAMP at the HFR. ANVS has requested that the findings of the pilot mission in Belgium will be used as a learning experience for the HFR OAMP programme.

As mentioned in the National Assessment Report of 2017, ANVS considers the planning to be ambitious. ANVS considers it important that the implemented OAMP shall be approved before the CSO-mission.

The final dates for the CSO-mission in 2020 have yet to be determined.

The majority of the recommendations and suggestions must be implemented at the time of the follow-up mission (2022) and be totally implemented by 2023.

2.1.5 State finding n°3 (area for improvement or challenge)-from the self-assessment

An improved ANVS inspection programme on ageing management will be developed, shifting focus from the development phase of the OAMPs to their operational phase.

2.1.6 Country position and action on finding n°3 (licensee, regulator, justification)

In the National Assessment Report it was stated that until now ANVS especially put effort in the review and inspection of the development stages of OAMPs. From now on a more structured inspection programme for the implemented programmes will be developed and implemented as part of the overall inspection programmes. It is expected these inspection programmes will be completed by 2021 (HOR), 2022 (KCB) and 2023 (HFR).

2.2 Electrical cables

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

No findings in this area.

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

Not applicable, see 2.2.1.

2.3 Concealed pipework

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

No findings in this area.

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

Not applicable, see 2.3.1.

2.4 Reactor pressure vessel

No findings in this area. On the other hand in the National Assessment Report on page 123, information was provided on the results of analyses on irradiated specimens taken out of the reactor in 2013 with the following text:

“In 2013 after 7 operation cycles specimen set SOP3 was removed from the RPV. SOP3 comprises about 60% of the assessment fluence. The specimens were tested in the hot cells of AREVA Erlangen in 2014. Adjusted reference temperatures for the assessment fluence are determined using prediction formulas in combination with the results of the surveillance programme. For the RT_{NDT} this has been done by means of Reg. Guide 1.99 Rev.2[46] and IAEA TRS No. 429[47] for the RT_{T0} (based on the fracture mechanics concept). The highest values resulting from this are called RT_{LIMIT}. This value can be compared to the limit curve give in KTA 3203[48]. According to the limit curve an RT_{LIMIT} of 65°C is allowed for a fluence of 3,5 10^{19} n/cm^2. The results of the assessment show that the RT_{LIMIT} of the Borssele RPV will be quite below that limit, see Table 12.

Concept	Limiting material	RT_{limit} [°C]	Difference to KTA 3203 RT_{limit} [K]
RT_{NDT}	BM Ring 03	19	46
RT_{T0}	WM	3	62

Table 12 RTLIMIT of RPV NPP Borssele

It can also be seen that the RTT0 concept (Master Curve concept) performed according to IAEA TRS No. 429 results in a lower RTLIMIT than the RTNDT (Charpy-V concept).
Based on these results no extra preventive measures against brittle fracture are necessary for the RPV of NPP Borssele. SOP4 is scheduled to be taken out in 2018. The aim is to take SOP4 out after the specimens have reached 100% of the assessment fluence.”

In the meantime the analyses of SOP4 have been carried out and the results are:

Concept	Limiting material	RT_{limit} [°C]	Difference to KTA 3203 RT_{limit} [K]
RT_{NDT}	BM Ring 03	22	43
RT_{T0}	WM	17	48

The specimens reached more than 100% of the assessment fluence. The conclusion is that after 60 years of operation margins are still available.

2.5 Concrete containment structure and pre-stressed concrete pressure vessel

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

No findings in this area.

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

Not applicable, see 2.5.1.

3 Country specific findings resulting from the TPR

This section is dedicated to the country specific findings resulting from the Topical Peer Review. Note: findings related to cables were not allocated by the TPR Board and are addressed in chapter 4 of the present report.

The country positions, corresponding actions and their planning (see the table in chapter 7), have generally been developed based on proposals from the licensee and finalized by the ANVS.

3.1 Overall Ageing Management Programmes (OAMPs)

3.1.1 TPR expected level of performance: finding 1

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.

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

In The Netherlands there is only one operational Nuclear Power Plant, the NPP Borssele. No new NPP is expected. Therefore, this topic is only applicable to NPP Borssele and only for extended shutdown. For every outage (shutdown) the chemistry department of the NPP Borssele sets up a monitoring plan for the water chemistry and measures how to set up the systems and components to avoid corrosion as much as possible. A general plan is available for short outages and another one for long outages. Currently NPP Borssele is testing Film Forming Amines in the secondary system, both to reduce hydrazine and to improve corrosion prevention during (long) outages. A project on this, including qualification, started in the outage of 2017 and is ongoing.

In case of extended shutdown it will be decided whether extra measures are needed like extra hydrazine injection or draining systems. The kind of measures are determined based on the specific situation of the extended shutdown (for instance primary system open or closed).

During regular shutdowns it is very important to exclude foreign materials. NPP Borssele has implemented a Foreign Material Exclusion (FME) programme. The risk of degradation of systems and components due to the inclusion of foreign materials is higher in extended shutdowns. NPP Borssele will use the FME measures also in case of extended shutdowns.

After every shutdown, before starting up the plant NPP Borssele has to demonstrate that all SSCs important to safety are qualified to operate. This demonstration is based on an assessment of all the activities performed during the outage, including In-Service Testing and Inspection.

The NPP is aware of an IAEA TecDoc about this topic which is being developed at the moment. The plant will study this TecDoc to look for further areas for improvement. If applicable the existing procedures will be updated or new procedures will be introduced.

3.2 Concealed pipework

3.2.1 TPR expected level of performance: finding 1

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.

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

The plant-level ageing management programme at the NPP Borssele, established that there is no active degradation mechanism at safety-related pipework penetrations through concrete structures. This conclusion is supported by the IAEA International Generic Ageing Lessons Learned (IGALL) guidelines for nuclear power plants. Therefore, no degradation based ageing management programme is applied to safety related pipework penetrations through concrete structures. Still, the condition of pipework at or near penetrations will be monitored in two separate programmes at the NPP Borssele.

The system health reports are updated annually and take into account the condition of penetrations and of pipework near penetrations as part of the system walkdowns. The walkdowns are performed as part of the equipment reliability programme and follow documented routes ensuring that all penetrations of piping are included. Instructions for the walkdown draw attention to the condition of pipe penetrations through concrete structures.

The ISI programme includes system leakage tests periodically, by visual inspection. The instructions for these visual inspections, which include all safety-classified systems, prescribe that the condition of pipework at or near penetrations, as well as the condition of the penetrations themselves, shall be taken into account and reported upon in the resulting inspection reports.

3.2.3 TPR expected level of performance: finding 2

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

3.2.4 Country position and action (licensee, regulator, justification)

Opportunistic inspections may take place whenever any concealed or buried system, structure or component is uncovered or accessible for another purpose.

By their nature, opportunistic inspections cannot be scheduled in advance. It is important that the organization is set to respond to the opportunities when they arise. At the NPP Borssele, a representative of the engineering department, also responsible for the conducting of inspections, is present at the daily production scheduling meeting. In this meeting the activities for the day are discussed, enabling the identification of opportunities for inspection.

To formally embed opportunistic inspections, they recently have been provisionally scheduled in the work management system. Currently, they are subsequently cancelled in case the opportunity did not arise. In order to further improve this practice the NPP Borssele is presently investigating a smarter means of using the work order system.

The approaches to opportunistic inspections will be documented in the relevant parts of the plant’s ageing management programmes, which are embedded in the management system.

3.3 Reactor pressure vessel

3.3.1 TPR expected level of performance: finding 1

No findings in this area.

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

Not applicable, see 3.3.1.

3.4 Concrete containment structure and pre-stressed concrete pressure vessels

3.4.1 TPR expected level of performance: finding 1

No findings in this area.

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

Not applicable, see 3.4.1.

4 Generic findings related to Electrical cables

In the subsections below, the country position for each finding related to electrical cables will be found.

The country positions, corresponding actions and their planning (see the table in chapter 7), have generally been developed based on proposals from the licensee and finalized by the ANVS.

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

NPP Borssele agrees to the statement that using operational aged cables for ageing assessments is a good practice. This Good Practice applies to NPP Borssele.

Below some examples are given of operational aged cables used for condition assessment and residual lifetime determination at NPP Borssele:

- Operational aged low voltage PVC insulated cables with a relatively high environmental temperature are used to investigate the reliable performance of the cables for Long term Operation.
- An operational aged XLPE insulated cable was used to requalify this cable type for accident requirements in the annulus room.
- 6000 V cables of the house load transformer were replaced and tested in a laboratory on water treeing and thermal ageing. With the results of the test a prediction model for thermal lifetime calculations was fine-tuned.
- A cable deposit is used for ongoing qualification of LOCA resistant cables.

4.1.2 Country planned action if relevant

Future programs may be started, but that depends for instance on cables performance data, in- or external operating experience, cables becoming available by coincidence due to other activities such as modification or replacement programs, etc.

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

The AMP of cables at the NPP Borssele is documented using COMSY as database in which all the cables at the plant are listed. Two additional specific databases are used for accident resistant cables to document the type test certificates and to determine the residual lifetime. In the Catalogue of Ageing Mechanisms the degradation mechanisms of cables and their effects are described.

In the document "Ageing Management of cables and wires" the AMPs for the specific cable commodities are described. The document also includes results out of the AMPs, other operating experience and the way in which this information is used to improve the AMPs.

4.2.2 Country planned action if relevant

This issue is sufficiently covered in the AM of NPP Borssele. No specific action is presently planned. Nevertheless improving AM, including the documentation of AMPs, is an on-going process.

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

See the answer to the topic above. Collecting data and the use of it to support the AMP is part of the Ageing Management process.

4.3.2 Country planned action if relevant

This issue is sufficiently covered in the AM of NPP Borssele. No specific action is presently planned. Nevertheless improving AM, including the documentation of AMPs, is an on-going process.

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

This identification and review was carried out in the Long Term Operation Assessment.

4.4.2 Country planned action if relevant

Topic fulfilled. No action.

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

At NPP Borssele water treeing is a topic in the AMP of high voltage cables.

In 2017 replaced 6000 V cables of the house load transformer were investigated regarding the presence of water trees by means of a laboratory testing program. No water trees were detected.

The 6000 V cables of the in 2018 newly installed reserve start-up transformer are fully watertight.

4.5.2 Country planned action if relevant

During the outage of 2019, dielectrical spectroscopy measurements were carried out on three inaccessible 6000 V ground cables to check for water treeing. The measurements were completed. No watertreeing was found. No further actions are considered necessary.

The topic “water treeing” is sufficiently covered in the AM of NPP Borssele.

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

A monitoring program was carried out to measure the environmental conditions of accident resistance components during normal operation. Based on the results and the initial conditions of the type test of components the qualified lifetime is calculated for each individual component.

The DBA conditions of every cable with a DBA requirement are below the DBA-specifications of the cables.

In the last 5 years a lot of cables with a DBA requirement were replaced due to LTO. The qualified life of these cables was not sufficient for the period of LTO. The new cables are qualified in conformity with the latest standards.

4.6.2 Country planned action if relevant

To check the data of the initial monitoring program for environmental conditions, a representative part of the measurements will be repeated around the year 2023.

The EQ-program covers the expected level of performance regarding Environmental Qualification.

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 and throughout their expected lifetime.

4.7.1 Country implementation

In NPP Borssele cables necessary for accident mitigation are part of the scope of cables with a DBA requirement. In the EQ-program these cables are qualified and the qualified life is monitored. See also the topic above.

4.7.2 Country planned action if relevant

As part of the EQ-program 5 cables of the in-core temperature measurements are replaced in the outages of 2019 and 2020 to fulfil the requirements of the latest qualification standards.

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

At NPP Borssele the initial AM program of cables was developed in the year 2000. Several techniques to measure electrical properties of the cable insulation and which may be helpful to detect ageing degradation have been reviewed. Generally it has been concluded that mechanical properties of insulation are more suitable to monitor ageing degradation. Just in a late period before "breakdown" electrical properties show a rapid degradation.

In IAEA NP-T-3.6 "Assessing and Managing Cable Ageing in Nuclear Power Plants" the following is stated about ageing management techniques based on electrical measurements: *"Most of the techniques are not very sensitive to insulation degradation. Most of these (electrical) tests are certainly effective as pass/fail indicators of functionality, but studies over many years in the nuclear industry suggest that there are no reliable data yet available that allow an appropriate correlation between these measurements and cable ageing"*.

Therefore NPP Borssele is cautious in the development of extensive electrical measurement programs in the light of ageing management.

Nevertheless some methods are chosen at NPP-Borssele:

- Partial Discharge and Dielectrical Spectroscopy measurements on 6000 V cables.
- Insulation resistance measurement is carried out on inaccessible low voltage cables of deep well pumps and neutron flux measurement.

4.8.2 Country planned action if relevant

NPP Borssele intends to review the use of additional methods in the next review of the ageing management program of cables in 2019.

5 All other Generic Findings

This chapter is dedicated to the generic findings made by the Topical Peer Review. Note that findings related to cables were not allocated by the TPR.

The country positions, corresponding actions and their planning (see the table in chapter 7), have generally been developed based on proposals from the licensee and finalized by the ANVS.

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

Allocated.

5.1.1.2 Country position and action

The NPP has undergone three IAEA SALTO peer reviews and is actively participating in SALTO peer reviews at other NPPs. Both the licensee and the regulator used the outcome of the three SALTO peer reviews to improve the existing ageing management and the oversight on it. Active participation in SALTO peer reviews at other NPPs helps the licensee the keep aware of the state-of-the-art on ageing management.

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

Good Performance allocated.

5.1.2.2 Country position and action

Not applicable.

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

Good performance allocated.

5.1.3.2 Country position and action

Not applicable.

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
Area for improvement (Afi) allocated in par. 3.1.1.

5.1.4.2 Country position and action
See par. 3.1.2

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
Afi allocated.

5.1.5.2 Country position and action
Refer to chapter 2, state finding number 4 (2.1.7/8).

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
Not allocated.

5.2.1.2 Country position and action
The NPP Borssele uses settlement measurements on the concealed pipework itself, which is considered a more direct way to identify possible ageing related effects on pipework than to rely on the identification of cracks in building walls. In addition, the Borssele NPP conducts 3-yearly qualified visual inspections on the inside of relevant pipework by means of robotic camera inspection, which also contributes to the insight of the physical condition of concealed pipework.

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
Not allocated.

5.2.2.2 Country position and action
The underground piping of the emergency cooling water system at Borssele NPP is made of concrete covered steel piping. This material is not included in the ASME tables and can therefore be considered as a novel material. However the application of this material is justified, because it has very good operating experience from more than 40 years of operation at the Borssele NPP and in similar European NPPs. The Borssele NPP replaced a considerable length of this type of piping due to conceptual ageing of design (separation principle) after nearly 40 years of operation, confirming the suitability and robustness of

the material in this application. The plant has no ageing related requirement to apply other new or novel materials in this application.

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

Afi allocated in para 3.2.1.

5.2.3.2 Country position and action

See para 3.2.2.

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

Good performance allocated.

5.2.4.2 Country position and action

Not applicable.

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

Area for improvement allocated in para 3.2.3.

5.2.5.2 Country position and action

See para 3.2.4.

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

Not allocated.

5.3.1.2 Country position and action

Not applicable (Borssele is a PWR).

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

Not allocated.

5.3.2.2 Country position and action

Not concerned. The neutron fluence of the NPP Borssele is relatively low. KWU PWRs have in general a low fluence because of the relatively big gap between the reactor core and the vessel wall. Furthermore in Borssele a low leakage core was implemented after 10 cycles of operation. Further shielding is not necessary.

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

5.3.3.2 Good performance allocated. Country position and action

The allocation of the Good performance is not correct, because this inspection is not applicable for NPP Borssele. It has no nickel base alloy penetrations susceptible to PWSCC.

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

Good performance allocated.

5.3.4.2 Country position and action

Not applicable.

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

Good performance allocated.

5.3.5.2 Country position and action

Not applicable.

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

Not allocated.

5.3.6.2 Country position and action

Not applicable because there is no new reactor in the Netherlands.

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

Not allocated.

5.4.1.2 Country position and action

This is a Good Practice that is not applicable in the case of The Netherlands, since the NPP Borssele employs a steel containment structure, which needs no sensors (strain gauges or other) that would predict the mechanical behavior of the containment structures.

Ageing mechanisms that may affect the condition of the steel containment sphere have been identified during the ageing management review that was conducted prior to LTO. None of these would benefit from complementary instrumentation.

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

Not allocated.

5.4.2.2 Country position and action

Structures at the NPP Borssele NPP are inspected according to the working procedures for civil structures. During the TPR it became clear that some regulators have established or amended regulatory guides to specifically address inspections and monitoring of inaccessible structures and structures with limited access. These guidelines may be applicable to other countries as well. The Netherlands (ANVS) therefore will ask those countries to provide the information and then decide what may be applicable.

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

Not concerned.

5.4.3.2 Country position and action

Not applicable.

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

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 chapter 6 of the NAcP report on AMP for other significant nuclear installations on a voluntary basis ultimately during 2020.

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.)

The Netherlands follows the recommendation of the Board, and will add the information at a later stage, ultimately in 2020

7 Table: Summary of the planned actions

This table contains the planned actions for each reactor and ANVS and the associated deadlines. The monitoring process by the ANVS for all actions by the licensee is as follows:

ANVS will require by official letter from the licensees the execution of the actions according to the plan and to provide a periodic progress report. Depending on the issue ANVS will review and assess or inspect the results and conclude on completion of the action. The specific monitoring for each action will be decided case by case. Therefore no specific actions of monitoring are described in last column of the table.

The three actions that ANVS will carry out will be included in the regular work plan.

Actor	Thematic	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
NPP Borssele	OAMP	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.	The plant is testing improving corrosion prevention in the secondary system. This will be finished and reviewed in the upcoming years. The plant will study an IAEA TecDoc about this issue looking for areas for improvement. The TecDoc is now in development.	1-1-2022 1-1-2022	
NPP Borssele	Cables	Potential of water treeing in inaccessible HV ground cables.	Dielectrical spectroscopy measurements will be carried out on 3 inaccessible 6000 V ground cables in the outage of 2019 to check for water treeing and results will be provided.	2019 The measurements were carried out already	

Actor	Thematic	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
NPP Borssele	Cables	Stability of environmental conditions in the long term should be checked.	To check the data of the initial monitoring program for environmental conditions, a representative part of the measurements will be repeated around the year 2023.	1-1-2024	
NPP Borssele	Cables	The current cables of the in-core temperature measurements are qualified in conformity with the KTA-standards of 1988. The cable type does not fulfill the requirements of the latest standards.	As part of the EQ-program, 5 cables of the in-core temperature measurements are replaced in the outages of 2019 and 2020 to fulfil the requirements of the latest qualification standards.	1-7-2020	
NPP Borssele	Cables	The use of techniques to detect the degradation of inaccessible cables may be improved	NPP Borssele will review the use of additional methods in the next periodical review of the ageing management program of cables in 2019.	1-1-2020	
NPP Borssele	Concealed pipework	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.	The system health reports take the condition of pipework penetrations and pipework at or near penetrations into account as part of the annual system walkdowns The ISI instructions for visual inspection will require that the condition of the penetration and pipework at or near penetrations is taken	1-9-2019 1-1-2020	

Actor	Thematic	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
			into account during the inspection.		
NPP Borssele	Concealed pipework	Opportunistic inspection of concealed pipework is undertaken whenever the pipework becomes accessible for other purposes.	A representative of the technical department is present in the daily production scheduling meeting, enabling the identification of opportunities for inspection. A smart means of using the work order system to ensure that opportunistic inspections will be conducted when the opportunity arises is being investigated in cooperation with the IT department.	Implemented 1-1-2020	
ANVS	Concrete containment structure	A proactive and comprehensive methodology is implemented to inspect, monitor and assess inaccessible structures or structures with limited access.	The Netherlands (ANVS) will approach regulators that have developed regulatory guidance to specifically address inspections and monitoring of inaccessible structures and structures with limited access and then decide what is applicable.	2021	
HFR	OAMP	The development and implementation of the OAMP is not yet realized.	HFR will complete the OAMP sufficiently timely before the 2020 SCO mission. Then it will implement improvements based on that mission.	2020 2023	

Actor	Thematic	Finding	Planned action	Deadline	Regulator's Approach to Monitoring
ANVS	OAMP	Need of extension of the licences of HFR and HOR.	Extend the licence conditions for RRs on AM, taking into account IAEA SSG-10 and external review on AM.	2023	
ANVS	OAMP	No licence condition on regular external review of AM.	Include similar licence condition on HOR as on HFR to require periodic external review.	2023	
ANVS	OAMP	Structured OAMP inspection programmes need to be developed for the operating phase.	ANVS will develop and implement structured inspection programmes for operating OAMPs for NPP and RRs, as part of the overall inspection programmes of the installations.	2020 (HOR), 2022 (KCB), 2023 (HFR).	

Authority for Nuclear Safety and
Radiation Protection (ANVS)

PO Box 16001 | 2500 BA The Hague, The Netherlands

www.anvs.nl

September 2019