Office for Nuclear Regulation

ENSREG Topical Peer Review on Ageing Management

United Kingdom National Action Plan – September 2019

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Executive summary

The Council of the European Union's (EU) Nuclear Safety Directive requires the member states of the EU to undertake a topical peer review (TPR) every six years with the first starting in 2017. The topic selected for the first review was ageing management of nuclear power plants and research reactors.

The UK does not have any research reactors within the scope of the TPR. Therefore, the UK participation in the review was limited to considering:

- The Advanced Gas Cooled Reactors (AGR) and the single Pressurised Water Reactor (PWR) operated by EDF Energy Nuclear Generation Limited (EDF-NG)
- The two European Pressurised Water Reactors (EPR) at Hinkley Point C being constructed by EDF Energy New Nuclear Build Generation Company Limited (NNB)

As required by the TPR process, the UK produced a self-assessment of ageing management in its National Assessment Report. This found that both the UK's operating reactors and its reactors under construction had adequate ageing management programmes appropriate to the stages that they were at in their lifecycles. However, a number of secondary but beneficial improvements were identified for both licensees and programmes for improvement were developed and agreed.

The UK participated in the written peer review of the European countries National Assessment Reports and the subsequent TPR workshop. These identified a number of findings that needed to be addressed by the participants including UK.

Most of the findings are matters that need to be addressed by the licensees. ONR has asked the licensees to provide their responses to the findings and assessed them to provide the information for this action plan.

During the assessment against the TPR Workshop findings, the UK has identified nine actions that need to be incorporated in the NAcP. As in the self-assessment in the National Assessment Report, none of the actions indicate a significant shortfall in ageing management, but are secondary, beneficial improvements. This report describes the programme for addressing these actions.

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1. INTRODUCTION

1.1. The Council of the European Union's (EU) Nuclear Safety Directive requires the member states of the EU to undertake a topical peer review (TPR) every six years with the first starting in 2017. The peer review process consists of three stages:

- Production of a self-assessment in a National Assessment Report (NAR) on the selected topic by each member state;
- Written comments on member states' NARs;
- A peer review workshop.

1.2. The topic that was selected for the first review was ageing management of nuclear power plants and research reactors. The scope for research reactors was those with a power of 1MWth or more. The UK does not have any of these. Therefore, the scope for the UK was::

- The Advanced Gas Cooled Reactors (AGR) and the single Pressurised Water Reactor (PWR) operated by EDF Energy Nuclear Generation Limited (EDF-NG)
- The two European Pressurised Water Reactors (EPR) at Hinkley Point C being constructed by EDF Energy New Nuclear Build Generation Company Limited (NNB)

1.3. In common with the other countries participating in the review, ONR prepared and issued the UK's NAR to a standard technical specification at the end of 2017. Much of this report was prepared by the reactor licensees. The process included a review of ageing management by the licensees and an assessment of their submissions by the UK regulator, ONR. The UK NAR was therefore the UK self-assessment of ageing management.

1.4. The UK self-assessment found that both the UK's operating reactors and its reactors under construction had adequate ageing management programmes appropriate to the stages that they were at in their lifecycles. However, a number of secondary but beneficial improvements were identified for both licensees and programmes for improvement were developed and agreed.

1.5. The NAR was then reviewed by other participating countries and a panel of subject matter experts using written comments and ONR plus the licensees participated in the workshop in May 2018. The conclusions and findings of the workshop were issued in November 2018. These required each country participating in the review to address generic findings and relevant country specific findings.

1.6. The findings from the TPR workshop are in three categories:

- Good Practice - A good practice is an aspect of ageing management which is considered to go beyond what is required in meeting the appropriate international standard. Where the workshop found that the UK had demonstrated a good practice, there is no need for any further action. Where a good practice has been identified in another country, the UK has assessed itself against it to see whether it provides an opportunity for ALARP improvements.
- TPR expected level of performance - A "TPR expected level of performance" for ageing management is the level of performance that should be reached to ensure

consistent and acceptable management of ageing throughout Europe. For each of these the Findings Report identifies whether:

- The UK demonstrated that it met the TPR expected level of performance, in which case there is no need for any further action.

- The UK did not demonstrate that it met the TPR expected level of performance. For these the TPR has identified it as an area for improvement and the UK needs to either demonstrate that it does meet the expected level of performance or put an action in place to ensure that it does.

- Challenge - Challenges are common to many or all countries and are areas where action at a European level could help to increase available knowledge or drive consistency or produce beneficial new techniques or technology to assist in specific aspects of ageing management. Challenges do not need to be addressed by individual countries and hence there are no specific UK actions for these and they are not addressed in this report.

1.7. Each TPR Workshop finding needs to be addressed by the participants and the outcome summarised in a National Action Plan (NAcP). This report is the NAcP for the UK.

1.8. Most of the findings are matters that need to be addressed by the licensees. ONR has therefore asked the licensees to provide their responses to the findings and assessed them to provide the information for this action plan. Where the position of the licensee is presented in this action plan, it is agreed by ONR.

1.9. During the assessment against the TPR Workshop findings, the UK has identified nine actions that need to be incorporated in the NAcP. As in the self-assessment of the NAR, none of the actions indicate a significant shortfall in ageing management, but are secondary, beneficial improvements. Where an action presented in this report is to be completed by a licensee, both the content of the action and the timescale for its completion are agreed by ONR.

1.10. To ensure consistency of National Action Plans across all of the participants, ENSREG has produced a template for each to follow. The report is based on the template.

2. FINDINGS RESULTING FROM THE SELF-ASSESSMENT

2.1. Overall Ageing Management Programmes (OAMPs)

2.1.1 EDF-NG to issue a formal company guidance document to describe the ageing management arrangements, described in Chapter 2 of [UK NAR]

2.1. EDF-NG completed this action for producing top level guidance for managing ageing before the TPR workshop and this was reported in the UK presentation at the workshop.

2.2. Action complete.

2.1.2 EDF-NG to incorporate a review against relevant IGALL documents in the periodic review and update documents in the technical governance process. This will be in two steps:

- **Update the technical governance document review management process by 28 February 2018;**
- **First review and update of all technical governance documents by mid-2021.**

2.3. EDF-NG completed the first part of this action before the TPR workshop and this was reported in the UK presentation at the workshop.

2.4. EDF-NG has changed the frequency of document reviews. Therefore, the date for the second part of this action has been extended to 31 December 2022. The updates are a routine process and no further TPR action is proposed, but ONR will monitor progress.

2.5. Action complete.

2.1.3 EDF-NG to review the arrangements for the annual reporting of ageing management, and include ageing management within an appropriate oversight process for each station for its reviews of performance for the calendar year 2018.

2.6. EDF-NG incorporated ageing management into its process for Annual Review of Safety therefore the original action has been completed. ONR has seen this in practice during the annual reviews at the sites and is content that it has been implemented.

2.7. Action complete.

2.1.4 NNB to formalise the ageing management arrangements by producing a Corrosion and Ageing Management Strategy.

2.8. NNB has produced a document entitled “Corrosion Management Plan”. This only covers the corrosion aspects of ageing management. Therefore, the action, which was to formalise all ageing management arrangements, has not been fully completed.

2.9. One of the findings of the TPR Workshop (see §3.1.2) was to review the content and scope of the overall AMP against the guidance in the recently issued IAEA Safety

Standard on ageing management. This is a key part of an ageing management strategy and hence the NAR action and the workshop finding need to be considered together. The outstanding part of this action has been incorporated into the response to the finding in §3.1.2 to assess ageing management arrangements against the guidance in the new standard.

2.10. No further specific response is required for this action.

2.2. Electrical cables

2.2.1 EDF-NG to review implementation of the technical guidance note for cable condition monitoring at the operating reactor sites to identify areas of good practice and make any necessary improvements to ensure consistent implementation.

2.11. EDF-NG has reviewed practice across all of its stations, which were all implementing the guidance satisfactorily. The Chief Engineer identified the best practices across the fleet and advised all of the stations on the areas where they could improve further.

2.12. Action complete.

2.2.2 EDF-NG to review the advice given within the technical guidance note for cable condition monitoring to ensure that appropriate advice is given for Neutron Flux Detection cables and make any necessary improvements.

2.13. EDF-NG has issued guidance to provide specific advice for neutron flux detection cables.

2.14. Action complete.

2.2.3 EDF-NG to update the existing Cable Conditioning Monitoring Technical Guidance Note to differentiate between power cables and I&C cables

2.15. EDF-NG has proposed that a better approach to ensure that the issue behind this is addressed is to revise its Control & Instrumentation Service Management document to ensure that it adequately references the Cable Conditioning Technical Guidance Note. ONR has accepted this.

2.16. **Revised action:** EDF-NG to revise its Control & Instrumentation Service Management document to ensure that the advice in the Cable Condition Monitoring Technical Guidance Note is adequately addressed (Action 5). Completion date: 31 December 2019.

2.3. Concealed pipework

2.3.1 EDF-NG to review the existing buried pipework inspection strategy and update governance and technical guidance documentation to align and consolidate it within the existing fleet-wide Corrosion Management Programme.

2.17. EDF-NG has reported that it has been progressing this, but it has been delayed due to operational issues. ONR is satisfied that the licensee is now applying significant

resource to ensure that the strategy and governance is updated and consolidated in line with the TPR expectations.

2.18. New completion date (Action 6): 31 December 2019.

2.4. Reactor pressure vessel

2.19. No findings identified.

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

2.5.1 EDF-NG to provide guidance on the ageing management of PCCV strain gauges.

2.20. EDF-NG has provided details of its strategy to address ageing management for the Vibrating Wire Strain Gauges (VWSG). This material includes a review of the numbers of VWSG in the PCCV, together with an assessment of their functionality and reliability. The review considers that there are faults in the data logger that processes the PCCV strain gauge data and recommends that intervention is required to investigate the faults. ONR considers that the proposed action is appropriate, although notes that no timescale has been identified for its completion. ONR is content that EDF-NG has produced adequate guidance in relation to ageing management of PCCV strain gauges for the purposes of the TPR.

2.21. Action complete.

2.22. The TPR workshop also identified a finding related to PCCV instrumentation and the response to this is addressed in §5.4.1.

2.5.2 EDF-NG to review and make any necessary improvements to the guidance relating to ageing mechanisms and acceptance criteria for [PCPV] SSCs to ensure that it is comprehensive and based on relevant good practice.

2.23. This area for improvement was raised as the EDF-NG self-assessment did not adequately define the acceptance criteria for cooling water leaks affecting the PCPVs. EDF-NG has supplied further details of its arrangements for the identification, recording and assessment of leaks that could affect the structural integrity of the PCPV. This information is primarily within a Company Technical Specification, which identifies ageing mechanisms, prioritisation criteria for the various types of leak and the required actions when leaks are identified.

2.24. Action complete.

2.5.3 Provide fleet-wide guidance on the ageing management of PCPV strain gauges.

2.25. EDF-NG has provided details of its strategy to address ageing management for the VWSGs for PCPVs. This material includes a review of the numbers of VWSGs in each vessel, together with an assessment of their functionality and reliability. The review has categorised the performance of the gauges for each station. A series of recommendations have been identified which detail further action, where this is

considered necessary. ONR considers that the proposed actions are appropriate, although notes that no timescale has been identified for their completion. ONR is content that EDF-NG has produced adequate guidance in relation to ageing management of PCCV strain gauges for the purposes of the TPR.

2.26. Action complete.

2.5.4 Review and make any necessary improvements to the guidance relating to ageing mechanisms and acceptance criteria for PCPV SSCs to ensure that it is comprehensive and based on relevant good practice.

2.27. This area for improvement was raised as the EDF-NG self-assessment did not adequately define the acceptance criteria for cooling water leaks affecting the PCPVs. EDF-NG has supplied further details of its arrangements for the identification, recording and assessment of leaks that could affect the structural integrity of the PCPV. This information is primarily within a Company Technical Specification, which identifies ageing mechanisms, prioritisation criteria for the various types of leak and the required actions when leaks are identified. ONR is content that EDF-NG has carried out a review of its guidance in relation to ageing mechanisms and acceptance criteria of concrete structure SSCs and considers that based on the information sampled the existing company guidance is adequate.

2.28. Action complete.

2.5.5 EDF-NG to review and make any necessary improvements to the guidance in relation to the prediction, detection and mitigation of ageing effects due to the irradiation of concrete.

2.29. EDF-NG has recently undertaken an AMP review for the oldest reactors in the fleet, which has considered the wider understanding of the effects of radiation exposure on concrete based on a variety of technical data and operating experience. In addition, ONR considers that EDF-NG has carried out an adequate review of more recent research on concrete irradiation. ONR notes EDF-NG's intention to engage with other researchers on this topic and with the IGALL programme to assess the effect of irradiation on concrete for long-term operation. Based on the information sampled, ONR is content that EDF-NG has carried out an adequate review of its guidance.

2.30. Action complete.

2.5.6 EDF-NG to review and make any necessary improvements to the fleet-wide arrangements in relation to providing additional evidence, based on an appropriate visual inspection regime that rubber bearings have not been subject to significant ageing effects.

2.31. EDF-NG has supplied further details of its recent review of bearing inspections. ONR is content that since the production of the UK NAR that EDF-NG has produced company guidance that identifies the ageing mechanisms for the bearings. Inspections have recently been carried out for a number of vessels where no previous bearing inspections have been undertaken. Bearing inspections are planned for those vessels where they have not been undertaken and where inspection is reasonably practicable. Based on the information sampled, ONR is content that EDF-NG has carried out an adequate review of its guidance in relation to bearing

inspections and that the evidence of inspections carried out to date is that bearings have not been subject to significant ageing related degradation.

2.32. Action complete.

2.5.7 EDF-NG to formalise requirements for regular fleet-wide tendon grease testing.

2.33. EDF-NG has reviewed its tendon grease inspections. These are focused on the highest risk stations, which are those with historical experience of tendon wetting due to pressure vessel cooling system leaks. ONR considers that the review was adequate and notes that it has highlighted that action is required (at the first available opportunity) to undertake grease testing at one of the stations where testing has not been carried out in recent years. The licensee does not wish to formalise the requirement to routinely test grease samples on all vessels and the safety cases do not require this.

2.34. ONR considers that since the production of the UK NAR there has been significant progress in carrying out further grease inspections, which have now been undertaken on the majority of the PCPVs. ONR notes that grease testing is carried out for the vessels with the highest risk of degradation and that the Appointed Examiner (APEX) retains the authority to require testing for other vessels on a risk informed basis.

2.35. ONR is content that EDF-NG's response to this improvement is adequate for the TPR.

2.36. Action complete.

2.5.8 NNB to formalise the ageing management arrangements for the concrete structures, for all stages of construction. The arrangements should describe the methods and criteria used for selecting SSCs to be included in the programme and the processes/procedures for the identification of relevant ageing mechanisms.

2.37. NNB has provided a number of documents that set out the high-level strategy for the future examination, inspection, maintenance and testing (EIMT) requirements for the civil engineering SSCs, which is a key element of ageing management. ONR has reviewed these and considers that they are adequate for the pre-operative period and also provide some assurance of NNB's EIMT intentions for operation, until detailed documents become available at a later date. Nonetheless, ONR considers that the licensee should provide further detail of its strategy for ageing management of civil structures. This is considered further as part of the response to the finding in §3.1.2 to assess ageing management arrangements against the guidance in the new safety standard by IAEA, SSG-48, therefore no further response is needed for this action.

2.38. No further specific response is needed for this action.

2.5.9 NNB to review and make any necessary changes to ageing mechanisms and acceptance criteria for the liner coating and penetration seals to ensure that these are comprehensive and provide appropriate guidance to enable the development of the material specifications and EIMT activities.

2.39. NNB has provided further information in relation to the specifications for the liner coating and penetration seals. Although the products to be used have not yet been finalised, ONR is content that NNB has adequate procedures in place to specify the

requirements for these items, to capture the outline EIMT requirements before the products are selected and to approve materials proposed by the contractor. In terms of the more detailed EIMT arrangements, ONR is content that these can be addressed at a later date as part of normal business and hence no further action is required for the TPR.

2.40. Action complete.

3. COUNTRY SPECIFIC FINDINGS RESULTING FROM THE TPR

3.1. Overall Ageing Management Programmes (OAMPs)

3.1.1 ***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.

3.1. UK practice was recognised by TPR as a good performance, therefore no action is required on this finding.

3.1.2 ***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.

3.2. The new IAEA Safety Standard for ageing management, SSG-48, was issued in November 2018.

3.3. UK operates a non-prescriptive goal setting regime for nuclear regulation. The licensees must demonstrate that their plants are safe so far as is reasonably practicable. The starting point for this is that the licensees must demonstrate that they meet relevant good practice (RGP) and the IAEA Safety Standards are one example of RGP. To ensure that the guidance in SSG-48 is incorporated into OAMPs, the licensees need to review their arrangements against it and make any necessary improvements.

3.4. EDF-NG is reviewing its arrangements against SSG-48 to identify any gaps in its arrangements. The review will produce recommendations for improvement by September 2019. The output of the gap analysis against SSG-48 will feed into a broader review on ageing and obsolescence.

3.5. **New action**: EDF-NG to review arrangements against IAEA's Specific Safety Guide SSG-48 and produce recommendations for improvements by September 2019. EDF-NG to incorporate these into its broader review of ageing and obsolescence, including implementing any necessary improvements to arrangements (Action 1). Completion date: 31 December 2021.

3.6. NNB has yet to start to assess its arrangements against SSG-48. There are two outstanding matters from the UK self-assessment discussed in §2.1.4 and §2.5.8, which require NNB to develop its ageing management strategy further. This finding will impact on the ageing management strategy and these two matters have been incorporated into a single action addressing this finding.

New action: NNB to produce an ageing management strategy consistent with IAEA guide SSG-48 (Action 2). Completion date: 31 March 2020.

3.7. ONR has a set of Technical Assessment Guides (TAG) which provides its assessors with guidance on the expected content of licensees' safety cases. These do not place requirements on the licensees, but describe ONR's expectations. As a result of a research project undertaken in parallel with the TPR, which included an assessment of ONR's TAGs against SSG-48, ONR has concluded that it needs to develop a new TAG for ageing management.

New action: ONR to publish a Technical Assessment Guide (TAG) on ageing management (Action 3). Completion date: 31 December 2021.

3.1.3 ***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.

3.8. EDF-NG has arrangements in place to protect plant during extended outages. These are supported by a Plant Preservation Group. The arrangements have been implemented satisfactorily at a number of sites over the years.

3.9. During the construction of Hinkley Point C, construction and installation work is done by contractors and the plant handed over to the licensee at a suitable time. NNB's arrangements for compliance with the site licence require it to have Care and Maintenance (C&M) plans in place for all SSCs. These provide the strategy, intent and the schedule of inspection and/or maintenance for the plant. NNB monitors the implementation of these plans whilst the plant is the responsibility of the contractor and has developed a performance to measure to track C&M activities. Once an SSC has been handed over to the licensee, it becomes responsible for C&M and this is implemented through its normal compliance arrangements.

3.10. UK practice is consistent with this finding and hence no action is required.

3.1.4 ***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.

3.11. UK does not have any research reactors that are within the scope of the TPR and hence this finding is not applicable.

3.2. Concealed pipework

3.2.1 ***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.

3.12. EDF-NG has confirmed that, whilst they were not highlighted in the NAR, the scope of pipework inspections includes penetrations through concrete structures.

3.13. This finding relates mainly to implementation of ageing management. It is too early in the design process for NNB as the licensee for Hinkley Point C to have the procedures in place and this may be the case for a number years. Both EDF-NG and NNB are part of the EDF Energy Group and NNB expects to base its procedures for ageing management for concealed pipework on those used by EDF-NG. The EDF-NG procedures are consistent with the TPR findings as noted in the previous

paragraph. Therefore, the NNB procedures will be based on those consistent with the TPR findings, taking into account any subsequent developments. The licensee has made a commitment that the TPR findings will be addressed and this is consistent with the design process and regulatory requirements. ONR agrees that no specific action is necessary for NNB in the context of this finding, but that the normal regulatory processes will ensure that the findings are incorporated into the site's AMP at the appropriate time.

3.14. UK practice is consistent with this finding and no action is required.

3.2.2 ***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.

3.15. UK practice was recognised by TPR as a good performance and hence no action is required on this finding.

3.2.3 ***Opportunistic inspections*****:** Opportunistic inspection of concealed pipework is undertaken whenever the pipework becomes accessible for other purposes.

3.16. UK practice was recognised by TPR as a good performance and no action is required on this finding.

3.3. Reactor pressure vessel

3.3.1 ***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.

3.17. UK practice was recognised by TPR as a good performance and no action is required on this finding.

3.3.2 ***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.

3.18. During the 2016 outage at Sizewell B, EDF-NG inspected the whole of the pressure vessel, including the beltline. This is reported in para 5.158 of the UK National Assessment Report.

3.19. The defects identified in Section 7.1.4 of the TPR report for the beltline region of the RPV originated in manufacturing and are not due to ageing related degradation. NNB has performed comprehensive surface and volumetric inspection of the RPV core shell forgings during manufacture, with the ultrasonic inspection supported by a capability statement that confirms the procedure is capable of detecting defects of

10 mm in depth by 20 mm in length, with high reliability. The ultrasonic inspections have also been repeated by an independent agent. The findings of the original inspection have been confirmed, including that there are no defects greater than this size, or out-with the RCC-M code requirements. Therefore, as NNB has implemented rigorous contract and independent repeat inspection of its beltline base material during manufacture, there is no need to inspect these areas during operation. This will be reviewed on an ongoing basis through consideration of worldwide OPEX in this area.

3.20. UK practice is consistent with this finding and no action is required.

3.3.3 ***Environmental effect of the coolant*****:** Fatigue analyses have to take into account the environmental effect of the coolant.

3.21. UK practice was recognised by TPR as a good performance and no action is required on this finding.

3.3.4 ***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.

3.22. Sufficient specimens have been extracted from material coupons constituting the beltline region; C1 Core Shell Forging, C2 Core Shell Forging, C1/C2 Core Shell Beltline Weld (manufactured using the same welding procedure specification and filler material batch as the production vessel welds), amounting to 6 completely assembled capsules, with coupon material available for 2 additional capsules. Each capsule comprises of an identical load out of Charpy Impact, Tensile and Compact Tension (Fracture Toughness) test specimens and the associated dosimeters, in keeping with the current EDF French and UK practice.

3.23. A full complement of 4 capsules are loaded into the EPR RPV at any given time, with new capsules inserted after the extraction and testing of the first 2 ISP capsules. Pairs of capsules are situated outboard of the core barrel at diametrically opposing locations, mid height in the RPV beltline region, giving rise to a lead factor on the RPV specimens with respect to the vessel wall.

3.24. The inclusion of the heavy reflector between the core and vessel wall ensures that the end of life irradiation embrittlement is an order of magnitude lower than the current generation of PWRs, justifying the reduction in the number of capsules contained with the RPV compared to previous designs, where 6 or 8 capsules were more commonly found. This guarantees that the irradiated forging parent material and representative weld coupon will cover the foreseen 60-year operational life and future plant life extensions.

3.25. The specification and strategy for UKEPR irradiation specimens has been extensively reviewed by EDF SA and EDF Energy NG to ensure that global best practices and UK context requirements are considered and implemented.

3.26. UK practice is consistent with this finding and no action is required.

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

3.4.1 ***Monitoring of pre-stressing forces*:** Pre-stressing forces are monitored on a periodic basis to ensure the containment fulfils its safety function.

3.27. UK practice was recognised by TPR as a good performance and hence no action is required on this finding.

4. GENERIC FINDINGS RELATED TO ELECTRICAL CABLES

4.1. Findings from the TPR for electrical cables relate mainly to implementation of ageing management. It is too early in the design process for the NNB as the licensee for Hinkley Point C to have the procedures in place and this may be the case for a number years. Both EDF-NG and NNB are part of the EDF Energy Group and NNB expects to base its procedures for ageing management for electrical cables on those used by EDF-NG. The EDF-NG procedures are already consistent with the TPR findings or, for a small number, short-term actions have been put in place to improve them. Therefore, the NNB procedures will be based on those consistent with the TPR findings, taking into account any subsequent developments. The licensee has made a commitment that the TPR findings will be addressed and this is consistent with the design process and regulatory requirements. The focus of this section of the report is on EDF-NG and the operating reactors. ONR agrees that no specific actions are necessary for NNB in the context of the TPR for electrical cables, but that the normal regulatory processes will ensure that the findings are incorporated into the site's AMP at the appropriate time.

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.

4.2. EDF-NG has a technical guidance note which describes how it inspects and assesses cables for ageing, taking into account the stressors on the plant for all sites. For the majority of stressors, the environment on the reactors is relatively benign and the data used as the foundation for the technical guidance note is adequate for the assessing degradation. The possible exception to this is the effect of radiation and this is addressed in the following three paragraphs.

4.3. For the PWR at Sizewell B the licensee has noted that samples of each type of cable are retained on site. These are held in two equipment storage facilities. One is located inside containment and subject to the same environment to other cables subject to radiation exposure. A second facility containing the same sample types is contained in a similar facility located on site in the stores area and so free from radiation exposure. Small pieces can be cut from these samples during the stations life to assess or help identify possible ageing mechanisms not revealed in other installation inspections or be used to help explain any deterioration discovered during installation inspections.

4.4. NNB will use the same approach at Hinkley Point C.

4.5. Due to the shielding afforded by the concrete pressure vessels on the AGRs, cables are in a low radiation environment and this finding is not applicable for these reactors.

4.6. UK practice is consistent with this finding and no action is required.

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.

4.7. The UK NAR describes how the cable AMP is documented in two sections:

- Section 2 describes the overall AMP process in detail, including how the AMP is documented for all systems.
- Section 3 describes elements specific to cables, which is primarily the technical guidance note for cable condition monitoring.

An important aspect of documentation for cables is ensuring that inspection activities are recorded. The UK TPR report paras 3.79 to 3.89 states that all cables that are targeted for inspection are identified in the cable inspection schedule and the results of inspections are recorded in the schedule. The schedule is maintained in an appropriate database held by the Electrical Engineering Group at the Station.

4.8. UK practice is consistent with this finding and no action is required.

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.

4.9. The UK NAR Section 3 describes the methods to collect ageing and performance data through the technical guidance note for cable condition monitoring. As an example, the methods for paper insulated lead sheathed cables up to 11kV are described in paras 3.97 to 3.100 and other types of cables subsequently. As noted in response to the previous finding, the results of inspections are recorded in the cable inspection schedule. Any adverse findings are subject to the remedial actions identified in the technical guidance note. More significant anomalies are dealt with using the licensee's Organisation Learning Process as described in NAR para 2.47 and 2.89 to be included, where appropriate in a Corrective Action Plan.

4.10. UK practice is consistent with this finding and no action is required.

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.

4.11. The UK NAR Tables 3.3 and 3.6 summarise the stressors, significant and observed ageing mechanisms, degradations, potential effects and remedial actions as presented in the licensee's Technical Guidance Note on Cable Condition Monitoring. The means of reviewing and updating the AMP are described in UK NAR paras 2.192 to 2.207. These apply to the subject of this finding. They include, but are not limited to:

- Research
- Operating experience

- Periodic safety reviews
- Routine document reviews

If any new degradation mechanisms are identified on EDF-NG plants or elsewhere the Organisational Learning Process will ensure that these are fulling considered and incorporated into the AMP if appropriate.

4.12. UK practice is consistent with this finding and no action is required.

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.

4.13. The UK identified treeing as a recognised ageing mechanism in para 3.16 of its National Assessment Report. Partial discharge testing, as described in para 3.55 to 3.58 of the report, is used as an effective means of detecting treeing.

4.14. The UK practice is consistent with this finding and hence no action is required.

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.

4.15. An environmental monitoring system has been installed at Sizewell B to gather environmental data during the life of the plant. This will provide valuable information in understanding the actual conditions experienced by the cabling installation and hence provide an understanding of how representative of the stressors in the equipment qualification.

4.16. The tests that are used in equipment qualification are usually based on accelerated ageing and are often carried out at high radiation dose rates over short timescales. Since the publication of the original equipment qualification standards, advances in the knowledge of polymer ageing have shown that testing using high acceleration factors is not always representative of the lower dose rates and temperatures experienced by the materials in service. In particular, dose rate effects from long term oxygen diffusion and the potential for synergistic effects between radiation and thermal ageing could result in a higher rate of ageing in service than might be expected from EQ test data.

4.17. For design basis faults the cabling systems throughout the fleet are qualified for internal and external hazards such as seismic, fire, hot gas release and steam release. The identification of the hazard and the expected operating condition were all taken into account before careful optioneering, procurement, installation and testing of cables.

4.18. The targeted plant walkdown of the cables, identified in the company technical guidance note on cable condition is the primary way that the stressors used in the initial Equipment Qualification are assessed as being valid and current.

4.19. UK practice is consistent with this finding and no action is required.

4.7 TPR expected level of performance: determining cables' performance under highest stressors - Cables necessary for accident mitigation is tested to determine their capabilities to fulfil their functions under Design Extension Conditions and throughout their expected lifetime.

4.20. This finding is considered separately for Sizewell B (EDF Energy's only Pressurised Water Reactor) and the Advanced Gas Reactors below.

4.21. For Sizewell B the safety case is structured so that the 'Europe-wide' definition of Design Extension Condition (DEC) A faults (e.g. station black-out, faults with the potential for fuel damage) are actually covered within the Sizewell B design basis.

4.22. Design Extension Condition B faults (core melt events) are covered by Sizewell B's severe accident analysis, where essentially the emphasis is on demonstrating that the containment remains intact in a core melt event, supported by identified safeguards. The analysis identified the challenging environmental conditions for 'beyond design basis' conditions (e.g. the source term for core damage, temperature and pressure conditions including spikes, missile damage, etc.) and assessed the impact on claimed safeguards. The assessment compared the conditions against equipment qualification profiles, also considering the location and nature of equipment, and made judgements regarding the survivability of plant. For example, the ability of the Reactor Building (containment) Fan Cooler cabling to withstand an 800˚C temperature spike has been assessed and, while resulting in charring and momentary lowering of the insulating properties of the cabling material, it will not reduce them sufficiently to cause failure of the cable. Therefore, it has been assessed that the cabling can withstand DEC B conditions.

4.23. For the AGR fleet the plant environment for cables is relatively benign during normal operation. Post fault conditions are more challenging. Nonetheless, long periods are available before a release could occur.

4.24. The Symptom Based Emergency Response Guidelines provide symptom based guidance for restoring the reactor to a safe shutdown state and the addition of the Deployable Back Up Equipment (DBUE) procured during the Japanese Earthquake Response programme provides additional resilience and options for the operators. The DBUE are held off-site.

4.25. UK practice is consistent with this finding and no action is required.

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.

4.26. The main techniques for the detection of degradation of inaccessible cables are insulation resistance and partial discharge testing. The approach to these is described in UK NAR paragraphs 3.52 to 3.58.

4.27. UK practice is consistent with this finding and no action is required.

5. ALL OTHER GENERIC FINDINGS

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. EDF-NG has engaged with a number of external peer review services including OSART and SALTO and has provided support to missions to other countries. This is an ongoing process and is considered part of routine business. ONR considers that no specific action is necessary for this finding.

5.2. Hinkley Point C is currently under construction and it is too early for engagement with the peer review services for ageing management.

5.3. UK practice is consistent with this finding and no action is required.

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.

5.4. The UK practice on this finding was recognised as a good performance.

5.5. For operating reactors the processes involved in ageing management are summarised in Fig 2.2 and paragraphs 2.36 to 2.48 of the NAR. There are many processes, but the key ones for ageing management are Maintain Design Integrity (MDI), Equipment Reliability (ER) and Technical Governance (TG) as explained in paragraph 2.40. Detail on how these and the other processes contribute to ageing management and how the licensee has used international experience and R&D from INPO, EPRI, WANO, IAEA and other organisations to develop them is presented in the grey shaded boxes in the NAR associated with the following key activities of the IAEA Safety Guide NS-G-2.12:

- Understand – paragraphs 2.76 to 2.91
- Plan – paragraphs 2.130 to 2.134
- Do – paragraphs 2.135 to 2.141
- Check – paragraphs 2.142 to 2.149
- Act – paragraphs 2.172 to 2.180

5.6. Hinkley Point C is currently under construction and these factors are implicitly included in the management processes of the Responsible Designer (RD) appointed for the delivery of HPC and NNB's acceptance of the safety case and design deliverables. $2.3.2.2 of the UK NAR explains how international experience is incorporated into the design.

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.

5.7. UK has addressed this as a country specific finding in §3.1.2.

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.

5.8. UK has addressed this as a country specific finding in §3.1.3.

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.

5.9. UK does not have any research reactors that are within the TPR scope and hence this finding is not applicable.

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.

5.10. EDF-NG notes that its arrangements will ensure that should any significant settlement occur, the implication on adjacent services or structures would be assessed and it is compliant with the finding. ONR has seen evidence of EDF-NG's whole system approach and inspection in a number of areas prior to the TPR and is content that EDF-NG's processes do adequately address pipework penetrations. EDF-NG accepts that the visibility of this in its documentation needs to be improved.

5.11. **New action:** EDF-NG to ensure that cognisance is taken of any adverse settlement findings when assessing the condition of concealed pipework during its next routine up date of the relevant documentation (Action 7). Completion date: 30 April 2020.

5.12. This finding relates mainly to implementation of ageing management. It is too early in the design process for NNB as the licensee for Hinkley Point C to have the procedures in place and this may be the case for a number years. Both EDF-NG and NNB are part of the EDF Energy Group and NNB expects to base its procedures for ageing management for concealed pipework on those used by EDF-NG. The EDF-NG procedures are consistent with the TPR findings as noted above. Hence the NNB procedures will be based on those consistent with the TPR findings, taking into account any subsequent developments. The licensee has made a commitment that

the TPR findings will be addressed and this is consistent with the design process and regulatory requirements. ONR agrees that no specific action is necessary for NNB in the context of this finding, but that the normal regulatory processes will ensure that the findings are incorporated into the site's AMP at the appropriate time. Hence no action is required for Hinkley Point C.

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.

5.13. UK performance for this finding was recognised as a good practice. This relates to the replacement of some pipework that is vulnerable to corrosion by High Density Polyethylene (HDPE) pipework. To ensure the long term integrity of the pipework, samples are to be removed and inspected after 4 and 10 years of operation (UK NAR paragraph 4.97).

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.

5.14. UK has addressed this as a country specific finding in §3.2.1.

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.

5.15. The UK practice for this finding was recognised as a good performance.

5.16. The TPR Report identifies that this was the outcome of the discussions in the workshop and it is not included in any depth in either the UK NAR or the UK presentation to the workshop. The UK NAR paragraph 4.36 notes that Consequences of Failure analysis needs to address subsequent events. For pipework, failure can escalate either through the consequential impact of loss of supply of the contents to plant or due to hazards generated by the failure, including examples such as internal flooding, jets or pipe whip. ONR's Safety Assessment Principles which explain how the non-prescriptive goals for the nuclear industry can be met implicitly include the requirement that consequential effects of failures need to be included in the safety case, particularly the hazards and fault analysis principles.

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.

5.17. The UK practice for this finding was recognised as a good performance.

5.18. An example of an opportunistic inspection is described in UK NAR paragraph 4.155 where the licensee used an unrelated modification to gain an understanding of the condition of a concealed pipework for a cooling water system.

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

5.19. UK does not have and does not currently intend to proceed with building any BWRs and hence this finding is not relevant.

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.

5.20. The UK practice for this finding was recognised as a good practice.

5.21. For the existing reactor at Sizewell B, The shape of the periphery of the core results in the outer fuel assemblies approaching the inside of the reactor vessel much more closely at certain circumferential locations than at others. At all circumferential locations the reactor coolant, the core barrel and the baffle assembly act to reduce the neutron and gamma flux reaching the vessel inside wall. At the regions of closest approach of the core to the vessel, neutron shield pads are attached to the outside of the core barrel. These pads reduce the peaks on the neutron flux circumferential distribution at the vessel. The neutron shield pads, in combination with other internal structures and the reactor coolant, limit the neutron flux on the reactor vessel to levels necessary to maintain the vessel material ductility to acceptable levels. In addition, these shielding provisions limit the gamma heating rates in the vessel and biological shield.

5.22. The design of the new reactors at Hinkley Point C has a heavy reflector inside the core barrel and the details and benefits of this for ageing management are described in §5.1.2.2 of the UK NAR.

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.

5.23. The UK practice for the inspection of bottom mounted instrument (BMI) penetrations was recognised as a good performance.

5.24. For Sizewell B, the design took cognisance of worldwide experience to reduce the susceptibility to stress corrosion cracking (UK NAR paragraph 5.91). Speculative inspection of the BMI penetrations has been undertaken using deployed ultrasonic and eddy current techniques as described in UK NAR paragraph 5.122.

5.25. The design for Hinkley Point C has eliminated these penetrations and has also put in place other measures to prevent stress corrosion cracking including water chemistry control and the use of more resistant materials in the primary circuit as described in the UK NAR paragraphs 5.47 & 5.208.

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

5.26. UK has addressed this as a country specific finding in §3.3.2.

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.

5.27. UK practice for this finding was recognised as a good performance.

5.28. For Sizewell B, the fatigue analysis of the reactor pressure vessels is covered in Surveillance Programme 3 (SP3) on Fatigue Management and is described in UK NAR paragraphs 5.52 to 5.58. The surveillance programme includes consideration of the operational transients in the plant fatigue analysis, both in terms of their conditions and their frequencies.

5.29. For Hinkley Point C, there is a commitment to adopt a similar approach in the UK NAR paragraph 5.149.

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.

5.30. UK has addressed this as a country specific finding in §3.3.17.

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.

5.31. ONR has reviewed the information provided in the NARs for those countries identified as having good practice in this area. It considers that the use of complementary gauges is cited in relation to PWR PCCVs only although it applies equally to AGR PCPVs and hence both are addressed here.

5.32. Since the TPR, EDF-NG has undertaken a fleet wide review of the performance of its strain gauges as noted in response to the UK self-assessment action discussed in §2.5.1. This review confirms EDF-NG's strategy to focus on improving the reliability of

existing gauges for vessels where gauge availability has reduced significantly over time.

5.33. For the AGR PCPVs, it would not be reasonably practicable to provide additional surface mounted gauges in many of the areas with low gauge coverage. The current gauges are distributed around the vessels and embedded in the concrete. Any data obtained from new gauges would be of more limited value than data from existing gauges, as there would be no historical information on strain at the new locations. For the PCPVs, the ONR therefore agrees with EDF-NG's response and forward strategy.

5.34. Regarding the Sizewell B PWR PCCV, ONR considers it would be reasonably practicable to install complementary instrumentation and this is acknowledged by EDF-NG. The current gauge availability is lower than for the AGR PCPVs and to address this, EDF-NG has recommended work on the data logger. Once the outcome of this work is known, ONR considers that EDF-NG may need to reconsider the option to install complementary instrumentation.

5.35. **New action:** EDF-NG to complete its study for the Sizewell B PCCV to investigate whether data logger improvements can be used to enhance PCCV strain gauge reading availability and then reconsider whether it is ALARP to install complementary instrumentation (Action 8). Completion date: 31 December 2020.

5.36. NNB claims that for Hinkley Point B, the Containment Monitoring System (EAU) has been developed to facilitate the monitoring of strains, displacements and settlements of the common raft and the inner containment, and to monitor forces in pre-stressing tendons. This enables the validation of the design hypotheses and methods used for the design basis of the inner containment, and to follow the evolution of mechanical characteristics over its operational life.

5.37. The EAU System Design Manual defines the role and design basis of containment monitoring system. The design of the EAU system offers redundancy in terms of quantity and types of monitoring device such that in the event of the failure of a device then the behaviour of the structure may still be inferred from the assessment of data recorded by other device types.

5.38. Where the embedded sensors are non-repairable or replaceable items, in the event of their failure, surface mounted replacement gauges/sensors may be provided to ensure that the EAU system continues to meet its long term data acquisition function.

5.39. In the NAR ONR considered that NNB's containment monitoring proposals were in accordance with relevant good practice. The supplementary information provided by NNB confirms that there is redundancy in the system design to allow for future failures of gauges that cannot be recovered and the design does not preclude the future addition of surface mounted gauges if this is required due to gauge failure. NNB's practice is consistent with the finding and no action is required.

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.

5.40. For operating reactors, EDF-NG's technical governance arrangements in relation to inaccessible areas have been strengthened since the TPR. The change is primarily to confirm that if an engineering judgement cannot be made regarding the holistic

integrity of the inaccessible area under consideration, then a categorised defect should be raised. The assigned defect category should be based on the significance of the area, its hazard withstand function, enclosed plant and the general condition of local accessible areas. Arrangements are then made to carry out follow-up inspections if recommended. ONR accepts EDF-NG's position that it does not consider buried features or features concealed by finishes as inaccessible areas for the purposes of raising a categorised defect, unless defects become manifest on the superstructure or finishes.

5.41. ONR has reviewed the information provided in the NARs for those countries identified as having good practice in this area and identified two areas that need to be addressed in EDF-NG guidance as reflected in the following action.

5.42. **New action**: EDF-NG to include the following improvements in its guidance for the inspection of inaccessible areas of concrete containment structures and pre-stressed concrete pressure vessels during its next routine update:

- The use of opportunistic inspections where concealed or buried areas are being exposed for other purposes.
- Guidance based on examples to illustrate how condition information can be collected using indirect investigation methods.

Completion date: 30 June 2021

5.43. For Hinkley Point C, NNB claims that any areas of civil structure that cannot be easily inspected shall be identified by the Detailed Design Layout Review (DDLR) process to ensure they are communicated to the Pre-Operations / Operations team and that relevant measures are put in place to inform through life inspection strategies.

5.44. Alternative access requirements can be utilised, for example, remote access cameras with recording equipment, which provides at least visual access to the internal faces of concealed SSCs. For the inaccessible areas, even by remote means, reliance is placed on the application of code and standards to ensure robustness and durability are taken into account for the lifespan and environmental exposure conditions. It is judged that an evaluation of the acceptability of inaccessible areas can be derived based on the conditions observed in accessible areas.

5.45. The Inner containment structure of the UK EPR plant is lined with a steel liner that performs the 'leak-tightness function of the containment. As such, the internal surfaces of the inner containment structure, including the foundation slab, cannot be visually inspected, The EAU system provides a means of monitoring the stress, strains and displacements of the structure to assess and confirm that it is operating within its design basis and is not experiencing any unexpected atypical behaviour.

5.46. NNB's practice is adequate for the purpose of the TPR and hence no action is required.

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.

5.47. UK practice for this finding was recognised as a good performance.

5.48. For Sizewell B, the benefits of tendon load testing with other examinations is described in UK NAR §7.1.3.1(ii) paragraphs 7.247 to 7.255. This summarises the scope of the inspections during refuelling outages and the criteria and results in general terms.

5.49. For Hinkley Point C, the tendons will be grouted with the exception of four vertical tendons, as explained in UK NAR paragraph 7.275. The pre-stressing on the four vertical tendons will be monitored directly, but for the others will be inferred from length variations measured by strain gauges.

5.50. Whist not strictly covered by the finding, the AGR PCPVs also have tendons, with a sample typically examined every 3 years as described in UK NAR §8.1.3 (iii) paragraphs 8.146 to 8.162. As well as describing the tendon load measurements and their results, it also describes destructive testing of tendons removed from the vessel to investigate the effects of ageing.

6. STATUS OF THE REGULATION AND IMPLEMENTATION OF AMP TO OTHER RISK SIGNIFICANT NUCLEAR INSTALLATIONS

6.1. Board recommendation

6.1. 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.)

6.2. The most risk significant nuclear installation in UK is at Sellafield. ONR will carry out an intervention at Sellafield to establish the effectiveness of Sellafield's ageing management programme. ONR has an existing intervention planned at Sellafield on its overall asset management programme during 2019/20. Additionally ONR will carry out a number of further interventions at Sellafield during 2020/21. These will specifically review the implementation of SL's ageing management programme for SSCs important to safety including:

- Concealed pipework
- Concrete containment structures
- Electrical cables

6.3. **New action** ONR to report the findings of the review of SL's ageing management programme (Action 4). Completion date: 31 March 2021.

7. TABLE: SUMMARY OF THE PLANNED ACTIONS

7.1. The actions in the report are summarised in the table below. ONR has a system for regulatory issues which the licensees need to address. The actions have been incorporated into a series of regulatory issues specific to the TPR. The licensees' performance will be monitored against these issues as part of the normal regulatory process and they will be closed out in accordance with that process.

No	Installation	Thematic	NAR action/ Finding	Planned action	Deadline
1	EDF-NG sites	Overall AMP	***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.	EDF-NG to review arrangements against IAEA's Specific Safety Guide SSG-48 and produce recommendations for improvements by September 2019. EDF-NG to incorporate these into its broader review of ageing and obsolescence, including implementing any necessary improvements to arrangements.	31 December 2021
2	Hinkley Point C			NNB to produce an ageing management strategy consistent with IAEA guide SSG-48.	31 March 2020
3	N/A			ONR to publish a Technical Assessment Guide (TAG) on ageing management.	31 December 2021
4	Sellafield	Overall AMP	The Board recommends that countries explore the regulation and implementation of Ageing Management Programmes of other risk significant nuclear installations.	ONR to report the findings of the review of SL's ageing management programme.	31 March 2021.
5	EDF-NG sites	Electrical cables	EDF-NG to update the existing Cable Conditioning Monitoring Technical Guidance Note to differentiate between power cables and I&C cables.	EDF-NG to revise its Control & Instrumentation Service Management document to ensure that the advice in the Cable Condition Monitoring Technical Guidance Note is adequately addressed.	31 December 2019

No	Installation	Thematic	NAR action/ Finding	Planned action	Deadline
6	EDF-NG sites	Concealed pipework	EDF-NG to review the existing buried pipework inspection strategy and update governance and technical guidance documentation to align and consolidate it within the existing fleet-wide Corrosion Management Programme.	Revised completion date	31 December 2019
7	EDF-NG sites	Concealed pipework	**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.	EDF-NG to ensure that cognisance is taken of any adverse settlement findings when assessing the condition of concealed pipework during its next routine up date of the relevant documentation.	30 April 2020
8	EDF-NG sites	Concrete containment structures	**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.	EDF-NG to complete its study for the Sizewell B PCCV to investigate whether data logger improvements can be used to enhance PCCV strain gauge reading availability and then reconsider whether it is ALARP to install complementary instrumentation.	31 December 2020

No	Installation	Thematic	NAR action/ Finding	Planned action	Deadline
9	EDF-NG sites	Concrete containment structures	**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.	EDF-NG to include the following improvements in its guidance for the inspection of inaccessible areas of concrete containment structures and pre-stressed concrete pressure vessels during its next routine update: • The use of opportunistic inspections where concealed or buried areas are being exposed for other purposes. • Guidance based on examples to illustrate how condition information can be collected using indirect investigation methods.	30 June 2021