Torness Reactor 2 Periodic Shutdown 2021

Agreement to the Extension of the Operating Period

Project Assessment Report ONR-OFD-PAR-21-010
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EXECUTIVE SUMMARY

Title

Torness Reactor 2 Periodic Shutdown 2021- Extension of the Operating Period

Permission Requested

EDF Energy Nuclear Generation Limited (NGL), the operator and licensee of Torness nuclear power station, has written to the Office for Nuclear Regulation (ONR) requesting Agreement to an extension of the operating period of Reactor 2, until 10 June 2022. The request is in accordance with NGL's arrangements made under Licence Condition (LC) 30(2): Periodic Shutdown.

Background

The periodic shutdown (also known as statutory outage) of nuclear reactors operated by NGL is a requirement of LC 30. At Torness, statutory outages are undertaken at three-year intervals in accordance with the approved maintenance schedule preface. One purpose of these shutdowns is to inspect and maintain systems, structures, and components, particularly when these activities cannot be carried out when the reactor is at power.

The ONR Consent for Reactor 2 start-up following its last periodic shutdown was given on 13 November 2018 (Licence Instrument 556). NGL has written to ONR to request Agreement to extend the operating period of Torness Reactor 2 from 12 November 2021 to 10 June 2022 an extension of 210 days. The Licensee has presented a safety submission that provides the nuclear safety justification for the extension. The primary safety claim is that extension of the period of plant operation by up to 210 days will not significantly reduce the reliability or availability of nuclear safety systems and will not lead to a significant increase in the frequency of plant faults as initiating events.

Assessment and inspection work carried out by ONR in consideration of this request

ONR specialist inspectors in Mechanical Engineering, Structural Integrity, Electrical Engineering, Control and Instrumentation, Probabilistic Safety Analysis and Graphite have assessed the safety justification made by the Licensee. There were no issues identified that would prevent Agreement by ONR to the extension of the operating period of Torness Reactor 2. ONR's Civil Nuclear Security has been consulted and have no security concerns regarding the proposed extension.

The Scottish Environment Protection Agency (SEPA) has also been consulted and does not object to ONR issuing a Licence Instrument giving Agreement to the requested operating period extension.

Matters arising from ONR's work

No issues preventing issue of this Licence Instrument arose from the assessment of the Licensee's safety justification by ONR specialist inspectors.

Conclusions

ONR's assessment of the Licensee's safety justification concludes that NGL has demonstrated it is safe to operate Torness Reactor 2 until 10 June 2022.

Recommendation

The recommendation from this Project Assessment Report is that ONR issue Licence Instrument 563 under LC 30(2) for Nuclear Site Licence Sc.14, giving Agreement to extending the operating period of Torness Reactor 2 to 10 June 2022.

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LIST OF ABBREVIATIONS

AGR	Advanced Gas-Cooled Reactor
ALARP	As low as reasonably practicable
C&I	Control and Instrumentation
CNS	Civil Nuclear Security (ONR)
EC	Engineering Change
EIMT	Examination, Inspection, Maintenance and Testing
HOW2	(Office for Nuclear Regulation) Business Management System
INSA	Independent Nuclear Safety Assessment
LC	Licence Condition
LI	Licence Instrument
NGL	EDF Energy Nuclear Generation Limited
ONR	Office for Nuclear Regulation
PCPV	Pre-stressed Concrete Pressure Vessel
PSA	Probabilistic Safety Analysis
PSSR	Pressure Safety System Regulations
R2	Reactor 2
SEPA	Scottish Environment Protection Agency
SQEP	Suitably Qualified and Experienced Person

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1 PERMISSION REQUESTED

1. EDF Energy Nuclear Generation Limited (NGL), the operator and licensee of Torness nuclear power station, has written (Ref. 1) to the Office for Nuclear Regulation (ONR) requesting Agreement to an extension of the operating period of Reactor 2, until 10 June 2022. The request is in accordance with NGL's arrangements made under Licence Condition (LC) 30(2): Periodic Shutdown.

2 BACKGROUND

2. The nuclear site licence requires the licensee to periodically shutdown any plant or process under LC 30. This is to enable examination, inspection, maintenance and testing (EIMT) to take place. At Torness, reactor periodic shutdowns are undertaken every three years, as specified in the Maintenance Schedule Preface, which is an approved document under LC 28(4). The previous Consent to re-start (Ref. 2) was issued on 13 November 2018. Without ONR's Agreement to an extension of the operating period, Reactor 2 (R2) is required to shutdown on or before 12 November 2021.

3. On 18 August 2021, NGL wrote to ONR (Ref.1) requesting Agreement to extend the operating period for Torness R2, to 10 June 2022, an extension of 210 days. Attached to the letter was the safety justification that proposed the deferral of the next R2 periodic shutdown and presented a justification for its continued operation during the extended operating period. This Engineering Change (EC) proposal, EC 368353 is a Category 2 modification, this means that the licensee judges the proposal, if inadequately conceived or executed, might lead to a significant but not serious increase in the risk of a radiological hazard. The EC underwent an independent nuclear safety assessment (INSA), the approval statement for which is contained within an attachment to the request letter.

4. NGL has made significant changes to its strategy for Advanced Gas-cooled Reactor (AGR) periodic shutdown management across the fleet in 2020 and 2021, owing to the Covid-19 pandemic. NGL note that a number of statutory outages have been deferred from 2020 into 2021 and that this has resulted in outage overlaps and challenges to resourcing which NGL consider could challenge the ability to deliver outages safely and to the required quality standards.

5. In response, NGL intends to optimise the placement of the next Torness R2 statutory outage by a deferral. NGL have set a target date of 6 May 2022 to commence the R2 periodic shutdown but have added a contingency period for unforeseen circumstances. The EC proposal therefore justifies deferring the periodic shutdown to no later than 10 June 2022, with a maximum period of extension of 210 days.

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3 ASSESSMENT WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST

6. As the project inspector, I have considered NGL's request for ONR's Agreement to the extension of the operating period for Torness R2. I have followed ONR procedures and guidance for delivering permissioning, as detailed in HOW2 (Ref. 3).

7. It is not novel or uncommon for NGL to request an extension to the operating period of a reactor, however, these are normally for short durations. In this instance, owing to the maximum period of extension being 210 days, I judged it to be proportionate to obtain advice from the following disciplines to make an informed decision about NGL's request:

- Structural Integrity
- Mechanical Engineering
- Electrical Engineering
- Control and Instrumentation
- Graphite
- Probabilistic Safety Analysis

8. The civil engineering professional lead has considered the requirement for a civil engineering assessment of this outage deferral and the targeting of civil engineering interventions (Ref. 4). The civil engineering professional lead considers that outage deferrals are comparatively routine with recent ONR assessment of outage deferrals and outages not identifying any significant issues or shortfalls when compared against relevant good practice. The professional lead notes the dutyholders well developed processes and the rigorous, impartial, semi-independent assurance process for ensuring the safety of the reactor pre-stressed concrete pressure vessel (PCPV) provided by the Pressure Safety System Regulations (PSSR) competent person.

9. The professional lead further notes the extensive data relating to the condition and ageing of the PCPV. Ageing mechanisms of the civil engineering elements are well understood, gradual and predictable with no evidence to suggest that the safety functions provided by the PCPV'S will be compromised in the immediate future. On this basis the professional lead considers that outage deferrals are not considered to present significant safety challenges that warrant consideration from a civil engineering perspective at this time.

10. To provide further assurance of the civil engineering aspects I requested a discussion with the PSSR competent person for Torness R2 (Ref. 5). The competent person provided further details of PCPV maintenance and examination activities undertaken since NGL's EC had been written. These activities had not revealed any findings that would adversely affect the claims made in NGL's EC.

11. The findings of NGL's internal regulator have been taken into consideration by a review of the INSA approval statement for the EC. The INSA engineer considered that the risk from a deferral of the Torness R2 periodic shutdown by 210 days is ALARP subject to confirmation of the PSSR competent persons' approval of the proposal.

12. This agreement to the postponement of examinations required by the PSSR has been confirmed by the PSSR competent persons for the PCPV and PCPV penetrations. For other pressurised systems the competent person has confirmed support for the R2 outage deferral, subject to satisfactory completion of specified testing and examination. NGL will control completion of this work through their work management system and any items that do not meet criteria will be removed from service. NGL have committed to provide the agreement of the competent person to all postponements to ONR.

13. The proposal to defer the periodic EIMT and extend the plant operating period gives rise to two potential challenges to nuclear safety. Firstly, uncertainty regarding the condition of the plant will be increased, because of the longer interval between inspections and testing. Secondly, time-dependant degradation of the plant between maintenance activities will be increased, due to the longer operating period. Both of these could challenge the reliability and or availability of plant claimed for prevention of and protection from initiating events. This could increase the likelihood of initiating events that challenge nuclear safety.

14. The primary safety claims in NGL's EC are that:

- Nuclear safety systems will not incur any significant decrease in their reliability and functionality claims, and there will not be any significant increase in the risk of an initiating event during the extended period of operation; and
- The nuclear safety risks are not significantly impacted by the proposed delay in statutory outage activities by up to 210 days, as such, the change in risk is sufficiently small that operation for the proposed deferral period remains ALARP.

15. The EC presents the arguments and evidence to support these claims which was the basis for assessment of each of the ONR specialist inspectors. The following sections provide a high-level summary of the findings from each of the ONR specialist inspectors' assessments.

3.1 STRUCTURAL INTEGRITY

16. Reference 6 reports the findings of the ONR structural integrity assessment of the Torness R2 outage deferral request.

17. During their assessment the structural integrity specialist inspector considered the following areas:

- LC 28 compliance
- PSSR examinations
- Relevant regulatory issues

18. For LC 28 and PSSR the specialist inspector was content that compliance will be sustained despite the postponement of the periodic shutdown. This judgement was informed by a review of recent ONR structural integrity assessment reports for:

    - The periodic shutdowns of Torness Reactor 1 in 2017, Torness Reactor 2 in 2018, Heysham 2 Reactor 7 in 2018 and Heysham Reactor 8 in 2016; and
    - The postponement of the Torness Reactor 1 2020 periodic shutdown.

19. The specialist inspector identifies one regulatory issue of relevance that addresses the corrosion management programme for the carbon dioxide storage and distribution system. The specialist inspector notes that the Torness site inspector is satisfied with progress and intends to shortly close the regulatory issue. The specialist inspector therefore concludes that there are no regulatory issues that would impede ONR agreement to the extension to the operating period for Torness R2. Completion of actions associated with corrosion management of the carbon dioxide plant at Torness have also been discussed at Level 3 meetings with NGL. This has resulted in additional central technical organisation oversight to ensure timely delivery of inspections.

20. Overall, from a structural integrity perspective the specialist inspector recommended agreement to an extension of the operating period for Torness R2.

3.2 MECHANICAL ENGINEERING

21. Reference 7 reports the findings of the ONR mechanical engineering assessment of the Torness R2 outage deferral request.

22. The inspector's assessment focused on the nuclear safety risk associated with deferral of EIMT planned during the next statutory outage until 10th June 2022.

23. The specialist inspector sampled the following mechanical engineering components that were judged to be important to nuclear safety:

    - Gas circulators
    - Reactor gas safety relief valves
    - Main boiler feed system

24. The specialist inspector was satisfied that the nuclear safety systems sampled are unlikely to incur any significant decrease in their reliability and functionality

claims, and there is no significant increase in the risk of an initiating event during the extended period of operation. Based on the evidence sampled the specialist inspector was satisfied that:

- The claim that the gas circulators can continue operation until the deferred outage start date is reasonable. The inspector was also content that adequate EIMT provision has been made to support continued operations.
- The claim that the reactor gas safety relief valves can continue to operate until the deferred outage start date is reasonable. In making this judgement the inspector is content that adequate consideration has been given to reactor gas safety relief valve drift.
- The claim that the boiler feed system can continue to safely operate until the deferred outage start date is reasonable

25. Overall, from a mechanical engineering perspective, the specialist inspector was satisfied with the claims, arguments and evidence laid down in the NGL EC and supports ONR agreeing to an extension of the operating period of Torness R2 to no later than 10 June 2022.

3.3 ELECTRICAL ENGINEERING

26. Reference 8 reports the findings of the ONR electrical engineering assessment of the Torness R2 outage deferral request.

27. The specialist inspector was satisfied, from the sample assessed in an electrical engineering context with claims made in the deferral proposal, given that:

- The shutdowns that have occurred since the last statutory outage do not cause concern or indicate inconsistencies with the safety case assumptions.
- The potential impact of the deferral on maintenance, inspection, tests and other outage work is only moderate and does not create a significant increase in risk.
- There are no significant concerns raised from the deferral of the regular and systematic maintenance, inspection and testing of all plant which may affect safety and there are no significant challenges or increases in risk identified.
- The issues related to the 110V charger and inverter were minor.
- The system health scores associated with the systems sampled were demonstrated to be satisfactory. No matters of significant safety concern were identified that were not already being addressed or are the subject of actions to take corrective measures within the station arrangements.
- The relevant ONR electrical engineering specialist inspector is satisfied with the explanations and advice provided by NGL Torness and

relevant suitably qualified and experienced persons in response to the points for clarification raised by the 2DX2 gas circulator variable frequency convertor failure.
- There have not been any other significant emergent issues arising from the deferral of the last TOR R1 statutory outage that would cause concern.

28. The specialist inspector raised a recommendation in their report requiring NGL to confirm the findings of the gas circulator review panel, the impact to the central technical organisation's opinion of the outage deferral and the appropriate closure of commitment 2 in NGL's EC. Based on information subsequently provided by NGL the specialist inspector is content that this recommendation has been addressed and can be closed (Ref. 8).

29. The specialist inspector did not identify anything of safety significance from an electrical engineering perspective that should prevent the deferral of the statutory outage. Overall, the specialist inspector supports ONR agreeing to an extension of the operating period of Torness R2 to no later than 10 June 2022.

3.4 CONTROL AND INSTRUMENTATION

30. Reference 9 reports the findings of the ONR control and instrumentation (C&I) assessment of the Torness R2 outage deferral request.

31. The inspector's assessment focused on:

- The Torness R2 maintenance schedule items that will be subject to deferral.
- The potential for the performance of C&I systems / equipment important to safety to drift / degrade during the statutory outage deferral period.
- The potential for C&I systems and equipment important to safety to reach a reliability cliff edge during the statutory outage deferral period.
- Identification of C&I related risk reduction measures.

32. The inspector was content that C&I related statutory outage activities covered by the Torness R2 Maintenance Schedule have been reviewed by suitably qualified and experienced persons (SQEP) and that potential C&I related statutory outage risk reduction measures have been adequately considered.

33. The inspector considered the potential for the performance of C&I systems / equipment important to safety to drift, degrade or reach a reliability cliff edge to remain low during the statutory outage deferral period. The inspector observed that the increased use of equipment condition trending, including as found condition codes, would strengthen the justification presented and that this reflected findings in previous ONR C&I assessments. This finding has previously been captured by a regulatory issue which was closed on the basis

that a training package has been developed and training will be delivered by NGL. The specialist inspector will continue to monitor this as part of normal regulatory business.

34. The inspector identified a concern related to the availability of neutron flux detectors for Torness R2. The deferred statutory outage does not include an exchange of flux detector and thus the outage deferral proposal does not impact the risks associated with flux detector failure causing an unplanned reactor trip. The specialist inspector will follow this up through routine regulatory interactions with NGL.

35. In conclusion, the specialist inspector considers the C&I systems / equipment risks associated with deferring the Torness Reactor 2 statutory outage to be acceptable. The specialist inspector has not identified any concerns that would prevent ONR giving Agreement to NGL's request for the deferral of the Torness R2 periodic shutdown.

3.5 GRAPHITE

36. Reference 10 reports the findings of the ONR graphite assessment of the Torness R2 outage deferral request.

37. The specialist inspector sampled aspects of the EC concerned with graphite weight loss and brick cracking.

38. Regarding graphite weight loss, the specialist inspector notes that Torness R2 is the lead reactor for weight loss in the Heysham 2 and Torness station pair. However, the inspector considers that as the safety case is not reliant on an individual measurement any delay in obtaining the data should not introduce unacceptable risks in the confidence in the weight loss predictions at TOR R2.

39. The inspector also observed that a graphite weight loss limit is predicted to be reached within the proposed deferral period. NGL have submitted a new graphite weight loss safety case (EC 364022 001) to ONR and the inspector notes that ONR's acceptance of this weight loss safety case is not dependant on the outcome of the graphite activities at the Torness R2 statutory outage. The inspector is therefore content that agreeing to the deferral of the Torness R2 outage would have no impact on the risks associated with the assessment of the graphite weight loss safety case (EC 364022 001).

40. From the graphite brick cracking perspective the specialist inspector notes the finding of a keyway root crack at Heysham 2 reactor 7 in June 2021. The inspector was content that due to the lagging nature of Torness R2 the core condition should not, up to June 2022, influence the ability to shut-down and hold down the reactor in the event of a design basis seismic event. The specialist inspector also agreed with the licensees claim that inspecting a higher burn-up core would provide more meaningful information on the core condition.

41. The inspector considered peripheral brick cracking and the inspection results obtained from Torness R2 during the 2018 inspection. The results of the inspections showed peripheral brick cracking to be limited and have no obvious sign of progression nor spatial clustering. The specialist inspector therefore considers that a delay to inspections due in the statutory outage will not affect the intent nor capability of these inspections.

42. In conclusion, from the graphite perspective, the specialist inspector has no objections to the deferral of the periodic shutdown of Torness R2.

3.6 PROBABILISTIC SAFETY ANALYSIS

43. Reference 11 provides the findings of the ONR probabilistic safety analysis (PSA) assessment of the Torness R2 outage deferral request.

44. The inspector considered previous ONR assessment work carried out in support of the Torness reactor 1 outage deferral and concluded that assessment was also valid for Torness reactor 2 outage deferral. The primary purpose of ONR conducting a PSA analysis was to give initial confidence to the other ONR specialist inspectors reviewing the case that the overall risk increase for deferring the outage was demonstrably small and also to assist in identifying appropriate areas to sample within their respective assessments.

45. Overall, the PSA specialist inspector accepted that the potential risk increase from deferring the outage was small and recommended agreement to an extension of the operating period for Torness R2.

3.7 SECURITY

46. The civil nuclear security (CNS) site inspector is content (Ref. 12) that there are no issues from a security perspective that would impact on the decision to agree to the extension of the operating period of Torness R2.

3.8 ENGAGEMENT WITH OTHER GOVERNMENT AGENCIES

47. I have engaged with the Scottish Environment Protection Agency (SEPA) Site Inspector, who confirmed (Ref. 13) that they have no objections to the extension of the operating period for Torness R2.

4 MATTERS ARISING FROM ONR'S WORK

48. No issues preventing issue of this Licence Instrument arose from the assessment of the licensee's safety justification by ONR specialist inspectors.

5 CONCLUSIONS

49. NGL have requested an extension to the operating period of Torness R2 under the correct licence condition LC 30(2). The request was made on the grounds of outage overlaps and challenges to resourcing due to the Covid-19

pandemic. NGL have deferred a number of periodic shutdowns across the AGR fleet to minimise overlap of outages at different stations.

50. The justification to extend the operation of Torness R2, EC 368353, has undergone NGL's due process for a Category 2 submission in the production, review and authorisation of the statutory outage deferral justification.

51. NGL's justification has been assessed by ONR specialist inspectors, who have not identified any matters of nuclear safety significance arising from extending the operating period of Torness R2. No specialist inspector has objected to ONR Agreeing to the extension of the operating period.

52. Based on the work carried out by ONR, I judge that NGL has made an adequate justification for an extension of the Torness R2 operating period from 13 November 2021 to 10 June 2022.

6 RECOMMENDATIONS

53. I recommend that the ONR issues Licence Instrument 563 under LC 30(2) for Nuclear Site Licence Sc.14, giving ONR's Agreement to extending the operating period of Torness Reactor 2 to no later than 10 June 2022.

7 REFERENCES

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