Office for Nuclear Regulation

Heysham 1 Reactor 2 Periodic Shutdown 2021

Agreement to the Extension of the Operating Period

Project Assessment Report ONR-OFD-PAR-21-005
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EXECUTIVE SUMMARY

Title

Heysham 1 Reactor 2 Periodic Shutdown 2021- Extension of the Operating Period

Permission Requested

EDF Energy Nuclear Generation Limited (NGL), the operator and licensee of Heysham 1 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 17 March 2022. The request is in accordance with NGLs arrangements made under License 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 Licence Condition 30. At Heysham 1, 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 14 August 2018 (Licence Instrument 616). NGL has written to ONR to request Agreement to extend the operating period of Heysham 1 Reactor 2 from 13 August 2021 to 17 March 2022 an extension of 216 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 216 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, Civil Engineering, Electrical Engineering, Control and Instrumentation, and Graphite have assessed the safety justification made by the Licensee. There were no issues that would prevent Agreement by ONR to extend the operating period of Heysham 1 Reactor 2.

The Environment Agency has been consulted and does not object to ONR issuing a Licence Instrument giving Agreement to the requested operating period extension. Civil Nuclear Security has also been consulted and have no security concerns regarding the proposed 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 EDF has demonstrated it is safe to operate Heysham 1 Reactor 2 until 17 March 2022.

Recommendation

The recommendation from this Project Assessment Report is that ONR issue Licence Instrument 634 under LC30(2) for Nuclear Site Licence 60, giving Agreement to extending the operating period of Heysham 1 Reactor 2 to no later than 17 March 2022.

LIST OF ABBREVIATIONS

AGR	Advanced Gas-Cooled Reactor
ALARP	As low as reasonably practicable
APEX	Approved Competent Person
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
HRA	Hartlepool
HYA	Heysham 1
INA	Independent Nuclear Assurance
INSA	Independent Nuclear Safety Assessment
LC	Licence Condition
NGL	EDF Energy Nuclear Generation Limited
ONR	Office for Nuclear Regulation
PSSR	Pressure Safety System Regulations
R1	Reactor 1
R2	Reactor 2
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 Heysham 1 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 17 March 2022. The request is in accordance with NGLs arrangements made under License Condition (LC) 30 (2): Periodic Shutdown.

2 BACKGROUND

2. The nuclear site license 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 Heysham 1, reactor periodic shutdowns are undertaken every three years, as specified in the Maintenance Schedule Preface, an approved document under LC28 (4). The previous Consent to re-start (LI 616) was issued on 14 August 2018. Without ONR's Agreement to an extension of the operating period, Reactor 2 was required to shutdown on or before 13 August 2021.

3. On 18 May 2021, NGL wrote to ONR (Ref.1) requesting Agreement to extend the operating period for Heysham 1 Reactor 2 to 17 March 2022, an extension of 216 days. Attached to the letter was the safety justification proposing the deferral of the next Reactor 2 periodic shutdown and presented a justification for its continued operation during the extended operating period. This Engineering Change (EC) proposal, EC 369065 revision 000 is a Category 2 modification to the reactor. That 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 by NGL's internal nuclear assurance (INA).

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 and the response measures imposed by the UK Government. In NGL's opinion, the requirements for social distancing, enhanced hygiene measures and the requirements to obtain dispensations to work on site have all contributed to delays to the fleet periodic shutdown schedule. This has threatened overlaps between outages, which would increase risks associated with availability of key personnel and equipment. Resource availability has been impacted by restrictions to travel and the availability of local accommodation for delivery partners. All of these pressures could challenge the ability to deliver outages safely, to the required standards and in a timely manner.

5. In response, NGL intends to optimise the placement of the next Heysham 1 power station (HYA) Reactor 2 (R2) statutory outage by a deferral. NGL have set a target date of 7 February 2022 to commence the R2 periodic shutdown but have added a contingency of 38 days against unforeseen circumstances. The EC proposal therefore justifies deferring the periodic shutdown to no later than 17 March 2022, with a maximum period of extension of 216 days.

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

6. As the outage project inspector, I have considered NGL's request for ONR's Agreement to the extension of the operating period for HYA R2. I have followed ONR procedures for delivering permissioning, as detailed in HOW2 (Ref. 2).

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 216 days, I judged it to be proportionate to obtain advice from the following disciplines to make an informed decision about NGL's request:

- Mechanical Engineering
- Structural Integrity
- Civil Engineering
- Electrical Engineering
- Control and Instrumentation
- Graphite

8. In addition to the nuclear safety assessments identified, I sought the opinion of ONR's civil nuclear security (CNS) site inspector to understand if there were any aspects of the extension to the operating period that may have an impact on ONR's decision to agree to the extension. The CNS site inspector confirmed (Ref. 3) that 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 HYA R2.

9. I have also considered the findings of NGL's internal regulators assessment of the EC by a review of the INSA approval statement. The INSA engineer considered that the risk from a deferral of the HYA R2 periodic shutdown by 216 days is ALARP subject to confirmation of the Pressure Safety System Regulations (PSSR) competent persons' approval of the proposal.

10. NGL's review of planned outage work has taken in to account mandatory inspections required under the PSSR 2000 regulations. The PSSR competent person has confirmed that the deferral of the outage will not compromise PSSR compliance, through discussion with ONR. Use of the ONR regulatory PSSR position statement has been considered as part of this justification.

11. The proposal to defer the periodic EIMT and the 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.

12. The primary safety claims in the EC are that:

- extension of the period of plant operation by up to 216 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; and
- the nuclear safety risk is not significantly impacted by extending the operating period by up to 216 days, and the outate deferral ensures industrial and nuclear safety risks are ALARP by minimising risks associated with resource constraint and programme pressure.

13. 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 MECHANICAL ENGINEERING

14. Reference 4 reports the findings of the ONR mechanical engineering assessment of NGL's EC to defer the HYA R2 periodic shutdown 2021.

15. The inspector's assessment focused on the mechanical structures, systems and components judged important to nuclear safety that would be subject to additional operational demand by deferring the periodic shutdown.

16. The inspector's judgement was informed by a review of previous ONR intervention records from recent HYA R1 and R2 periodic shutdowns.

17. The inspector sampled aspects of the EC associated with:

- Gas Circulators
- Reactor Gas Safety Relief Valves
- Main Steam Safety Relief Vales
- the arrangements to ensure dispensations are obtained against NGL's internal mandatory requirements.

18. The inspector was satisfied that the mechanical engineering 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 inspector was satisfied with the claims, arguments and evidence that demonstrate that:

- The Gas Circulators are expected to continue providing their nuclear safety function reliably until the deferred statutory outage.
- The Reactor Gas Safety Relief Valves are expected to continue providing their nuclear safety function reliably until the deferred statutory outage.
- The Main Steam Safety Relief Valves are expected to continue providing their nuclear safety function reliably until the deferred statutory outage.
- NGL's internal dispensations have been granted.

19. Overall, from a mechanical engineering perspective, the inspector was satisfied with the claims, arguments and evidence laid down within EC 369058 and supports ONR agreeing to an extension of the operating period of Heysham 1 Reactor 2 to 17th March 2022.

3.2 STRUCTURAL INTEGRITY

20. Reference 5 reports the findings of the ONR structural integrity assessment of NGL's EC to defer the HYA R2 periodic shutdown 2021.

21. The inspector's assessment focused on:

- The impact of extending the operating period on anticipated degradation mechanisms.
- The significance of delays to the maintenance schedule activities on claims of plant reliability and availability.
- Delivery of the corrosion management defect remediation programme activities.
- Compliance of statutory inspection requirements.

22. The inspector's judgement was informed by a review of previous ONR assessments of the HYA periodic shutdowns for R1 in 2014 and 2018; R2 in 2016 and 2019, and the Periodic Safety Review.

23. The inspector sampled aspects of the EC associated with:

- Creep and creep-fatigue damage of boiler and reactor internal components
- Remote visual inspection of the pressure vessel insulation retaining strips
- Remote visual inspection of the boiler closure unit cover plates
- fatigue crack growth and fatigue damage, for external non-creeping components,
- creep life usage of components outside the reactor
- Boiler tube failure safety case
- Inspection Plans for the 2021 Statutory Outage
- Category 1 corrosion defects
- PSSR compliance

24. The inspector was satisfied with the claims, arguments and evidence presented in the EC from a structural integrity perspective. The inspector was content with the processes implemented for the Covid-19 easing or postponement of PSSR inspections, and satisfied that the required easement, postponement or inspections would be completed by their due dates.

3.3 CIVIL ENGINEERING

25. Reference 6 reports the findings of the ONR civil engineering assessment of the HYA R2 deferral EC.

26. The inspector's assessment focused on the civil engineering aspects of the EC and the opinion and findings of the approved competent person (APEX) for the pressure vessel. The inspector's judgement was informed by the previous statutory examination report and more recent evidence, where available.

27. The inspector sampled evidence from the twelve areas relating to the civil engineering aspects of the Pre-stressed Concrete Pressure Vessel, covered under the Maintenance Schedule and associated Written Scheme of examinations:

- Concrete surface
- Vertical tendon anchorages
- Circumferential pre-stressing anchorages
- Vertical and circumferential pre-stressing loads
- Vertical pre-stressing strands
- Embedded strain gauges
- Pressure vessel cooling water leaks
- Settlement and tilt
- Vessel temperatures
- Reactor coolant leakage
- Top cap deflection
- Boiler closure units

28. In the inspector's opinion either the testing and monitoring were not affected by the extension given that they were not outage dependent, or the evidence from the previous outage coupled with known plant conditions was sufficient to warrant extending the operating period.

29. The inspector concluded that there are no significant issues with deferring those Maintenance Schedule activities specified and the increase in the plant nuclear safety risk is acceptable when compared to the benefits resulting from the proposed deferral.

3.4 ELECTRICAL ENGINEERING

30. Reference 7, reports the findings of the ONR electrical engineering assessment of the HYA R2 deferral request.

31. The inspector reviewed a sample of the responses and considerations undertaken on the outage related maintenance schedule items related to the gas circulator systems and the essential supplies provided in the EC. The inspector also sampled the system health scores related to plant and equipment availability, condition and performance, for the gas circulators, transformers, short break supply systems, no break supply systems and emergency generation systems. The inspector did not identify any matters of significant safety concern that were not already being addressed or the subject of actions to take corrective measures within the station's own arrangements. The inspector was content that the evidence provided supports the claim that the operational history of HYA R2 is satisfactory.

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

- There have not been an abnormal number of shutdowns since the last outage that would cause concern or indicate inconsistencies with the safety case assumptions.
- There were 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 responses and considerations undertaken on the outage related maintenance schedule items related to the gas circulator systems and essential supplies systems.
- The system health scores associated with the systems sampled were demonstrated and 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.
- Activities having a benefit to safety will be carried out at the additional refuelling outage, planned for August 2021.
- Enhanced surveillance activities of the plant will be carried out at the additional refuelling outage, planned for August 2021.
- There have not been any significant emergent issues arising from the deferral of the HYA Reactor 1 2020 periodic shutdown that would cause concern.

33. Overall, the electrical engineering specialist inspector was content that the evidence presented within the case was acceptable and supported the deferral of the statutory outage to no later than 4 October 2021.

34. The inspector did not identify anything of safety significance from an electrical engineering perspective that should prevent the deferral of the Statutory Outage from 13 August 2021 to no later than 17 March 2022.

3.5 CONTROL AND INSTRUMENTATION

35. Reference 8 reports the findings of the ONR Control and Instrumentation (C&I) assessment of the HYA R2 deferral request, EC 369058.

36. The inspector's assessment focused on determining:

- Whether C&I related statutory outage EIMT activities covered by the HYA R2 Maintenance Schedule have been reviewed by a Suitably Qualified and Experienced Person (SQEP),
- If the potential for the performance of C&I systems / equipment important to safety to drift / degrade such that it becomes unable to perform its nuclear safety function during the statutory outage deferral period has been considered by SQEP and been adequately assessed to remain acceptably low,

- If the potential for C&I systems / equipment important to safety to reach a reliability cliff edge during the statutory outage deferral period has been considered by SQEP and been adequately assessed to remain acceptably low,
- If appropriate C&I related statutory outage risk reduction measures have been identified.

37. The inspector's judgement was informed by responses to queries associated with the EC, discussions with HYA SQEPs and a plant walkdown. In addition, the inspector reviewed the C&I findings from previous ONR assessments of the HYA R1 and R2 periodic shutdowns, the HYA and Hartlepool (HRA) periodic safety review and recent HYA system-based inspections. The inspector sampled evidence associated with:

- Safety circuits:
  - Main guardlines.
  - Diverse guardlines.
- Control rod control system.
- Reactor post trip logic system.
- Gas circulators.
- Secondary shut down system.
- Make-up water treatment plant / chloride Ingress protection / Condensate polishing plant.

38. The inspector was content that C&I related statutory outage activities covered by the HYA R2 Maintenance Schedule have been reviewed by SQEP. The inspector considered the likelihood of the performance of C&I systems / equipment important to safety drifting / degrading past the point that it is unable to fulfil its nuclear safety function(s), or reaching a reliability cliff edge, will remain low during the statutory outage deferral period. The inspector was satisfied that potential C&I related statutory outage risk reduction measures have been identified and considered. During the walkdown, the inspector did not observe any plant fault condition indications / alarms or identify any signs of degradation that would likely require remediation during the statutory outage deferral period.

39. Based on the evidence sampled and plant walkdown of systems important to nuclear safety, the inspector considers the C&I system / equipment risks associated with deferring the HYA R2 statutory outage until the 17th March 2022 to be negligible.

3.6 GRAPHITE ASSESSMENT

40. Reference 9 reports the findings of the ONR graphite assessment of the HYA R2 deferral request.

41. The inspector sampled aspects of the EC 369058 concerned with graphite weight loss and brick cracking.

42. Regarding graphite weight loss, the inspector notes that there are no timescale requirements associated with trepanning in the safety case and that the results are not normally available during the periodic shutdown. The inspector states that there are no safety concerns associated with the timing of the update to the graphite weight loss database and that the margins against the graphite weight loss limits at HYA are currently satisfactory. Therefore, in the inspectors view the delay in graphite trepanning as proposed in the EC is acceptable.

43. From the graphite brick cracking perspective, interim graphite inspections, of 15 fuel channels, are carried out at HYA during each refuelling outage, approximately every six months for each reactor. Inspections were carried out in March 2021 (HYA R2), June 2021 (HYA R1) and are planned to be carried out at regular intervals. The

inspector is therefore content that the deferral of the HYA R2 periodic shutdown as proposed in EC 369058 is acceptable for the graphite brick inspections.

44. In conclusion, from the graphite perspective, the inspector has no objections to the deferral of the periodic shutdown of HYA R2.

3.7 ENGAGEMENT WITH OTHER GOVERNMENT AGENCIES

45. I have engaged with the Environment Agency Site Inspector, who confirmed (Ref. 10) that they have no objections to extending the operating period for HYA R2 from August 2021 to no later than March 2022

4 MATTERS ARISING FROM ONR'S WORK

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

47. After the completion of ONR's assessments, NGL informed me (Ref. 11) that owing to a loss of grid and reactor trip event, the August 2021 refuelling outage will now take place in September. As a result, three additional PSSR postponements would be required. I have considered the information presented by NGL and judge that it does not have any significant implications regarding the deferral request. In addition, the structural integrity inspector has confirmed (Ref. 12) that it does not materially affect their assessment.

5 CONCLUSIONS

48. NGL have requested an extension to the operating period of HYA R2 under the correct licence condition LC30 (2). The request was made on the grounds of effective management and optimum availability of outage personnel and resources during the current phase of the Covid-19 pandemic. NGL have deferred a number of periodic shutdowns across the AGR fleet to minimise overlap of outages at different stations.

49. The justification to extend the operation of HYA R2, EC 369058, has undergone the NGL's due process for a Category 2 submission in the production, review and authorisation of the statutory outage deferral justification.

50. 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 HYA R2. No specialist inspector has objected to ONR Agreeing to the extension of the operating period.

51. Based on the work carried out by ONR, I judge that NGL has made an adequate justification for an extension of the HYA R2 operating period from 13 August 2021 to 17 March 2022.

6 RECOMMENDATIONS

52. I recommend ONR issues Licence Instrument 634 under LC30(2) for Nuclear Site Licence 60, giving ONR's Agreement to extending the operating period of Heysham 1 Reactor 2 to no later than 17 March 2022.

7 REFERENCES

1. EDF - HYA50883R - LC 30(2) - Request for Extension to Operating Period - 18 May 2021HSLHRA51208R, 12 Nov 2020. CM9 2021/40641.
2. *ONR Guide – The Purpose and Use of Permissioning - NS-PER-GD-001 Revision X*. Month Year. http://www.onr.org.uk/operational/assessment/index.htm
3. Heysham 1 Reactor 2 Periodic Shutdown 2021 - Deferral - Security Input. CM9 2021/53476.
4. NGL - Heysham 1 R2 - ONR-OFD-AR-21-022 - HYA R2 2021 Outage Deferral - Mechanical Engineering Assessment -. CM9 2021/55636.
5. ONR-OFD-AR-21-024 Revision 0 Heysham 1 Reactor 2 Period Shutdown Deferral from 13th August 2021 to no later than 17th March 2022 - Structural Integrity Assessment -. CM9 2021/54051.
6. EDF - ONR-OFD-AR-21-016 - Civil Engineering Assessment of the HYA R2 Statutory Outage deferral EC 369058 Ver. 000 - July 2021. CM9 2021/53184.
7. ONR OFD AR 21 025 - EE Assessment of Heysham 1 R2 2021 Outage Deferral - M Cowen - July 2021. CM9 2021/55163.
8. ONR-OFD-AR-21-013 - HY1 R2 2021 Statutory Outage Deferral C&I Assessment AR - Rev 0 - - (27 Jul 21). CM9 2021/57285.
9. RE: Heysham1 Reactor 2 - Request for Extension to Operating Period,. CM9 2021/59382.
10. RE: Heysham 1 Reactor 2 - Extension of Operating Period - Notice of No Objection. 2021/52320
11. FW: R2 PSSR implication -. CM9 2021/59390.
12. RE: R2 PSSR implication - structural integrity. CM9 2021/59391.