Office for Nuclear Regulation

Hunterston B Reactor 4 Periodic Shutdown 2020

ONR Agreement for Extension of Operating Period for Hunterston B Reactor 4

Project Assessment Report ONR-OFD-PAR-20-015
Revision 0
04 November 2020

Published 01/21

EXECUTIVE SUMMARY

Title

ONR Agreement for Extension of Operating Period for Hunterston B Reactor 4.

Permission Requested

EDF Energy Nuclear Generation Limited (NGL) has requested Agreement from the Office for Nuclear Regulation (ONR) to extend the operating period of Hunterston B (HNB) Power Station Reactor 4 (R4) by a period of 5 months to no later than 31 March 2021. This request is made in accordance with Licence Condition (LC) 30 (Periodic Shutdown) of the station's nuclear site licence.

Background

Nuclear site licensees are required to comply with conditions attached to the nuclear site licence. LC 30(1) states that for the purpose of enabling examination, inspection maintenance and testing of any plant or process, the licensee shall, when necessary, ensure that any such plant or process is shutdown in accordance with the requirements of the plant maintenance schedule. LC 30(2) gives ONR the authority to Agree to an extension of a plant's operating period based on an adequate safety justification from the licensee.

The current operating period for R4 will expire on the 6 November 2020. NGL wish to extend this operating period until the 31 March 2021. The proposed outage start date of no later than the end of March 2021 takes into account the recent restart date of HNB R4 from the recent graphite inspection outage and 6 months operation.

NGL considered deferral of the statutory outage for 5 months to 31 March 2021 will not significantly reduce the reliability or availability of nuclear safety systems and will not lead to any significant increase in the frequency of plant faults as initiating events during the extended period of operation.

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

NGL's safety justification for the extension of the operating period of HNB R4 until 31 March 2021 was examined by the following discipline specialists:

- Civil engineering
- Structural integrity
- Graphite
- Mechanical engineering
- Electrical engineering
- Control and instrumentation.

Overall, the specialist inspectors considered that the deferral would have no, or negligible, impact on nuclear safety and they all supported, or had no objections to Agreeing to the extension to the operating period for R4

Matters arising from ONR's work

ONR's assessment did not reveal any nuclear safety concerns that would prevent Agreement to the extension of the R4 operating period by 5 months. The assessment conclusions were supported by evidence that:

- NGL had sought input from relevant suitably qualified and experienced personnel (SQEP);
- Agreement was or will be reached with the Pressure Systems Safety Regulations (PSSR) competent person regarding any proposed postponements of inspections;
- The outage deferral is supported by NGL's independent nuclear safety assessment (INA).

Conclusion

ONR's assessment concluded that, NGL has carried out an adequate safety assessment demonstrating the safety of the proposed extension of HNB R4 operating period and supported the issue of ONR Agreement to NGL's request.

Recommendation

I recommend that ONR issue Licence Instrument 568 under LC30(2) for Nuclear Site Licence Sc.13 giving ONR's Agreement to extend the operating period of HNB R4 until 31 March 2021.

LIST OF ABBREVIATIONS

AGR	Advanced gas cooled reactor
ALARP	As low as reasonably practicable
CO_2	Carbon Dioxide
EC	Engineering Change
EC&I	Electrical Control and Instrumentation
EDF	Electricite de France
EIMT	Examination, Inspection, Maintenance and Testing
ERR	Equipment Reliability Reviews
HNB	Hunterston B nuclear power station
INA	Independent Nuclear Assurance
INSA	Independent Nuclear Safety Assessment
LC	Licence Condition
LSD	Living Safety case Documents
MITS	Maintenance Inspection and Testing Schedules
MS	Maintenance Schedule
NGL	Nuclear Generation Limited
ONR	Office for Nuclear Regulation
PCPV	Pre-stressed Concrete Pressure Vessel
PSSR	Pressure Systems Safety Regulations
RTS	Return to Service
R4	Reactor 4
SSR	Station Safety Report
SEPA	Scottish Environment Protection Agency
SQEP	Suitable Qualified and Experienced Personnel

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1 PERMISSION REQUESTED

1. EDF Energy Nuclear Generation Limited (NGL), the operator and Licensee of Hunterston B nuclear power station (HNB), has written to the Office for Nuclear Regulation (ONR) requesting Agreement to an extension of Reactor 4's (R4) operating period up to 31 March 2021 under Licence Condition 30(2) (Ref. 1).

2. This ONR project assessment report has been produced to record regulatory views and judgments in consideration of NGL's request for the extension of the operating period for HNB R4.

2 BACKGROUND

3. The nuclear site licence requires the Licensee to periodically shutdown plant under Licence Condition (LC) 30: Periodic Shutdown to enable examination, inspection, maintenance and testing (EIMT) to take place in accordance with the requirements of its plant maintenance schedule (MS) referred to in LC28(4) EIMT.

4. Requirements of the MS are derived from claims made in the station's safety case (required under LC23: Operating Rules), along with other regulatory requirements, such as Pressure Systems Safety Regulations (PSSR), and requirements from equipment manufacturers.

5. For safety case claims for the operation of equipment, these requirements normally relate to potential damage mechanisms such as creep, fatigue or corrosion. Time-based EIMT requirements are identified in the MS derived safety case requirements to ensure appropriate monitoring of equipment takes place and forewarning of failure can be achieved. Such time-based intervals are referred to as operating periods.

6. The operating period for the two reactors at HNB is identified in the MS preface, which is an approved document under LC28(4). This requires that each reactor is shut down after a maximum period of three calendar years following the Consent of ONR to the start-up of the reactor after a routine periodic shutdown. The previous start-up Consent Licence Instrument (LI) 558 (Ref. 2) for R4 is dated 06 November 2017. This required the shutdown of R4 on or before 06 November 2020.

7. LC 30(2) gives ONR the authority to Agree to an extension of a plant's operating period based on an adequate safety justification from the licensee.

8. The current operating period for R4 will expire on the 06 November 2020. NGL wish to extend this operating period until the 31 March 2021. The proposed outage start date of no later than the 31 March 2021 takes into account the recent restart date of HNB R4 from a graphite inspection outage and 6 months operation.

9. NGL consider that the deferral of the statutory outage for no longer than 5 months (Ref. 3) will not significantly reduce the reliability or availability of nuclear safety systems and will not lead to any significant increase in the frequency of plant faults as initiating events during the extended period. The safety justification was presented at category 2 which therefore required a formal independent nuclear safety assessment (Ref. 4)

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

10. The NGL safety justification for extending the HNB R4 operating period is based on the following claims:

- Claim 1 - The operational history of Reactor 4 is satisfactory
- Claim 2 - The inspection reports at the last statutory outage of Reactor 4 in 2017 are satisfactory
- Claim 3 - Constraints imposed by the safety case do not affect the deferment of the statutory outage

- Claim 4 - The proposed changes to the inspection interval are consistent with maintaining an overall risk that is ALARP.

11. A technical report has also been produced by NGL which takes the form of a plant area review (Ref. 5), divided into plant areas as per the maintenance inspection and testing schedule (MITS). The report and its appendices include the following areas:

- Identification of MITS activities required to be undertaken during a statutory outage.
- Review of issues identified during past MITS activities and arising in the current operating period. This is accomplished through a review of recent statutory outage Return to Service (RTS) Engineering Changes (EC), Station Safety Reports (SSRs) and Equipment Reliability Reviews (ERRs) and through consultation with the relevant HNB System Engineers.
- Review of other documents that may indicate reasons for why the activities cannot be deferred. This will include reviewing the appropriate Living Safety case Documents (LSDs).
- Assessment of the findings in the above reviews to establish if any present nuclear safety issues could be affected by deferring the R4 statutory outage to March 2021.
- Identification of any work that would be required in order to support an outage deferral.

12. Based on the claims, arguments and evidence, the following ONR specialist inspectors from the ONR HNB R4 2020 periodic shutdown team have examined NGL's safety justification:

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

13. Sections 3.1 – 3.6 below present a high-level summary of the findings from each of the specialist inspectors.

3.1 Civil Engineering Assessment

14. The scope of the specialist civil engineering assessment (Ref. 6) focussed on the Pre-stressed Concrete Pressure Vessel (PCPV) and its associated Maintenance Inspection and Test Schedule (MITS) activities.

15. In assessing the adequacy of this deferral, the specialist inspector has not confined their assessment to the specific MITS activities that are being deferred by this proposal but has considered the most recent results from MITS activities carried out since the last statutory outage in 2017.

16. Based on the material summarised and assessed the specialist civil engineering inspector reached the judgement that:

- In respect of Pressure Systems Safety Regulations 2000, Regulation 9(7), the specialist civil engineering inspector is satisfied that the licensee has demonstrated that deferral of the two civil engineering examination areas does not give rise to danger.
- The licensee has adequately demonstrated that the pre-stressed concrete pressure vessel is free from defects such that its safety function is not impaired.

- The licensee has adequately demonstrated that the threat of degradation is minimised as there are currently no known leakages of CO_2 or pressure vessel cooling water into the pre-stressed concrete pressure vessel.
- The licensee has demonstrated that the civil engineering components of the pre-stressed concrete pressure vessel have adequate margins to allow for any ageing and degradation processes in the stated statutory outage deferral period.

17. The specialist civil engineering inspector concluded that they are satisfied that the licensee has demonstrated that the overall condition of the pre-stressed concrete pressure vessel is satisfactory and will remain so for the period specified by the outage deferral (Ref. 3). They, therefore, do not object to the proposed statutory outage deferral from 6 November 2020 to 31 March 2021 from a civil engineering perspective.

3.2 Structural Integrity Assessment

18. The specialist structural integrity inspector focussed their assessment (Ref. 7) on the following areas:

- Steam and feed systems;
- Main cooling water systems;
- Pre-stressed Concrete Pressure Vessel (PCPV) penetrations;
- PSSR compliance.

19. The specialist inspector reviewed the recent HNB structural integrity periodic shutdown assessments and did not identify any structural integrity issues which impact upon R4 and would prevent deferral of the R4 2020 periodic shutdown until March 2021.

20. The specialist structural integrity inspector agrees with the view that accumulated degradation (creep, fatigue) normally associated with operating conditions would be less than for the normal 36 months between periodic shutdown after restart and subsequent shutdown in March 2021.

21. No structural integrity issues were identified relating to the steam and feed systems, cooling water systems, gas bypass plant, decay heat system or PCPV penetrations which impact upon R4 and prevent deferral of the R4 2020 periodic shutdown until March 2021.

22. The specialist structural integrity inspector is content that an appropriate process is being implemented to agree postponement of PSSR inspections. Their agreement to the deferral of the R4 2020 periodic shutdown in March 2021 is based on an expectation of compliance with the Pressure Systems and Safety Regulations. Consequently, the postponement process or the required PSSR inspections should be completed by their due dates.

23. To conclude, the specialist structural integrity inspector is satisfied that the claims, arguments and evidence laid down within the Licensee's safety case support deferral of the periodic shutdown, from a structural integrity perspective, until 31 March 2021.

3.3 Graphite Assessment

24. The specialist graphite inspector reviewed the deferral EC and its attachments (Ref. 8), taking into consideration the recent ONR R4 graphite assessment (Ref. 9), focussing on the implications of not performing the graphite trepanning activities.

- The specialist graphite inspector is content that due to the extended periods of shutdown, to date HNB R4 has not experienced the anticipated levels of

degradation due to irradiation and oxidation of the graphite material when the original statutory date was stipulated.

- NGL has confirmed that the results of the tests on trepanned samples extracted during the HNB R4 2017 statutory outage are in line with the predictive models and where appropriate the 2017 results have been used to re-calibrate the predictive model parameters. Hence from a graphite perspective the specialist inspector is content that Claim 2: The inspection reports at the last statutory outage of R4 in 2017 are satisfactory and can be accepted.
- NGL has also confirmed that the weight loss limits for HNB R4 are not anticipated to be exceeded by continued operation up to March 2021 and hence from a graphite perspective Claim 3: Constraints imposed by the safety case do not affect the deferment of the statutory outage, and can be accepted.

25. To conclude, the specialist graphite inspector is content deferral of the HNB R4 Statutory outage from 6 November 2020 to 31 March 2021 is acceptable from a graphite perspective.

3.4 Mechanical Engineering Assessment

26. The specialist mechanical engineering inspector has assessed NGL's safety justification for extending the HNB R4 operating period to 31 March 2021 (Ref. 10) focussing on the following systems and components considered important to nuclear safety in the operation of an advanced gas-cooled reactor (AGR):

- Gas circulators operational performance;
- Reactor vessel CO_2 gas safety relief valve condition;
- Control rod drop times.

27. Assessment findings did not identify any safety shortfalls and the Inspector has recommended ONR Agree to NGL's request to extend the HNB B R4 operating period from 5 November 2020 to 31 March 2021.

3.5 Electrical Engineering Assessment

28. The specialist electrical engineering assessment (Ref. 11) considered the arguments and evidence in the proposal that support the claims made by NGL. This included:

- An examination of equipment reliability reviews (ERR);
- A review of return to service ECs and 28-day reports;
- A review of the plant area review report.

29. The specialist electrical engineering inspector focussed their assessment on gas circulators, oil filled transformers, short break supply systems and no break supplies systems.

30. As a result of their assessment the specialist electrical engineering inspector did not identify anything of safety significance in relation to electrical engineering aspects that should prevent the deferral of the Hunterston B R4 statutory outage from 6 November 2020 to no later than 31 March 2021.

3.6 Control and Instrumentation Assessment

31. The objectives of the specialist control and instrumentation (C&I) assessment of NGL's nuclear safety justification for deferring the HNB R4 statutory outage up to the 31 March 2021 (Ref. 12) were:

- To determine whether C&I related statutory outage examination, inspection, maintenance and testing (EIMT) activities covered by the HNB maintenance schedule have been reviewed by suitably qualified and experienced personnel (SQEP);

- To determine if the potential for the accuracy of C&I systems / equipment important to safety to drift, past the point that it is 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;
- To determine 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 has been adequately assessed to remain acceptably low;
- To determine if appropriate C&I related statutory outage risk reduction measures have been identified.

32. Based on the information provided by NGL, the specialist EC&I inspector considers the additional C&I system / equipment risks associated with deferring the HNB R4 statutory outage up to the 31 March 2021 to be negligible.

4 MATTERS ARISING FROM ONR'S WORK

33. Each of the ONR specialist inspectors; civil engineering, structural integrity, graphite, mechanical engineering, electrical engineering and control and instrumentation, examined the NGL safety justification for the outage deferral. The specialist inspectors considered that the deferral would have no, or negligible, impact on nuclear safety and they all supported, or had no objections to Agreeing to the extension to the operating period for HNB R4.

34. Their judgements were supported by the evidence that:

- NGL had sought input from relevant suitably qualified and experienced personnel;
- Agreement was or will be reached with the PSSR competent person regarding any proposed postponements of Written Scheme of Examination (WSE) inspections;
- The outage deferral is supported by NGL's independent nuclear safety assessment (INSA) team.

35. No concerns were raised by any of the specialist inspectors and the request for the extension of the operating period was considered reasonable.

4.1 Engagement with other Government Agencies

36. The HNB Scottish Environment Protection Agency (SEPA) site inspector was informed that ONR intended to issue an LI giving its agreement to the extension of R4's period of operation. SEPA confirmed that it had no objections to the deferral proposal and ONR issuing an Agreement to extend the R4 operating period (Ref. 13).

5 CONCLUSIONS

37. ONR has undertaken assessment of NGL's safety justification for extending the operating period of HNB R4.

38. The current operating period for R4 will expire on the 6 November 2020. NGL wish to extend this operating period until the 31 March 2020. The proposed outage start date of no later than the end of March 2021 takes into account the recent restart date of HNB R4 from the recent graphite inspection outage and 6 months operation.

39. ONR's assessments of the proposed extension to the operating period judged that the outage deferral would have no, or negligible, impact on nuclear safety and supported, or had no objections to, Agreeing to the extension to the operating period.

6 RECOMMENDATIONS

40. I recommend ONR issues Licence Instrument 568 under LC30(2) for Nuclear Site Licence Sc.13, giving ONR's Agreement to extend the operating period of HNB R4so that the periodic shutdown commences no later than 31 March 2021.

7 REFERENCES

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2. Licence Instrument 558, Consent Granted under Condition 30(3) of Schedule 2 attached to Nuclear Site License No Sc.13 Hunterston B, CM9 2017/410629
3. EC No 367870 Proposal Version 02 –Deferral of Hunterston B R4 Statutory Outage MITS Routines from 2020 to 2021, CM9 2020/268270
4. EDF Nuclear Generation Ltd Milestone Full INSA Approval Statement, CM9 2020/275691
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6. ONR-OFD-AR-20-059, Civil Engineering Assessment of Proposed Statutory Outage Deferral for Hunterston B Reactor 4, CM9 2020/301035
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8. Email RE: HPE CM FW: EC 367870 – HNB Stat Outage Deferral, 50/09/2020, CM9 2020/284397
9. ONR-OFD-AR-20-040, EC367341 - Justification for Return to Service of Hunterston B R4 to Operate to a Core Burn-Up of 16.25 TWd - Graphite Structural Integrity Assessment, CM9 2020/261731
10. ONR-OFD-AR-20-054, Mechanical Engineering Assessment of Safety Justification for Extension of Operating Period for Hunterston B Reactor 4 Planned 2020 Periodic Shutdown, CM9 2020/294723
11. ONR-OFD-AR-20-058, Deferral of Hunterston B Reactor 4 Statutory Outage MITS Routines from 2020 to 2021 – EC 367870 – Revision 0 Version 2, CM9 2020/300885
12. ONR-OFD-AN-20-056, Control and Instrumentation (C&I) Assessment of the EDF Energy Nuclear Generation Limited (EDF NGL) Hunterston B (HNB) Reactor 4 (R4) Statutory Outage Deferral up to 31st March 2021 – Engineering Change (EC) Number 367870 000, CM9 2020/302954
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