Office for Nuclear Regulation

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Diverse shutdown and Nitrogen hold-down project

Application for Agreement under LC 22(1) arrangements to put into service the new nitrogen injection and blowdown system at Hunterston B power station

Project Assessment Report ONR-HNB-PAR-14-026
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EXECUTIVE SUMMARY

Application for Agreement under LC 22(1) arrangements to put into service the new nitrogen injection and blowdown system at Hunterston B power station

Permission Requested

EdF Energy Nuclear Generation Limited (NGL), the licensee of Hunterston B power station, has requested that the Office for Nuclear Regulation (ONR) issue an Agreement or Acknowledgment to NP/SC 7557 Revision 000, which presents the safety case for putting the new nitrogen and blowdown plant into operational service at Hunterston B as part of the provision of enhanced long-term shutdown. The permission is requested under arrangements made under Licence Condition (LC) 22(1)that requires the licensee to make and implement adequate arrangements to control any modification carried out on any part of the existing plant which may affect safety.

Background

The intention of the licensee's diverse shutdown and nitrogen holddown project is to enhance the Hunterston B and Hinkley Point B reactor short and long-term shutdown systems following the most severe seismic event evaluated. The licensee intends to achieve this by replacing a subset of articulated shutdown control rods with a new "super-articulated" design of rod and by provision of a new seismically qualified nitrogen injection and blowdown system. The modified shutdown rod design is intended to enable the new rods to successfully enter core control channels, resulting in significantly enhanced capability to accommodate greater graphite core distortion than the existing design of rod.

The new seismically qualified nitrogen storage, distribution, injection and blowdown system, also known as the diverse holddown system (DHD), is designed to be capable of injecting nitrogen gas into the reactor core and reducing the concentration of carbon dioxide gas (blowing down) following the most severe seismic event evaluated. Nitrogen gas injected into the core will absorb neutrons, effectively reducing the ability of the core to sustain the nuclear reaction. The new systems at Hunterston B and Hinkley Point B are designed to provide sufficient nitrogen to achieve sustained reactivity control (known as holddown) for both reactors at each site. The two systems together (i.e. super-articulated control rods and diverse holddown) will enhance the functionality and integrity of the existing shutdown systems.

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

ONR has closely monitored the progress and quality of the safety case submissions through direct assessment, regular reviews, technical meetings and site inspections. The licensee has been required, through its arrangements under the site licence, to obtain agreement from ONR to pass beyond identified project hold points. ONR have so far issued a total of six Licence Instruments against this project, with one remaining Licence Instrument needing to be issued at each of the two sites to enable the licensee to put the new DHD systems into service.

The safety case submission justifying putting the new DHD system at Hunterston B into service has completed the licensee's due process. The licensee's internal independent nuclear assurance function has undertaken an independent nuclear safety assessment of the submission and issued approval with two minor caveats. The licensee will address and sentence these caveats using its due process. The independent nuclear assurance function supports putting the system into service.

Prior to putting the system into service, the site's Operational Safety Review Committee will confirm readiness and sanction implementation of the modification, in accordance with arrangements made under Licence Condition 22.

The licensee's staged submission safety case has been assessed by ONR specialist inspectors. ONR inspectors have undertaken a readiness inspection on site to determine the adequacy of the licensee's implementation of its arrangements for safety case compliance, operating rules, operating instructions, maintenance and training associated with this modification.

Matters arising from ONR's work

The work undertaken by ONR inspectors associated with this request has not identified any regulatory issues or concerns that would prevent ONR issuing Agreement for the licensee to put the new DHD system into service at Hunterston B.

The ONR external hazards specialist inspector identified a shortfall against ONR expectations in the seismic response spectra used by the licensee and has raised a candidate issue for the regulatory issues database in line with ONR guidance on the management of regulatory issues. The inspector judges that this issue can be addressed by the licensee after the new system has been put into service and therefore supports ONR issuing Agreement to the modification.

The ONR control and instrumentation specialist inspector identified five shortfalls against ONR expectations in the licensee's safety case. He has raised a candidate issue for these shortfalls on the regulatory issues database in line with ONR guidance on the management of regulatory issues. The inspector judges that the shortfalls can be addressed by the licensee after the new system has been put into service and therefore supports ONR issuing Agreement to the modification.

Conclusions

Following assessment and inspection of matters associated with this request, I am satisfied that the licensee has presented an adequate safety case submission justifying putting the new DHD system at Hunterston B into service and consequently Agreement should be granted.

Having taken into account the opinions of the ONR specialist inspectors, I judge the shortfalls identified in the licensee's submission do not warrant delaying putting the new DHD system into service at Hunterston B, in light of the significant nuclear safety benefit it will provide.

Recommendation

I recommend that the Civil Nuclear Reactor Programme operating reactor sub-programme Superintending Inspector:

- Signs this PAR to confirm acceptance of the regulatory arguments that will help justify issuing Licence Instrument 545.
- Signs this PAR approving its release for publication, after redaction where appropriate.
- Signs Licence Instrument 545, agreement under LC 22(1) arrangements to put the new DND system at Hunterston B into service.

I recommend that the ONR nominated site inspector for Hunterston B should seek a strategy from the licensee to address the shortfalls identified in the external hazards and control and instrumentation assessments, which have been recorded in the respective candidate regulatory issues.

LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
C&I	Control and instrumentation
CNRP	Civil Nuclear Reactor Programme
DHD	Diverse hold-down
DSD	Diverse shutdown
EC	Engineering change
EH	External hazards
HOW2	(Office for Nuclear Regulation) Business Management System
HNB	Hunterston B power station
HPB	Hinkley Point B power station
INA	Independent Nuclear Assurance
INSA	Independent nuclear safety assessment
LC	Licence Condition
LCR	Local control room
NGL	EdF energy Nuclear Generation Limited
NII	Nuclear Installations Inspectorate
NSC	Nuclear Safety Committee
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
PSD	Primary shutdown
SACR	Super articulated control rods
SAP	Safety Assessment Principle(s)
SEPA	Scottish Environment Protection Agency
SS	Stage submission

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1 PERMISSION REQUESTED

1. EdF Energy Nuclear Generation Limited (NGL), the licensee of Hunterston B (HNB) power station, has requested that the Office for Nuclear Regulation (ONR) should issue an Agreement or Acknowledgment under arrangements made under Licence Condition (LC) 22(1), to NP/SC 7557 Revision 000 (Category 2), which presents the safety case for putting the new nitrogen and blowdown plant into operational service at HNB, as part of the provision of enhanced arrangements to ensure long-term-shutdown of the nuclear chain reaction. This project assessment report (PAR) considers this request and recommends Agreement to the modification.

2 BACKGROUND

2. In parallel with presenting the current graphite core safety case[2] at Hinkley Point B (HPB) and HNB, NGL has been developing a longer-term safety case strategy, which was formally presented[3] to ONR in 2009. This stated that a safety case could be made for operating with a level of graphite brick cracking provided the short-term and long-term shutdown systems were enhanced to improve their tolerance to core distortion. A project, known as the diverse shut-down (DSD) project, was set up by NGL to provide such enhancement by replacement of a subset of the high neutron absorption control rods by a new “super-articulated” design and by provision of a new seismically qualified nitrogen plant at each station and new connections to the reactor vessels.

3. The existing nitrogen hold-down system comprises of a nitrogen storage/evaporation plant connected to the reactors by a network of pipes and valves. In the event that the primary shutdown devices fail and the reactivity of the core has not been reduced sufficiently to permanently shut down the nuclear reaction, the system will permit reactor operators to partially depressurise (blowdown) the reactor then inject nitrogen. Nitrogen has a large neutron capture cross section and so will absorb neutrons, effectively reducing the reactivity of the nuclear reaction, shutting down the reactor.

4. The new nitrogen diverse holddown (DHD) system will extend the functionality and integrity of the DHD system, and provide safety benefits namely:

- It is designed to remain functional after an infrequent (bottom line) seismic event.
- It is functionally capable of supplying sufficient nitrogen to achieve holddown (sustained reactivity control) for both reactors.
- It replaces a system that contains obsolete components.
- Provides a reduction in the fire risk by allowing removal of propane storage from site as part of the decommissioning of the existing nitrogen plant.
- A reduction in the number of instances where plant technical specification entries are required for plant maintenance.

5. In March 2009 the licensee wrote[4] to the Nuclear Installations Inspectorate (NII) stating that it expected to have completed implementation of the new nitrogen system at HNB by the end of 2011. The project has, however, been subject to numerous delays. The licensee has communicated the delays and the causes behind them at planned level 4 meetings, and by telephone discussions with the ONR project inspector. Where necessary ONR specialist inspectors have provided judgments on the licensee’s explanation for the delays and their planned remediation.

6. In September 2014 ONR wrote[5] to the HNB Station Director with regulatory concerns associated with further delays in putting the new DHD into service. ONR sought assurance and evidence from site that realistic and achievable plans were in place for testing and commissioning the new plant, and that site were taking all reasonably

practicable measures to expedite this work. ONR subsequently received suitable assurances from the Station Director[29].

2.1 LICENSEE'S SAFETY CASE

7. The licensee has judged[6] in the extant safety case that the primary shutdown (PSD) system will provide adequate protection against an infrequent seismic event until such time as keyway root cracking occurs in the main population of graphite bricks. In 2009 the NII wrote[7] to the licensee requiring confirmation that seismic qualification of the nitrogen system and provision of functional capability for both reactors should be the next step towards an ALARP(as low as reasonably practicable) position.

8. In response to the NII letter the licensee undertook a feasibility study to determine the options for provision of enhanced integrity and functional capability. The outcome of the study led to the decision to install a new seismically qualified DHD system and super articulated control rods (SACR).

9. The licensee presented its safety case for the proposed enhancements in a Paper of Principle, NP/SC 7557[8], which was a Category 1 submission. This was endorsed[9] by licensee's Nuclear Safety Committee (NSC) in December 2009.

10. The associated modifications were divided into in a number of stage submissions (SS) that were presented at the appropriate nuclear safety category (category 1 having the highest nuclear safety significance). The SS are as follows:

- NP/SC 7557, a category 1 Paper of Principle, sets out the principles and administrative arrangements to be applied to the project. It describes the proposals to enhance PSD and hold-down capability.
- SS 1 provided clarification of the safety functional requirements (SFR) needed for compliance with the nuclear safety principles.
- SS 2, a category 1 submission justified the proposed implementation of new reactor blowdown and injection routes together with the associated instrumentation, controls and power supplies.
- SS 3, a category 2 submission, covered the new nitrogen storage and distribution system. The SS was later subdivided into SS3a (civil engineering design), SS3b (mechanical design) and SS3c (control and instrumentation design).
- SS 4, a category 2 submission, covered the commissioning, operation and maintenance of the new system as well as the operating strategy.
- SS 5[10], a category 2 submission, presented the safety case for putting the new DHD system into operation. The licensee has used this document as the vehicle for seeking approval from ONR to put the new nitrogen system at HNB into service.
- SS 6 is a category 2 submission and will cover the removal of the redundant nitrogen plant at HNB.
- NP/SC 7643, a category 1 submission, presented the consolidated safety case for nitrogen injection at HNB and HPB. After initiating the project, the licensee judged that updating the safety case in SS5 would result in significant delays in putting the new system into operation. This submission updated the safety case in advance of SS5.
- The stage submissions were supported by enabling engineering change (EC) documents at category 2 or 3.

2.1.1 LICENSEE'S INDEPENDENT NUCLEAR ASSURANCE CHALLENGE AND NSC

11. Within the licensee's arrangements, the independent nuclear assurance (INA) organisation provides an independent challenge to safety cases. The stage

submissions and the category 2 enabling ECs were subject to independent nuclear safety assurance (INSA) approval. These documents require INSA approval as part of the licensee's due process for implementing the modification. INA issued the INSA approval statement[11] for SS5 with two minor caveats. The statement supports bringing the new DHD into service despite the unresolved minor issues; these would be addressed by the licensee and sentenced by its due process.

12. The project's category 1 submissions and some of the category 2 submissions were presented to the NSC for their consideration and support. The committee's deliberations are reported in the NSC meeting minutes. The proposals included in SS 5 were presented[12] at the October 2014 NSC meeting as a "matters arising" for information, as required under the licensee's arrangements. The licensee intends to provide a further "matters arising" at a future NSC when the new system has been put into service.

13. The licensee's internal regulatory process requires that INA independently evaluates the process for putting the new DHD system into service at HNB. INA sought assurance by undertaking a series of surveillance activities during the project and immediately before the request to put the system into service. This included site inspections, oversight of management processes and document reviews. On completion of these activities INA issued a report, Concurrence-Part B, which presents the findings of their work and includes a statement on whether it supports putting the system into service.

14. The INA Concurrence-Part B[13] was undertaken in January 2015 and the report will form part of the licensee's due process for putting the new DHD into service. The findings of the Concurrence-Part B fed into the INA's INSA for SS5, which supports bringing the system into service. I am assured that the unresolved minor issues identified in the INSA statement will be resolved before INA issue Concurrence.

2.2 ONR'S PERMISSIONING STRATEGY

15. In September 2010, NII wrote to both HPB[14] and HNB[15] requiring the licensee to obtain its agreement before proceeding beyond identified points in the DSD project. The permissioning strategy involved issuing a total of nine Licence Instruments for the two sites, reflecting the importance NII/ONR attached to the provision of the SACR and the DHD system. The Licence Instruments issued, under consideration or not yet requested, under LC 22(1) arrangements are as follows:

- Installation of the first SACR at HNB. The Licence Instrument has been issued for this modification.
- Installation of the first SACR at HPB. The Licence Instrument has been issued for this modification.
- Modification to the nitrogen injection route and installation of a new blowdown route. There was one LI for each of the four reactors. All Four Licence Instruments have been issued for these modifications.
- Putting the new nitrogen plant into operational service at HNB. This PAR considers this modification.
- Putting the new nitrogen plant into operational service at HPB. The licensee has not yet requested ONR Agreement to this modification.

16. Whist the safety benefits of these modifications relate principally to future conditions with greater core degradation, there is a need to ensure that there is no detriment to the current safety requirements from the operation of the new nitrogen system.

17. ONR business management system within the civil nuclear reactor programme (CNRP) requires that a task sheet is produced for activities exceeding five days' work.

The task sheet provides the background for the proposed intervention, the anticipated outcomes, duration, prioritisation, list specialisms assigned to the project and the intervention strategy.

18. As project inspector for the DHD project, I have maintained and updated the task sheet. The task sheet was endorsed by the CNRP sub-programme board.

19. The ONR process for delivering a permissioning activity requires preparation of a PAR to inform the permissioning decision by the delegated authority. This PAR for the agreement to put the new DHD system at HNB into service is informed by the assessment and inspection findings of the inspectors assigned to the project.

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

20. I have considered NGL's request to ONR for agreement to put the new DHD system at HNB into operation as part of my role as ONR project inspector assigned to the project. I have followed ONR procedures for delivering a permissioning project, as detailed in HOW2[16]. To support my work I have utilised the services of the ONR specialist inspectors assigned to this project by the ONR CNRP management team. I have taken note of the work undertaken by NGL's internal regulator, INA, who has been involved throughout the project.

21. I have consulted with the Scottish Environment Protection Agency (SEPA) to establish whether it objects to ONR issuing an Agreement to put the HNB new diverse hold-down system into operation. The Agency's response[17] is provided in Section 4 of this report.

22. The work undertaken by ONR can be considered in two themes. Firstly assessment of the licensee's safety case undertaken by specialist inspectors assigned to the project. Secondly, inspections undertaken by the ONR HNB nominated site inspector during planned site inspections, and the readiness inspection undertaken by myself and the aforementioned inspector.

23. ONR and the licensee have held level 4 technical exchange meetings throughout the project in order to obtain updates on project progress, discuss technical matters and progress issues identified by the project, INA or ONR.

24. The ONR permissioning documentation, licensee's safety case and the associated assessment reports, intervention records and reports, contact records and reports, and the relevant correspondence between ONR and the licensee can be found in either TRIM folder 4.4.2.9138 or 4.4.2.14032.

3.1 CIVIL ENGINEERING

25. An ONR civil engineering specialist carried out an assessment[18] of the relevant parts of the licensee's safety case.

26. The design of the HNB new nitrogen storage and distribution plant foundation raft is based on the same plant at HPB. The civil engineering designs at both sites are dominated by the requirement for seismic qualification of the new plant and equipment. The licensee has modified the HNB equipment seismic response spectra to generally stay within the bounds of the HPB spectra. This was achieved at HNB by excavating to rock and replacing the soil below the foundation with mass concrete to significantly reduce the effects of soil structure interaction.

27. The inspector also assessed the design of the service trench that connects the new nitrogen plant with the existing reactor building and is unique to HNB.

28. The safety case for the civil engineering components of the new DHD system is presented in three claims supported by arguments and evidence. The three claims are:

- The raft design is consistent with the functional specification for the mechanical plant.
- The plot is in an appropriate location for the plant.
- The civil design provides a raft with integrity which is adequate to support the plant, and to underwrite plant functionality during and after all relevant hazards. This last claim was expanded to include the service trench.

29. The inspector concluded that he is broadly satisfied that the claims, arguments and evidence laid down within the licensee's safety case, as they relate to the civil engineering works, have been demonstrated in the civil engineering design reference documents. He states that he is content to support the issue of a Licence Instrument to put into service the new nitrogen plant that forms part of the DHD system at HNB.

30. At the design stage, ONR had sought justification[19] from the licensee for the use of vertically positioned liquid nitrogen storage vessels as opposed to horizontally positioned vessels for seismically qualified plant. This issue was considered by the ONR civil engineer who assessed[20] the civil engineering aspects of the HPB DHD system design. He concluded that the licensee had provided an acceptable justification for the use of vertically positioned vessels.

3.2 CONTROL AND INSTRUMENTATION (C&I) SYSTEMS

31. An ONR C&I specialist undertook an assessment[21] of the C& I aspects of licensee's safety case that centred on SS3C and SS5. He judged that there were a number of areas within the licensee's safety case where further evidence is required to substantiate the claims and arguments it has made. He has collated these shortfalls in issue 3312 on the ONR regulatory issues database, in line with ONR guidance, to ensure they are adequately considered and closed out. The areas requiring resolution are:

- Segregation – The licensee is to provide evidence that they have satisfied appropriate standards or relevant good practice in respect of segregation of the two independent channels of the blow-down injection system within the Local Control Room (LCR) and cable routes from the LCR to the reactor building, or provide justification why this is acceptable.
- Common Cause Failure – The licensee is to provide further evidence and justification, in respect of the apparent common cause failure shortfall identified in the C&I design substantiation report, as to why this is acceptable.
- ONR notes the Electromagnetic Compatibility compliance testing does not appear to meet the requirements of international standards or relevant good practice. The licensee is to provide justification that the Electromagnetic Compatibility compliance testing is adequate, or to commit to further testing.
- A significant number of components have a proof test interval of between four and eight weeks, ONR considers this to be a particularly demanding maintenance schedule and requests that the licensee provide justification that this is necessary and appropriate, and there is no significant detriment arising from these frequent maintenance activities, so that risks remain ALARP.
- A number of smart timers are used within the new nitrogen storage and vaporisation plant with a1 x 10^{-3} probability of failure per demand CMF target reliability. However these timers have not undergone any formal qualification and the licensee has argued these are acceptable on an ALARP basis. ONR

notes this does not meet the licensee's standards, and considers this basis is not sufficiently robust for the claim being made. The licensee is to provide suitable justification for these devices or to indicate how these shortfalls will be eliminated.

32. The points listed above were discussed at a meeting[30] held between ONR and the licensee. At the meeting ONR gained assurance that the licensee understood ONR's concerns and would work to provide the additional evidence required.

33. The C&I specialist considered the status of both the existing and new nitrogen plants, and deterministically considered whether, from a C&I perspective, the new system could be detrimental to reactor safety in terms of;

- Inadvertent injection causing an over-pressurisation fault.
- Inadvertent blowdown operation and reactor under-pressurisation.

34. On the basis of the arguments presented in the assessment summary, the C&I specialist considers the risk of inadvertent injection or inadvertent blowdown due to C&I causes to be acceptable such that it would be appropriate to introduce the new Nitrogen plant and follow up with the resolutions to the outstanding issues. The C&I specialist recommends, therefore, that ONR issue an Agreement for the licensee to put the new DHD system into service.

3.3 EXTERNAL HAZARDS (EH)

35. An ONR EH specialist undertook an assessment[22] of the nitrogen injection and blowdown systems for HNB and HPB and also attended level 4 meetings with the licensee.

36. His report presented the results of his assessment of the licensee's SS 2 submission that supported the issue of agreements at HNB and HBP to modifications to the nitrogen injection and reactor blowdown routes.

37. He has been subsequently involved with level 4 meetings on the suitability of the concrete raft for seismically qualified nitrogen injection plant at HPB (consideration of this feature at HNB is addressed in the civil engineering assessment). From his interactions with the licensee and assessment of their safety case, the EH specialist identified two issues, which the licensee has addressed in SS5.

- Consideration of beyond design seismic events.
- Seismic qualification of small components, such as C&I components, within the design.

38. The EH specialist has undertaken an assessment[23] of the seismic aspects presented in SS5. He notes that in SS5 the licensee makes no claim against keyway root cracking and so it does not cover the suitability of the new DHD if such cracking is observed in the main population of the graphite core bricks.

39. The licensee recognises that the new DHD system may be required to underwrite a future safety case following the discovery of keyway root cracking and the plants at HNB and HPB have been designed to operate following what the licensee terms an infrequent (bottom line) seismic event. The EH specialist considers that the design response spectra used by the licensee has not been shown to be consistent with ONR's expectation for protection against a design basis external hazard, including seismic hazard. This expectation, which is presented in ONR SAP EHA.4, is that the design basis seismic event should conservatively have a predicted frequency of being

exceeded of less than 10^{-4} per year. This is currently being considered by ONR as part of the Fukushima response Stress Test Finding 2.

40. SS 5 claim 1 states that the enhanced systems will fulfil the safety duties and operational duties of the original plant. The EH specialist considered that there is very little seismic withstand requirement associated with claim 1 in SS5 and consequently he did not carry out a detailed seismic qualification of the new system. However, he is confident that the seismic response criterion used by the licensee provides an adequate basis for the seismic demand associated with claim 1. On this basis the EH specialist has no objection to ONR issuing an Agreement to put the new DHD into service at HNB.

41. The EH specialist will be raising a candidate issue for the ONR issues database to address the seismic qualification of the DHD. The specialist considers the issue of seismic qualification will need to be addressed should the licensee claim the DHD for operation after detection of keyway root cracking in the general population of the graphite core bricks.

3.4 FAULT STUDIES (FS)

42. An ONR FS specialist undertook an assessment[24] of the safety functional requirements for the SACR and DHD systems at both HNB and HPB. He concluded that in SS1, the licensee had provided an adequate specification of the safety functional requirements for the new nitrogen plant to ensure that full implementation of the diverse shutdown project would not have a significant detriment on the existing safety case. He also concluded that the ALARP argument for installing the diverse shutdown system is significantly flawed in not considering beyond design basis seismic events.

43. In his report, the FS assessor notes that the INSA approval statement raised caveats with regard to the seismic resistance of small bore pipework, a concern on operator actions required for nitrogen injection and to a circuit breach due to a seismic event during refuelling. His report contains a recommendation that the licensee should be asked to address these caveats. The assessor later noted[25] that the licensee had addressed these caveats in the consolidated safety case.

44. As the FS assessment was undertaken during the design stage, one of the assessor's recommendations was that the licensee should consider whether there were any practicable enhancements to the proposals for the new nitrogen plant to increase seismic margins beyond the bottom line earthquake level. This issue has been followed up by ONR at subsequent level 4 meetings and the licensee's response is included in SS5.

45. The FS specialist considered that he could not support putting the new DHD systems at HNB and HPB into service until the licensee had demonstrated that the new system had been designed, constructed and commissioned to meet the design basis safety case requirements. This stance is understandable given that the assessment was undertaken during the design stage and over two years prior to the licensee commissioning the system.

46. Another FS specialist has reviewed[26] SS5, which addresses the issues that the FS specialist raised, and supports ONR Agreement to putting the new DHD system at HNB into service.

3.5 STRUCTURAL INTEGRITY

47. The structural integrity issues associate with the new DHD systems at HNB and HPB centred on the licensee's justification of vertically positioned nitrogen storage vessels and the pipework tie-in connections into the seismically qualified tertiary injection points. The latter modification extended the reactor primary pressure boundary.

48. The issue of the acceptability of the licensee's justification of vertically positioned nitrogen storage vessels was addressed in the civil engineering assessment reported in section 3.1. ONR addressed the pipework modifications that extended the reactor primary pressure boundary by requiring the licensee to obtain ONR Agreement for the modification on each of the four reactors. Licence Instruments have been issued for the aforementioned modifications to the reactors at HNB and HPB.

49. My specialism is structural integrity and so in that role I judge, in my capacity as a specialist structural integrity inspector, I have found nothing that would prevent ONR agreeing to the licensee putting the new DHD system at HNB into service.

3.6 READINESS INSPECTION

50. The ONR HNB nominated site inspector and I undertook a readiness inspection[27] at HNB towards the end of the commissioning period. The aim of the inspection was to obtain evidence to inform the permissioning process. We undertook an inspection of the new DHD system and held meetings with appropriate members of; the project team; commissioning team; engineering team, and training department. The inspections sampled the licensee's LC 22 arrangements, the safety case requirements (safety functional requirements), commissioning, operating rules operating instructions, plant component maintenance and examination, and staff training.

51. The readiness inspection raised five observations, all of which have been addressed satisfactorily[28] by the licensee.

52. One of the outcomes of the inspection was that it addressed the concerns of the fault studies specialist highlighted above in paragraph 45.

53. From the evidence obtained during our inspection, we were content that sufficient progress was being made in relation to the implementation of the plant modification under LC 22 (1). We did not identify any shortfalls that would prevent ONR issuing agreement to put the new DHD system into service.

4 MATTERS ARISING FROM ONR'S WORK

54. I have considered the licensee's request for ONR's agreement under its LC 22(1) arrangements to put the new DHD system into service at HNB. I have followed ONR procedures for delivering a permissioning activity, as detailed in HOW2. To inform my work I have considered the statements associated with safety improvements contained in the licensee's request letter, the comments of the licensee's NSC, the findings of the work undertaken by INA, and the findings and judgements of ONR specialist inspectors assigned to the project.

55. The DHD project has suffered significant delays during design, construction and to a lesser extent commissioning. Where necessary ONR specialists have provided judgements on the licensee's explanation for the delays and the planned remediation.

    In September 2014 ONR wrote to the HNB Station Director with regulatory concerns associated with further delays in putting the new DHD into service. ONR sought assurance and evidence from site that realistic and achievable plans were in place for testing and commissioning the new plant, and that site were taking all reasonably

practicable measures to expedite this work. ONR subsequently received suitable assurances from the Station Director.

56. ONR specialist inspectors assigned to the project undertook assessments of the relevant sections of the licensee's safety case. Each discipline has produced a report that presents the inspector's findings, opinions, judgments and recommendations. I judge that none of the recommendations and actions arising from the inspectors' work are sufficiently significant for ONR not to agree to the licensee putting the new DHD system at HNB into service. The basis for my judgment is that all the inspectors are supportive of ONR issuing Agreement.

57. The external hazards specialist inspector supports ONR issuing Agreement to put the new DHD system into operation. However, he considers that the design spectrum response used by the licensee has not been shown to be consistent with ONR expectation for protection against a design basis seismic hazard. He has therefore raised a candidate issue on the regulatory issues database in line with ONR policy of tracking and managing such issues through to closure. He judges that ONR should nonetheless issue an Agreement to put the new DHD system into service as it offers safety benefits over the existing system and the EH specialist considers that it is acceptable to address the issue with the licensee's seismic spectrum after the system has entered service. **I recommend that the ONR nominated site inspector for HNB should seek a strategy from the licensee for addressing this shortfall.**

58. The C&I specialist inspector has identified five shortfalls in the licensee's safety case that should be resolved. He has incorporated these shortfalls in issue 3312 on the regulatory issues database, in line with ONR guidelines. On an ALARP basis, the inspector considers it is appropriate for the licensee to address these shortfalls after the new DHD system has been put into service. He therefore recommends that ONR issue the Agreement for the licensee to put the new DHD system into service. **I recommend that the ONR nominated site inspector for HNB should seek a strategy from the licensee for addressing these shortfalls.**

59. The ONR HNB nominated site inspector and I undertook a readiness inspection of the new HNB DND system at the end of the commissioning phase. We did not identify any shortfalls that would prevent ONR issuing Agreement to put the new DHD system into service.

5 CONCLUSIONS

60. The licensee has written to ONR and requested agreement under LC 22(1) arrangements to put the new DHD system at HNB into service. The proposal has been presented to the licensee's NSC for information. It has passed through the licensee's due process and been found to be acceptable. An INSA approval for the enabling safety case, SS5, has been issued by the licensee's internal independent regulator, INA, with minor caveats. The statement supports bringing the new DHD system into service.

61. INA has undertaken Concurrence-Part B, the findings of which have informed the INSA statement for SS5 that supports putting the new DHD system at HNB into service.

62. Assessments of the licensee's submission by the relevant ONR specialists found nothing that would prevent the issue of Licence Instrument 545 giving agreement to the licensee to put the new DHD system into service at HNB.

63. The ONR external hazards specialist considers that there is a shortfall against ONR expectations with the seismic response spectrum used by licensee and is raising a candidate issue on the ONR regulatory issues database in line with ONR guidance.

64. The ONR C&I specialist has identified five shortfalls in the licensee's safety case that should be resolved. He has raised issue 3312 on the ONR regulatory issues database in line with ONR guidance.

65. Having taken into account the opinions of the ONR specialist inspectors, I judge that the shortfalls evident in the licensee's submission do not warrant delaying putting the new DHD system into service at HNB, in light of the significant nuclear safety benefit it will provide.

66. I have consulted with SEPA who has confirmed that it does not object to ONR issuing the Agreement.

67. I have prepared Licence Instrument 545 for review in conjunction with this PAR. The Licence Instrument is a standard format given within ONR permissioning instructions and does not require review by the Treasury Solicitor's Office.

68. I judge that, based on the evidence presented in this report, I am satisfied that there is nothing to prevent ONR issuing agreement for the licensee to put the new DHD system at HNB into service.

6 RECOMMENDATIONS

69. I recommend that the CNRP operating reactor sub-programme Superintending Inspector:

- Signs this PAR to confirm acceptance of the ONR technical and regulatory arguments that will help justify issuing Licence Instrument 545.
- Signs this PAR approving its release for publication, after redaction where appropriate.
- Signs Licence Instrument 545, agreement under LC 22(1) arrangements to put the new DND system HNB into service.

70. I recommend that the ONR nominated site inspector for HNB should seek a strategy from the licensee to address the shortfalls identified in the external hazards and C&I assessments, which are also detailed in the respective candidate regulatory issues.

7 REFERENCES

1. LC 22(1) Agreement request letter. TRIM Ref 2015/30981
2. NP/SC 7538: HNB HPB safety case for graphite core and core restraint. TRIM Ref. 2009/242205.
3. NP/SC 7556: Strategy to develop safety cases for future graphite operation. TRIM Ref 2009/368184.
4. Letter from NGL on DHD timetable. TRIM Ref. 2015/45311
5. ONR letter to HNB. TRIM Ref. 2014/325030
6. NP/SC 7643. Consolidated safety case. TRIM Ref. 2012/371996
7. NII letter to HNB. TRIM 2008/608843
8. NP/SC 7557: Enhanced long term shutdown provisions. Paper of Principle and associated INSA statement. TRIM Ref. 2013/240108
9. NP/SC 7557: Paper of principle NSC meeting minutes. TRIM Ref. 2010/547
10. NP/SC 7557: Enhanced long term shutdown provisions. Stage submission 5 version 5. TRIM Ref. 2015/53466
11. NP/SC 7557: SS5 INSA statement. TRIM Ref. 2015/48801
12. Email NP/SC 7557: SS5 NSC meeting. TRIM Ref.2015/29821
13. INA Concurrence part B findings. TRIM Ref. 2015/66111
14. Letter HPB 71689N. TRIM Ref. 2010/320638
15. Letter HNB 71187N. TRIM Ref. 2010/438659
16. ONR HOW2 Guide - Purpose and Scope of Permissioning - NS-PER-GD-014 Revision 4. July 2014. http://www.onr.org.uk/operational/assessment/index.htm
17. Email SEPA response to ONR Agreement. TRIM Ref. 2015/25444
18. ONR-HNB-AR-14-099. Assessment of the design of the civil works for the new nitrogen plant. TRIM Ref. 2015/3283
19. ONR-NSS-IR-12-040 Level 4 meeting with NGL. TRIM Ref. 2012/88922
20. ONR civil engineering consideration of the design of the base slab. TRIM Ref. 2015/667700
21. ONR-CNRP-AR-14-108. C&I assessment of the licensee's safety case for HNB TRIM Ref. 2015/84465
22. ONR CNRP AR No. 32/2011. TRIM Ref. 2011/408896
23. External Hazards Specialism confirmation. TRIM Ref. 2015/66517
24. CNRP AR No. 30/11 Initial hold-points on modifications to plant-Reactor physics and fault analysis aspects. TRIM Ref. 2011/400063
25. Email: Consolidated safety case contents [redacted] TRIM Ref. 2012/424450
26. Email ONR Fault studies specialist TRIM Ref. 2015/30300
27. ONR-HNB-IR-14-182. Readiness inspection of new DHD system at HNB. TRIM Ref. 2014/440753
28. NGL response to ONR readiness inspection observations. TRIM Ref. 2015/45409

29. HNB response to ONR letter. TRIM Ref. 2014/341165

30. ONR-CNRP-CR-14-365. TRIM Ref. 2015/83488