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 Hinkley Point B power station

Project Assessment Report ONR-HPB-PAR-14-027
Revision 0
30 September 2015

EXECUTIVE SUMMARY

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

Permission Requested

EdF Energy Nuclear Generation Limited (NGL), the licensee of Hinkley Point B power station, has requested that the Office for Nuclear Regulation (ONR) issue an Agreement or Acknowledgment to the safety case for putting the new nitrogen storage, vaporisation, distribution, injection and blowdown system into operation at Hinkley Point B. 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 an 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 reactors' 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, vaporisation, 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 DHD) 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 seven Licence Instruments against this project, with the one remaining Licence Instrument required to be issued being for Hinkley Point B to enable the licensee to put the new DHD system into service at that site.

The safety case submission justifying putting the new DHD system at Hinkley Point 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. An ONR inspector undertook 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 at Hinkley Point B into service.

The ONR external hazards specialist inspector identified a shortfall against ONR expectations in the seismic response spectra used by the licensee at both Hunterston B and Hinkley Point B. This shortfall has been communicated to the licensee in a letter from the ONR Hunterston B nominated site inspector and at a subsequent regulatory meeting. ONR will consider the licensee's seismic methodology and spectrum as a separate issue. The external hazards specialist inspector supports ONR issuing Agreement to the modification.

The ONR control and instrumentation specialist inspector identified three 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 control and instrumentation specialist inspector judges that ONR can follow-up resolution of the shortfalls 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, ONR was satisfied that the licensee presented an adequate safety case submission justifying putting the new DHD system at Hinkley Point B into service and consequently Agreement was granted.

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

Recommendation

It was recommended that the Civil Nuclear Reactor Programme Operating Reactors sub-programme Superintending Inspector:

- Signed this PAR to confirm acceptance of the regulatory arguments that will help justify issuing Licence Instrument 546.
- Signed this PAR approving its release for publication, after redaction where appropriate.
- Signed Licence Instrument 546, Agreement under LC 22(1) arrangements to put the new DHD system at Hinkley Point B into service.

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
EA	Environment Agency
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)
SS	Stage submission

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1 PERMISSION REQUESTED

1. EdF Energy Nuclear Generation Limited (NGL), the licensee of Hinkley Point B (HPB) power station, has requested[1] 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 stage submission 5 (Category 2), which presents the safety case for putting the new nitrogen storage, vaporisation, distribution, injection and blowdown system into operational service at HPB power station. The modification is part of the provision of enhanced arrangements to ensure long-term-shutdown of the reactors' 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 HPB and Hunterston B (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 hold-down (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.
   - 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[32].

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 HPB into service.
- SS 6 is a category 2 submission and will cover the removal of the redundant nitrogen plant at HPB.
- 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 HPB. 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 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. INA completed its assessment[13] in September 2015 and was content to grant concurrence with no caveats.

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 are listed below:

- 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. The Licence Instrument for this modification was issued in March 2015.
- Putting the new nitrogen plant into operational service at HPB. This PAR considers this modification and will be the final Licence Instrument for ONR's permissioning activities on this project.

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. 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

18. I have considered NGL's request to ONR for agreement to put the new DHD system at HPB 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, which has been involved throughout the project.

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

20. 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 HPB nominated site inspector or specialist inspectors during planned site inspections, and the readiness inspection undertaken by myself.

21. In view of the similarities between the HNB and HPB DHD systems and supporting safety cases, my permissioning work for HPB has taken cognisance of the comparable activities on HNB. The licensee detailed the differences between the two systems and safety cases[23], which it considered had minor implications for nuclear safety. The ONR specialists included consideration of these differences between the sites where necessary in their assessments.

22. 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.

23. 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

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

25. 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.

26. The inspector focused on HPB stage submission 3A, which covered the civil engineering aspects of the new nitrogen storage and distribution system. The main purpose of the assessment was to understand the margins in the design of the base slab prior to the licensee pouring concrete to case the slab. This is important as the new nitrogen storage, vaporisation and distribution plant, and its local control room is sited on the slab. He considered that the evidence provided did not show that adequate safety margins existed for certain elements of the design. The licensee accepted the shortfall and modified the design and the safety case. The inspector then completed his assessment and concluded that in his opinion there were no residual civil engineering related concerns that would preclude ONR agreeing to the licensee putting the plant into service.

27. 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 an ONR civil engineer[20], who concluded that the licensee had provided an acceptable justification for the use of vertically positioned vessels.

3.2 CONTROL AND INSTRUMENTATION (C&I) SYSTEMS

28. An ONR C&I specialist undertook an assessment[21] of the C&I aspects of licensee's HNB 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 was required to substantiate the claims and arguments made. He 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 were:

- 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.

29. The C&I specialist considered that it was appropriate for ONR to issue Agreement for the licensee to put the new DHD system at HNB into service, with the resolutions of the outstanding issues to follow.

30. I made a recommendation in the PAR[22] that considered the licensee's request to put the new DHD system at HNB into service for the ONR nominated site inspector to seek a strategy from the licensee for addressing the C&I and external hazards shortfalls. The shortfalls were discussed at meetings[23, 24] held between ONR and the licensee. At the meetings ONR gained assurance that the licensee understood ONR's concerns and would work to provide the additional evidence required.

31. The C&I specialist subsequently undertook an assessment[25] of the licensee's safety case (SS3C and SS5) for HPB. There is significant commonality with the HNB and HPB DHD systems and so the HPB assessment was based on the outcome of the HNB assessment and the differences between them. The scope of the assessment covered two aspects, namely:

- The shortfalls identified in the C&I assessment of the HNB DHD system and how they impact on the similar installation at HPB.
- The differences between the two installations from a C&I perspective, as identified in the licensee's control philosophy and functional requirements specification.

32. The C&I specialist considered that the licensee needed to provide further evidence on three shortfalls to effectively substantiate the design of the HPB DHD C&I systems. The shortfalls had also been identified previously for the HNB DHD system. The outstanding shortfalls at HPB are as follows:

- SMART timer devices
- Segregation
- Electromagnetic compatibility

33. The C&I specialist has raised issue, number 3843, on the ONR regulatory issues database in line with ONR guidance, to ensure that the HPB shortfalls are adequately considered and closed out. Overall, he considers that on the basis on an ALARP judgment it is appropriate for NGL to put the HPB DHD system into service. He therefore recommends that ONR issue Agreement for NGL to put the HPB DHD system into service.

3.3 EXTERNAL HAZARDS (EH)

34. An ONR EH specialist undertook an assessment[26] of the nitrogen injection and blowdown systems for HNB and HPB and also attended level 4 meetings with the licensee.

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

36. He has been subsequently involved with level 4 meetings on the suitability of the concrete raft for seismically qualified nitrogen injection plant at HPB. From his interactions with the licensee and assessment of their safety case, the EH specialist identified two issues, which the licensee has addressed in SS 5.

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

37. The EH specialist has undertaken an assessment[27] of the seismic aspects presented in SS5. He notes that in SS 5 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.

38. 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[33] as part of the Fukushima response Stress Test Finding 2.

39. 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 HPB.

40. The EH specialist had highlighted a similar shortfall on the seismic qualification of the HNB DHD system. This seismic shortfall and the HNB DHD system C&I shortfalls were included in a letter to the licensee from the HNB nominated site inspector and formed the basis for a subsequent level 4 meeting[23] between ONR and the licensee. The meeting was attended by representatives from the licensee's design authority, INA, both HNB and HPB and the DHD project team. ONR attendees included the CNRP operating reactors delivery lead, graphite lead and the HNB nominated site inspector. ONR stated that it will be dealing with the licensee's seismic methodology and spectrum as a separate issue.

41. On the matter of the seismic shortfall, I consider the regulatory interactions with the licensee on this issue are sufficient and ONR do not need to undertake any further work in regard to this permissioning activity.

3.4 FAULT STUDIES (FS)

42. An ONR FS specialist undertook an assessment[28] 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[29] 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[30] SS5, which addresses the issues that the FS specialist raised, and supports ONR Agreement to putting the new DHD system at HPB into service.

3.5 STRUCTURAL INTEGRITY

47. The structural integrity issues associated 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 as a specialist inspector I have found nothing that would prevent ONR issuing Agreement to the licensee to put the new DHD system at HPB into service.

3.6 READINESS INSPECTION

50. I undertook a readiness inspection[31] at HPB towards the end of the commissioning period. The aim of the inspection was to obtain evidence to inform the permissioning process. I inspected of the new DHD system and held meetings with appropriate members of; the project team; commissioning team; nuclear safety group; 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. I also sampled the licensee's administrative process for putting the new plant into service. This is a tiered approach, the final stage of which requires the approval of the Operational Safety Review Committee, supported by INA before the plant can be put into service.

51. The readiness inspection raised three points that required further clarification. I was content for these points to be closed out by the INA concurrence.

52. One of the outcomes of the inspection was that it addressed the concerns of the fault studies specialist highlighted above in paragraph 43.

53. From the evidence obtained during our inspection, I was satisfied that sufficient progress was being made in relation to the implementation of the plant modification under LC 22 (1). I did not identify any shortfalls that would prevent ONR issuing the 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 HPB. 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 safety case, 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 judgments on the licensee's explanation for the delays and the planned remediation.

56. 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. From regular updates I received from NGL's DHD project lead architect engineer, who provided technical oversight on both sites, I was satisfied that the response for HNB provided the necessary assurance for HPB.

57. 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 HPB into service. The basis for my judgment is that all the inspectors are supportive of ONR issuing Agreement.

58. 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. ONR will be dealing with the licensee's seismic methodology and spectrum as a separate issue to DHD project permissioning. I consider the regulatory interactions with the licensee on this issue are sufficient and ONR do not need to undertake any further work in regard to this permissioning activity.

59. The C&I specialist inspector has identified three further shortfalls in the licensee's HPB DHD safety case that should be resolved. He has incorporated these shortfalls in issue 3312 on the regulatory issues database, in line with ONR guidelines; these will be progressed as part of normal business.

60. I undertook a readiness inspection of the new HPB DHD system at the end of the commissioning phase. I did not identify any shortfalls that would prevent ONR issuing Agreement to put the new DHD system into service.

61. Putting the new HPB DHD system into service will provide significant nuclear and conventional safety benefits over the existing facility, namely:

- Extending the functionality and integrity of the DHD systems.
- Providing a modern, seismically qualified system capable of holding-down both reactors.
- Reduced operator and maintenance burden.
- Reduction in the number of instances where short-duration Technical Specification entries are required for plant maintenance.
- Enable the licensee to reduce the fuel oil stock holding to the assessed safe infrequent seismic event level. The reduction will require Agreement from ONR as it affects a Nuclear Safety Requrement.

5 CONCLUSIONS

62. The licensee has written to ONR and requested agreement under LC 22(1) arrangements to put the new DHD system at HPB into service. The proposal has been presented to the licensee's NSC as a matter arising. It has passed through the licensee's due process and been found to be acceptable. An INSA approval for the enabling safety case, SS 5, has been issued by the licensee's internal independent regulator, INA, with minor caveats. The statement supports bringing the new DHD system into service.

63. 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 HPB into service.

64. Assessments of the licensee's submission by the relevant ONR specialists found nothing that would prevent the issue of Licence Instrument 546 giving agreement to the licensee to put the new DHD system into service at HPB.

65. The ONR external hazards specialist considers that there is a shortfall against ONR expectations with the seismic response spectrum used by licensee.

66. The ONR C&I specialist has identified three further 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 and will take these forwards as part of normal business.

67. 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 HPB, in light of the significant nuclear safety benefit it will provide.

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

69. I have prepared Licence Instrument 546 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 Government Legal Department.

70. 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 HPB into service.

6 RECOMMENDATIONS

71. 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 546.
- Signs this PAR approving its release for publication, after redaction where appropriate.
- Signs Licence Instrument 546, agreement under LC 22(1) arrangements to put the new DND system HPB into service.

72. I recommend that the ONR nominated site inspector for HPB 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.

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