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**NNB GenCo proposal to modify the design of Hinkley Point C
ONR Agreement to Category 1 modification: HVAC Plateau Redesign of DVL & DEL**

Project Assessment Report ONR-NR-PAR-18-002
Revision 0
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EXECUTIVE SUMMARY

Title

ONR Agreement to Category 1 modification: HVAC Plateau Redesign of DVL and DEL (RC1.2)

Permission Requested

NNB Generation Company (HPC) Ltd (NNB GenCo), for the purposes of arrangements made under Condition 20(1) of Schedule 2 attached to Nuclear Site Licence No. 97A to control any modification to the design of the Hinkley Point C (HPC) nuclear installation, currently under construction in Somerset, has requested ONR's agreement to, or acknowledgment of, implementation of the modification as described in the Licence Summary Statement (LSS) titled '*HVAC Plateau Redesign of DVL and DEL (RC1.2)*', HPC-NNBOSL-U0-000-LSS-100000 Revision 5.0, dated February 9th 2018.

Background

The safeguard building ventilation system (DVL) maintains a suitable environment for plant and personnel within certain non-controlled areas of the four safeguard buildings. The safety chilled water system (DEL) provides the heat sink for the safeguard and fuel building Heating, Ventilation and Air Conditioning (HVAC) systems with a safety classified cooling function, including DVL. The preliminary HVAC design for the safeguard buildings was challenged by ONR during Generic Design Assessment (GDA) as analysis had shown that the proposed design could not meet ONR expectations.

Since that time, NNB GenCo has developed a modified design of DVL and DEL to address ONR's concerns, and the safety justification for the proposed re-design is set out in the LSS. Key references in the LSS are two Basis of Safety Case (BoSC) documents which were assessed by ONR during 2016. That assessment concluded that on the basis of the material available at the time ONR considered there to be no significant issues that should prevent NNB GenCo from fully developing the design of the DVL and DEL HVAC systems, and the supporting safety case. However, it was recognised that the design was still at a high level and there were a number of key areas that required further evidence in order to justify the claims and arguments made in the BoSCs. Further developments of the safety case for the revised design are set out in the LSS, which includes a forward work plan for the timely closure of remaining regulatory issues.

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

ONR fault studies, mechanical engineering, essential electrical and C&I inspectors have carried out an assessment of the safety justification for the modifications set out in the LSS. ONR's assessment of the LSS was carried out alongside the assessment of the case for release of the Nuclear Island Concrete (NIC) hold point in autumn 2018, and focused on the adequacy of the NNB GenCo forward work plan and the resolution of aspects required to be complete by NIC, as well as progress against key topics.

Matters arising from ONR's work

From their assessment of the safety case for the design modification, the ONR mechanical engineering and fault studies inspectors raised four Level 4 Regulatory Issues. The ONR inspectors are content for these issues to be addressed by the licensee as the project progresses, and that they do not prevent ONR giving Agreement to the proposed modification.

Conclusions

Based on the evidence sampled, I am satisfied with NNB GenCo's case for the acceptance of this design change. Although ONR's assessment has identified four Regulatory Issues for follow-up, the relevant ONR technical specialists and the design & safety case delivery lead are satisfied that these issues can be closed out in due course, and should not prevent ONR giving its agreement under LC 20(1) for this design modification to go ahead.

Recommendation

I recommend that ONR issues licence instrument LI517 giving its Agreement under LC20(1) to NNB GenCo's proposed modification to the design of Hinkley Point C.

LIST OF ABBREVIATIONS

ALARP	'as low as reasonably practicable'
AR	Assessment Report
BoSC	Basis of Safety Case
C&I	Control and Instrumentation
CCF	Common Cause Failure
DDM	Demande de Modification (decision on modification request)
DEL	Safety Chilled Water System
DELb	DEL Backup Train
DELM	DEL Main Line Train
DVL	Safeguard Building (Uncontrolled Area) Ventilation System
DVLb	DVL Backup Train
DVLm	DVL Main Line Train
DWL	Safeguard Building (Controlled Area) Ventilation System
EPR	European Pressurised Water Reactor
EVR	Containment Cooling Ventilation System
FDM	Fiche de Modification (modification initiation form)
GDA	Generic Design Assessment
HOW2	(ONR) Business Management System
HPC	Hinkley Point C
HVAC	Heating, Ventilation and Air Conditioning
IRWST	In-containment Refuelling Water Storage Tank
ITA	Independent Technical Assessment (NNB GenCo)
LC	Licence Condition
LCU	Local Cooling Unit
LSS	Licence Summary Statement
MAAP	Modular Accident Analysis Program
NCHICS	Non-Computerised HVAC C&I System
NIC	Nuclear Island Concrete
NNB GenCo	NNB Generation Company (HPC) Limited
NSC	Nuclear Safety Committee (NNB GenCo)
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report (ONR)
PCSR	Pre-Construction Safety Report
PS	Protection System
RC	Reference Configuration
RD	Responsible Designer

RGP	Relevant Good Practice
SAP	Safety Assessment Principle(s)
SAS	Safety Automation System
SDCC	Safety Design Change Committee (NNB GenCo)
SSC	Structure, System and Component
TAG	Technical Assessment Guide(s) (ONR)
TDC	Technical Direction Committee (NNB GenCo)
VFD	Variable Frequency Drive

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Table 1..... Regulatory Issues arising from ONR assessments

1 PERMISSION REQUESTED

1. NNB Generation Company (HPC) Ltd (NNB GenCo), for the purposes of arrangements made under Condition 20(1) of Schedule 2 attached to Nuclear Site Licence No. 97A to control any modification to the design of the Hinkley Point C (HPC) nuclear installation, currently under construction in Somerset, has requested (Ref. 1) ONR's agreement to or acknowledgment of implementation of the modification as described in the licensee's Licence Summary Statement (LSS): *HVAC Plateau Redesign of DVL and DEL (RC1.2)*, numbered HPC-NNBOSL-U0-000-LSS-100000 Revision 5.0, dated February 9th 2018 (Ref. 2)
2. This project assessment report (PAR): summarises ONR's assessment of NNB GenCo's proposal to modify the design of the HPC EPR; records ONR's judgement of the impact of the modification upon nuclear safety; and responds to NNB GenCo's request. It has been produced in accordance with ONR HOW2 guidance (Ref. 3).

2 BACKGROUND

2.1 Safeguard building ventilation system (DVL) & safety chilled water system (DEL)

3. The primary role of the safeguard building ventilation system (DVL) is to maintain a suitable environment for plant and personnel within the non-controlled area of the four safeguard buildings, with the exception of: the main control room, the computer rooms and a number of adjacent rooms at the 12.0 m level in division 2, and several valve compartments that are served by independent heating, ventilation and air conditioning (HVAC) systems. DVL also provides air to the safeguard building controlled area ventilation system (DWL) in normal operation, and participates in hazard mitigations, for example external explosion (explosion pressure wave dampers), extreme cold (heaters), internal explosion (hydrogen extraction) and internal fire (fire dampers).
4. The primary role of the safety chilled water system (DEL) is to provide the heat sink for the safeguard and fuel building HVAC systems with a safety classified cooling function, including DVL.

2.2 Reason for modification

5. The preliminary HVAC design for the safeguard buildings was challenged during GDA as analysis had shown that the proposed design could not meet ONR expectations. Although a preliminary solution was proposed at the end of GDA, which was the addition of a non-computerised control and instrumentation (C&I) system to the UK EPR design, further significant modifications became necessary. Given DVL and DEL have a key safety role and the significant modifications proposed, Basis of Safety Case (BoSC) documents were produced for DVL (Ref. 4) and DEL (Ref.5). The BoSCs are key supporting references to the LSS.
6. The key modifications to DVL include:
 - two additional backup DVL (DVLb) trains are to be implemented in divisions 2 and 3, in addition to the existing backup trains in divisions 1 and 4, giving eight class 1 DVL trains in total (one main and one backup per division);
 - DVL ducting cross-connections are to be removed between safeguard divisions. All divisions of the safeguard buildings no longer contain any cross-connecting HVAC ductwork and are segregated. This increases their protection against common cause failure (CCF) mechanisms such as internal fires and flooding;
 - the DVL centralised ventilation air handling unit design is to be optimised, with two cooling coils in series with a new sizing and design, which permits cooling to be provided by either the DEL main or backup train in that division;
 - C&I diversity is to be increased via the use of the safety automation system (SAS), the Protection System (PS) and the non-computerised HVAC C&I system (NCHICS);

- Local Cooling Units (LCU) are to be introduced into the C&I rooms, and the mechanical rooms (divisions 1 and 4 only).
7. The key modifications to DEL include:
- the backup DEL (DELb) trains in divisions 1 and 4 are to be reclassified from safety class 2 to class 1;
 - DEL cooling capacity is to be increased via use of larger chillers;
 - a heat-wave approach is to be implemented to operate all DELm and DELb trains simultaneously in heat-wave conditions;
 - cross-connections between DEL main (DELm) trains are to be removed.
 - C&I for DELm trains 1&4 is to be made diverse from trains 2&3;
 - NCHICS is to be implemented for DELb;
 - the ultimate heat sink is to be diversified with two DEL trains water cooled and two air cooled.
8. The design changes above also lead to the following major civil modifications:
- safeguard buildings 2 and 3 – transformation of a mezzanine floor into a full floor, increasing the building height by 2 m; and
 - safeguard buildings 1 and 4 – reshuffle and increase in the number of air intakes / outfalls for DVL and DEL.
9. The principle of the safety and ALARP justification for the modifications to DVL and DEL is to increase the reliability of the HVAC mechanical systems to be commensurate with the reliability of the C&I and electrical systems which they are protecting. In order to improve the reliability of the HVAC, additional diversity, redundancy and independence were required. In order to accommodate the additional equipment of the improved HVAC systems, some civil modifications were required to increase the footprint of the safeguard buildings.

3 ASSESSMENT CARRIED OUT BY ONR IN CONSIDERATION OF THE REQUEST

3.1 Scope

10. ONR has already undertaken a comprehensive assessment of the licensee's Pre-Construction Safety Report, PCSR3 (Ref. 6) as well as 'supplementary' safety submissions that support the release of certain construction hold-points (Ref. 7). These supplementary safety submissions include the Nuclear Island Concrete (NIC) Report, which justified the suitability of the current HPC design to support release of the NIC hold point.
11. The proposed modification will only affect certain aspects of the safety case and therefore ONR's assessment has been limited to those technical areas concerned. The topic area assessments are reported in a series of Assessment Reports (AR), as discussed below. Each AR considers the impact of the change on the relevant parts of the evolving safety report and whether the resulting changes to the reference design configuration (RC1.2) represent relevant good practice (RGP) and/or the contribution to overall plant risk from the components, systems or structures affected is as low as reasonably practicable (ALARP) and thus consistent with the UK context.

3.2 Assessment topic areas

12. ONR fault studies, mechanical engineering, essential electrical and C&I inspectors have carried out an assessment of the safety justification for the modifications to DVL and DEL set out in the LSS (Ref. 2). Although it was not considered necessary to consider the Internal Hazards topic in relation to the safety case described in the LSS, the AR produced by ONR's Fault Studies inspector (see Ref. 7) notes that further substantiation of the internal hazards aspects of the design will be required as part of a fully developed safety case for the HVAC, and that the formal safety case for the

HVAC system will be subject to assessment by an ONR Internal Hazards specialist when it has been delivered.

13. As discussed earlier, the LSS is supported by two BoSCs that were assessed by ONR during 2016 (Ref. 8). That assessment concluded that on the basis of the material available at the time ONR considered there to be no significant issues that should prevent NNB GenCo from fully developing the design of the DVL and DEL HVAC systems, and the supporting safety case. However, it was recognised that the design was still at a high level and there were a number of key areas that required further evidence in order to justify the claims and arguments made in the BoSCs. As a result, a number of observations and recommendations were included in ONR's assessment reports that ONR required NNB GenCo to consider going forward. These requirements were captured by two regulatory issues:
 - Issue 4969: *NNB GenCo to prepare a detailed programme of forward work activities associated with the ongoing design and safety case development for the DVL and DEL HVAC systems for the period up to NIC. The programme should include Design Authority's forward work, Independent Technical Assessment (ITA) conditions and follow-up issues and ONR observations. ONR expects the programme to be suitably front-end loaded to further de-risk key aspects (for example, thermal modelling, qualification and mitigation against not being able to meet diversity requirements) well in advance of NIC.*
 - Issue 4970: *NNB GenCo to complete the DVL and DEL HVAC systems forward work activities in accordance with the programme submitted as part of the LC 20 submission prior to submission of the NIC Report to ONR. ONR will monitor progress via routine regulatory oversight with any concerns escalated as appropriate.*
14. The focus of the ONR assessment of the LSS, which was carried out at the same time as the assessment of the case for release of the NIC hold point, was therefore on the adequacy of the forward work plan, resolution of aspects needed to be complete by NIC and progress against other topics.
15. For convenience in reporting, summaries of each of the ONR technical assessments for this LC20 modification were included in the ONR Design & Safety Case cornerstone report (Ref. 7) which informed the PAR for granting consent to the start of Unit 1 nuclear island concrete (NIC). The ONR assessment outcomes for this modification which are summarised below have been largely drawn from the relevant sections of that cornerstone report.

3.2.1 Fault Studies assessment

16. The ONR fault studies inspector (Ref. 7) focused on the following aspects:
 - identification and categorisation of HVAC safety functions and the traceability to the SSCs that deliver these safety functions, and their classification;
 - analysis of the revised HVAC system design to inform the various failure modes and potential hazards introduced by the design, such that the identified initiating events are adequately captured and bounded;
 - the treatment of potential CCF due to shared components within the design of the DVLm and DVLb trains; and
 - analysis of plant transients following bounding design basis initiating events.
17. The inspector concluded:
 - although the 'golden thread' through the safety case is not as readily traceable for loss of DVL and DEL events as it is for other faults, the identification of safety functions against initiating events and the application of the categorisation criteria and classification of the HVAC systems is appropriate;
 - a systematic approach has been employed for the identification of faults;

- suitable and sufficient consideration has been given to potential CCFs within the proposed design; and
 - the analysis of simultaneous loss of divisions one and four (or divisions two and three), with no batteries in those divisions, indicates that the non-hazardous stable state and safe shutdown state can be achieved, although the analysis assumptions are yet to be substantiated. Notwithstanding this, the inspector considered further consideration should be given to automatic isolation (failsafe design) of the chemical and volume control system isolation valve upon loss of power to prevent a continued loss of primary circuit inventory; this is captured by a level 4 regulatory issue (6708; see Table 1) and can be resolved post-NIC.
18. Based on the previous assessment of the BoSCs, the information provided and additional justification supplied by NNB GenCo during the assessment, the ONR fault studies inspector was satisfied with the claims, arguments and evidence presented in the LSS and supporting documentation. The inspector concluded, from a fault studies perspective, that ONR may issue an agreement to NNB GenCo's request to implement the modification described in the LSS, and development of the justification will continue to be monitored through regular level 4 meetings.

3.2.2 Mechanical Engineering assessment

19. The ONR mechanical engineering assessment (Ref. 7) focused on the following aspects:
- mitigation proposals to address predicted elevated temperatures (in excess of equipment qualification temperatures) in a number of C&I and electrical rooms within the safeguard buildings following a total loss of C&I fault;
 - further justification and substantiation of elevated temperatures in equipment rooms;
 - mechanical diversity for relevant equipment; in particular, whether the supply chain will be able to provide suitably diverse components to meet the claimed three-way diversity requirement for DVL and DEL;
 - demonstration that the design process considers potential conflicts between HVAC and seismic requirements for the false floors in the C&I rooms; and
 - thermal analysis to demonstrate acceptability of the removal of variable frequency drives (VFD) from LCUs.
20. The inspector concluded:
- NNB GenCo has developed a robust approach for addressing the elevated room temperatures and the risk of the need for future design changes that could be foreclosed post-NIC is low;
 - the thermal modelling methodology is suitable and sufficient for this stage of the project, but NNB GenCo will need to provide evidence prior to commissioning that the models used to justify the temperatures are appropriate for the as-built rooms. This is captured as a level 4 regulatory issue (6722; see Table 1);
 - for DVL, NNB GenCo provided evidence that a future change from three-way to two-way diversity is acceptable in terms of the safety analysis. The less onerous requirements associated with two-way diversity for DVL are more readily achievable by the supply chain. The ONR fault studies inspector also considered the implications of moving from three-way to two-way diversity on the safety case and concluded that although detailed evidence is expected to be provided to support this position in the future, there is no fundamental reason why a robust safety case cannot be made;
 - for DEL, NNB GenCo stated the supply chain has currently offered three-way diversity for the chillers, but not the circulating pumps. Although consideration

of pumps was ongoing, NNB GenCo's position is reasonable as it is not foreclosed post-NIC. However, the inspector raised a level 4 regulatory issue (6724; see Table 1) to ensure that the supply chain options are resolved;

- further information is required on the consideration of potential conflicts between HVAC and seismic requirements for the false floors in the C&I rooms, which was not available due to the early stage of the design process. As this is not required until mid-2019, the inspector raised a level 4 issue (6726; see Table 1) to track resolution;
 - the thermal analysis adequately justifies the use of fixed speed fan motors for the LCUs.
21. Overall, the inspector was satisfied that, from a mechanical engineering perspective, the modifications proposed to DVL and DEL have been justified using an appropriate methodology; the claims, arguments and evidence laid down within the LSS are acceptable; and subject to successful implementation, the contribution to overall plant risk of the proposed modification is ALARP.

3.2.3 Essential Electrical assessment

22. The ONR essential electrical inspector (Ref.7) focused on the following aspects:
- whether the modifications to the DVL and DEL architecture have been taken into account in the power rating considerations of the electrical equipment;
 - VFD control and a potential future change from VFD control to direct-on-line start motors; and
 - mitigation proposals to address predicted elevated temperatures (in excess of equipment qualification temperatures) in a number electrical rooms within the safeguard auxiliary buildings following a total loss of C&I fault.
23. The inspector concluded:
- regarding the power rating considerations, the approach taken was reasonable in ensuring the equipment of the electrical distribution system is adequately sized without being overly conservative;
 - the system modelling considers the use of VFDs. The electrical power of the VFDs is small, and the effect on the overall system should a change be made to direct-on-line start motors is likely to be negligible, if not reducing the load;
 - if NNB GenCo is unable to demonstrate that the assumptions used in the temperature modelling are overly conservative and that the room temperatures will exceed the equipment design requirements, other options have been identified through discrete modifications to the ducting arrangements for the switch-rooms or the provision of local heat transfer units to expel the excess heat into neighbouring unaffected rooms at relatively low power. The impact of these options from an electrical engineering perspective is minimal.
24. Overall, the inspector was satisfied that the issues that could affect the electrical systems from this modification have been appropriately recognised and considered. Furthermore, the inspector was satisfied that where there are unknowns at this stage of the design, NNB GenCo has in place a reasonable strategy and contingency plans together with a means of tracking implementation of this modification through the commitments made in the LSS. The inspector also noted that should the need arise to implement any of the options identified in the contingency plan, the impact of any of these from an electrical engineering perspective is minimal.

3.2.4 Control & Instrumentation Assessment

25. The ONR C&I inspector (Ref.7) focused on the following aspects:
- whether the safety class 2 SAS C&I interferes with the class 1 DVL to perform its safety function;
 - the impact of CCF of NCHICS and the fire detection system;
 - potential CCF between the dedicated Teleperm XS (C&I system) (TXS) and the TXS based PS;
 - NCHICS sizing;
 - proposal to remove class 1 VFDs via a further modification;
 - risks around the capability of the current C&I platform to control the proposed chiller design for DELb; and
 - progress against other C&I recommendations raised during ONR's assessment of the BoSCs.
26. The inspector concluded:
- regarding the potential for SAS to damage DVL, NNB GenCo has identified viable potential modifications if the risk of SAS damaging class 1 equipment is not ultimately judged to reduce the level of risk ALARP;
 - CCF of NCHICs is no longer a concern, as was the case in the BoSCs, as NNB GenCo no longer needs to claim the main line and backup lines in a heat-wave;
 - although further analysis is ongoing to demonstrate that failure of the fire detection system will not lead to CCF of the fire dampers (across all divisions), NNB GenCo has identified potential options to mitigate the CCF, which can be implemented within the constraints of the civil engineering design;
 - the loss of the dedicated TXS and the PS has been adequately considered in the safety case;
 - NNB GenCo has provided adequate evidence of sufficient space for the NCHICS;
 - although removal of the VFDs and use of a fixed speed fan will be the subject of a separate modification and justification post-NIC, no concerns were identified that would be foreclosed by proceeding beyond NIC;
 - NNB GenCo has provided sufficient confidence on the viability of the replacement control system for DEL, and its lack of impact on the C&I sizing;
 - recommendations raised following the C&I assessment of the BoSCs that are related to NIC have been adequately progressed. Others will be discussed via regular level 4 meetings and monitored through level 4 regulatory issue 4970.
27. Overall, from the perspective of C&I, the inspector was satisfied with the claims, arguments and evidence laid down within the LSS.

3.2.5 Future licensee activities regarding the modification

28. As noted earlier, given the stage at which this modification is being incorporated into the reference configuration, a number of aspects still need to be closed out. To reflect this, the LSS identifies a number of future activities which are to be completed post implementation of the modification into RC 1.2.
29. All inspectors that assessed the LSS were content with the future activities identified by NNB GenCo, which will form a key source of evidence in any future safety case, with the key commitments captured under ONR extant regulatory issues 4970, 6708, 6722, 6724 and 6726.
30. Overall, the inspectors were satisfied that if NNB GenCo delivers the proposed evidence, the claims and arguments laid down within the LSS provide an appropriate justification for the modification. However, it is noted that the design is not yet stable

and the safety justification has the potential of becoming fragmented with a number of further modifications proposed (to the subsequent design configuration, RC 2). These include for example removal of the class 1 VFDs, reduction of the classification of DELb to class 2 and introduction of non-computerised controllers on DELb. NNB GenCo's own Independent Technical Assessment (ITA) function has also recognised this (Ref.7) and recommended that *"an overall review of HVAC design changes should be provided in order to de-risk the HVAC design and ensure there is no impact on the overall reliability"*.

31. ONR's design & safety case lead (Ref. 7) supported the ITA recommendation, and noted that as it is being tracked by ITA it was not necessary for ONR to raise a regulatory issue. The design & safety case lead was also satisfied that ongoing development of the design and completion of the substantiation will continue to be monitored by ONR through resolution of the associated regulatory issues, and through regular level 4 meetings.

3.2.6 ALARP considerations

32. Taking into consideration the assessments carried out by ONR technical specialists, ONR's design & safety case delivery lead (Ref. 7) noted that, subject to its successful implementation, and taking into account the outstanding issues that are being addressed, the proposed modifications:
 - represent RGP; and
 - will ensure that the contribution to overall plant risk from the SSCs affected is ALARP.

3.2.7 Conclusion on ONR assessments

33. As noted in the design & safety case cornerstone report for NIC (Ref. 7), all ONR inspectors that assessed the LSS recommended that in accordance with NNB GenCo's arrangements for compliance with LC 20, ONR may provide agreement to GenCo's request to implement the modification to the HPC EPR described in the LSS.

4 NNB GENCO INTERNAL ASSURANCE AND GOVERNANCE

34. NNB GenCo's control of modifications to the design of the HPC EPR uses the arrangements for compliance with LC20 described in the suite of procedures and associated guidance listed in the licensee's Nuclear Site Licence Compliance Matrix (Ref. 9). The arrangements involve activities within both the Responsible Designer (RD) and NNB GenCo.
35. A proposed modification, initiated by a 'fiche de modification' (FDM), is assessed by the RD and NNB GenCo as it is developed. A 'decision du modification' (DDM) is subsequently produced to capture details of the modification. The modification is categorised in accordance with NNB GenCo and RD procedures (Refs. 10 and 11). NNB GenCo's LC20 arrangements require it to review modification proposals raised by the RD and to confirm the nuclear safety categorisation. Modifications of nuclear safety Category 1 or 2 are issued to NNB GenCo for acceptance. NNB GenCo's Independent Technical Assessment (ITA) function assesses all Category 1 modifications.
36. The licensee's Safety Design Change Committee (SDCC) will assess the adequacy of the technical information in the LSS and agree to the categorisation. If approved by the SDCC (Ref. 12), a Category 1 LSS will be presented to the HPC Nuclear Safety Committee (NSC) for 'Consideration and Advice' before being submitted to ONR for regulatory review. In accordance with its LC20 arrangements NNB GenCo cannot implement a Category 1 modification to the installation's design without ONR's acknowledgement or agreement.

4.1 Safety Design Change Committee

37. The LSS for the proposed modification was submitted to the 17th May 2017 SDCC (Ref. 13) where, following discussion, the committee suggested a number of areas of the LSS for further development and requested resubmission to a later meeting. Revised versions were subsequently discussed at the 21st June 2017 and 6th September 2017 meetings (Ref. 14 and 15). Following discussion of the Revision 3 draft at the 20th September 2017 Nuclear Safety Committee (Ref. 16), further amendments were made to the LSS and a final version submitted to the 14th November 2017 SDCC (Ref. 17), where it was accepted by the committee as suitable for a nuclear safety category 1 design change.
38. Having reviewed the minutes of the SDCC meetings, I am satisfied that the proposed modification was subject to a thorough consideration by the committee, as required by the licensee's LC20 arrangements, and that the SDCC's final acceptance statement was justified by those considerations.

4.2 Nuclear Safety Committee

39. Following acceptance by the SDCC, the LSS was submitted to the 7th December 2017 Nuclear Safety Committee (NSC) for consideration and advice (Ref. 18). Specifically, the NSC was asked to consider and advise on:
- the acceptability of the proposed modifications to the DEL and DVL systems;
 - the adequacy of the safety justification supporting the modifications to the DEL and DVL systems; and
 - the adequacy of the future work programme and NNB surveillance during the detailed design phase.
40. Following discussion of each of these questions, the committee:
- supported the proposed modifications to the DVL and DEL systems;
 - considered that the safety case was likely to satisfy ALARP requirements, but there was still some work to do;
 - judged that the ongoing thermal analysis work was likely to support the safety case as presented, but recognised there was further work to complete before this could be confirmed;
 - advised that further consideration should be given to the integration of the HVAC safety case into the wider safety case and to ensuring all items in the further work plan are focussed on the key issues such that no undue risk is carried forward.
41. Having reviewed the minutes of this NSC meeting, and the previous meeting which had discussed the draft LSS, I am satisfied that, in line with the licensee's LC20 arrangements, the proposed modification was subject to a suitably thorough consideration by the committee, and that the committee's overall support for the modification was justified by those considerations.

4.3 Independent Technical Assessment

42. The Independent Technical Assessment (ITA) report from NNB GenCo's assurance function (Ref. 19) provides a thorough assessment of the LSS. ITA accepted the final version of the LSS subject to satisfactory completion of further work required to close out the LSS commitments and the ITA Conditions of Acceptance (from its assessment of the BoSCs).
43. The further work required is set out in a comprehensive HVAC forward work plan (Ref. 20). Prior to NIC, ITA confirmed (Ref. 21) that the identified further work had been adequately progressed at that point.

4.4 Conclusions on NNB GenCo internal assurance & governance

44. I am satisfied that the proposed modification has been satisfactorily progressed through NNB GenCo's rigorous due process, including reviews by the SDCC and the NSC, and engagement and sign-off by the NNB GenCo internal assurance function (ITA).

5 MATTERS ARISING FROM ONR'S WORK

45. Arising from ONR's assessment of the LSS for the proposed design modification, the ONR mechanical engineering and fault studies inspectors raised four Level 4 Regulatory Issues which are set out in Table 1. The design & safety case delivery lead notes (Ref. 7) that the ONR inspectors are content for these issues to be addressed by the licensee as the project progresses, and that they do not prevent ONR giving Agreement to the proposed modification.

6 CONCLUSIONS

46. This PAR presents the findings from ONR's considerations of the request by NNB GenCo to implement a modification to the HPC EPR. Section 3.2 above sets out the findings of ONR's assessment of those technical topics relevant to the proposed modification. Section 4 above examines the adequacy of NNB GenCo's application of its governance and assurance processes in its consideration and approval of the proposed modification.
47. Having considered the matters discussed above, I am satisfied that:
- NNB GenCo has completed its due process for the proposal; and
 - the ONR technical assessments support ONR giving agreement to the proposal.
48. I have prepared the Hinkley Point C Licence Instrument LI 517 in accordance with ONR guidance, which provides ONR's agreement to NNB GenCo implementing the design modification described in NNB GenCo's Licence Summary Statement document titled '*HVAC Plateau Redesign of DVL and DEL (RC1.2)*', HPC-NNBOSL-U0-000-LSS-100000 Revision 5.0 (Ref. 2).

7 RECOMMENDATIONS

49. I recommend that the Superintending Inspector:
- accepts this PAR to confirm support for the ONR technical and regulatory arguments that justify Hinkley Point C Licence Instrument LI 517;
 - approves this PAR for publication, after redaction where appropriate; and
 - signs Hinkley Point C Licence Instrument LI 517.

8 REFERENCES

1. NNB-209-RIO-001912 - LC20(1) Request for Acknowledgement or Agreement under LC20(1) Category 1 design change - 21 February 2018. CM 2018/70787
2. Licence Summary Statement - HPC-NNBOSL-U0-000-LSS-100000 Rev. 5.0, February 2018. CM 2018/70809
3. ONR HOW2 Guide - Purpose and Scope of Permissioning - NS-PER-GD-014 Rev 4. July 2014. <http://www.onr.org.uk/operational/assessment/index.htm>
4. EDF, Basis of Safety Case: DVL, HPC-CNENXX-AU- DVL-RES-200511, Revision B, June 2016, CM 2016/363201
5. EDF, Basis of Safety Case: DEL, HPC-CNENXX-AU- DEL-RES-200550, Revision B, June 2016, CM 2016/363205
6. ONR-NR-AR-17-038 Hinkley Point C (HPC) Pre-Construction Safety Report 3 (PCSR3), PCSR3 – Summary Assessment Report, Revision 0, February 2018, CM 2017/356172
7. ONR-NR-AR-18-029 Revision 0. Design and safety case cornerstone assessment report – Hinkley Point C Consent to commence unit 1 nuclear island concrete CM 2018/252545
8. ONR, Hinkley Point C Basis of Safety Cases: DVL and DEL, HPC50260N, January 2017, CM 2017/12084.
9. Nuclear Site Licence Compliance Matrix, NNB-209-MAT-000076, Version 6.0, June 2018. CM 2018/2604924.
10. NNB GenCo Company Procedure NNB-202-PRO-000033 Rev 4.0. Manage Design Modification. CM 2018/27420
11. RD Instruction: INS-UKEPR-313 UK EPR Management of Design Changes UKX-ECUKXX-XX-000-INS-000808 CM 2018/27305
12. NNB-202-TOR-00003 Version 2.0. Safety Design Change Committee Terms of Reference. November 2015 CM 2018/295612
13. NNB GenCo, Safety Design Change Committee: Minutes, HPC-HPC-NNBOSL-XX-000-MOM-100118, Version 3.0, May 2017, CM 2018/70804
14. NNB GenCo, Safety Design Change Committee: Minutes, HPC-HPC-NNBOSL-XX-000-MOM-100124, Version 3.0, June 2017, CM 2018/70805
15. NNB GenCo, Safety Design Change Committee: Minutes, HPC-HPC-NNBOSL-XX-000-MOM-100133, Version 2.0, September 2017, CM 2018/70806
16. NNB GenCo, Nuclear Safety Committee Minutes, NSC036, NNB-102-MOM-000625, Version 1.0, September 2017, CM 2017/372115
17. NNB GenCo, Safety Design Change Committee: Minutes, HPC-HPC-NNBOSL-XX-000-MOM-100138, Version 1.0, November 2017, CM 2018/70808
18. NNB GenCo, Nuclear Safety Committee Minutes, NSC037, NNB-102-MOM-000637, Version 1.0, December 2017, CM 2018/14133
19. NNB GenCo, ITA Review of HVAC Design - DVL & DEL BoSC, NNB-103-REP-000095, Version 3.0, February 2017, CM 2018/70813
20. NNB GenCo, HVAC Forward Work Programme, Revision 4.2, July 2018, CM 2018/289452
21. NNB GenCo, email to ONR, HVAC (DVL/LSS) LSS ITA Assessment Query, September 2018, CM 2018/285004

Table 1
Regulatory issues arising from ONR assessments

Issue number	Issue level	Target/ Milestone	Topic	Issue / actions
6708	4	June 2019	Fault studies	<p>Justification for NNB GenCo's strategy for isolation of the chemical and volume control system following loss of divisions 1&4 as a result of essential support system faults at HPC, requiring local to plant operator action</p> <p>NNB GenCo claims that the non-hazardous stable state and the safe shutdown state are achievable for faults resulting in the simultaneous loss of divisions 1&4 (or divisions 2&3), with no batteries (electrical switchboards entirely lost) in those divisions. This can potentially occur as the result of a loss of two non-diversified HVAC trains. If the initiating event impacts divisions 1&4, both chemical and volume control system charging pumps are stopped with the discharge line isolation valves becoming inoperable as they are electrically supplied by divisions 1&4. The current submission assumes that if the discharge line is open prior to the event, it will remain open and as such primary circuit inventory continues to be discharged to the CVCS via the open valve.</p> <p>This appears to be inconsistent with the claim regarding isolation of the primary circuit, following all design basis faults, made in the closure form for GDA assessment finding AF-UKEPR-CC-026.</p>
6722	4	June 2019	Mechanical engineering	<p>Analysis of HVAC performance</p> <p>There is a risk due to the methodology and underlying assumptions used to demonstrate the performance of the HVAC system that it may not be representative of the as built rooms.</p>
6724	4	June 2019	Mechanical engineering	<p>Diversity of safety chilled water system pumps</p> <p>The current procurement strategy for the safety chilled water system pumps does not meet the safety case diversity requirements.</p>
6726	4	June 2019	Mechanical engineering	<p>Design of the false floor in C&I rooms and analysis of impact on HVAC system performance</p> <p>The design of the false floor in the safeguard building C&I rooms was not complete at the time of the HVAC performance analysis. It was noted that the final design of the false floor may have a significant impact on the performance of the HVAC system and this needs to be addressed prior to the installation of the false floor.</p>