Office for Nuclear Regulation

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Modification to the Hinkley Point C UK EPR Design

ONR Agreement to Category 1 modification: Modification of the diverse openings on the fuel path, the Fuel Transfer Tube and associated civil works

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EXECUTIVE SUMMARY

Title

ONR Agreement to Category 1 modification: Modification of the diverse openings on the fuel path, the fuel transfer tube and associated civil works.

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/ acknowledgment of implementation of the modification as described in the Licence Summary Statement titled *'Modification of the Diverse Openings on the Fuel Path, the Fuel Transfer Tube and Associated Civil Works to cope with the Design Basis Analysis (DBA) of a Gross Failure'*, numbered HPC-NNBOSL-AU-HRA-LSS-10005, Version 3.0, dated 11 January 2018.

Background

During ONR's Generic Design Assessment (GDA) Step 4 assessment of the UK EPR, it was recognised that the safety case in support of the Spent Fuel Pool (SFP) and associated fuel handling areas/compartments needed further development. GDA Issue UKEPR-FS-03 was raised requiring the GDA requesting parties [Électricité de France (EdF) and AREVA] to provide a comprehensive safety case to cover the potential failure of the penetrations/openings in the SFP and connected compartments, which was previously excluded from the safety analysis.

The resulting safety submission proposed a number of modifications to the design of the UK EPR to improve the performance of different compartments in flooded conditions, thus reducing the initiating events leading to challenging consequences. Design modifications to the fuel transfer tube and various openings on the fuel transfer path, along with associated changes to the civil structures have now been proposed by NNB GenCo under LC 20(1) and these are considered in this PAR.

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

The following were sampled during ONR's assessments:

- fault studies aspects of the claim that a safe shutdown state will be achieved following gross failure of the FTT during refuelling;
- adequacy of the design changes in relation to prevention of internal flooding hazards;
- mechanical engineering aspects of the secondary barriers / doors;
- structural integrity aspects relevant to the FTT;
- civil engineering aspects, including impacts on the nuclear island structure;
- demonstration that the level of risk will be reduced As Low As Reasonably Practicable (ALARP) in relation to the personnel access arrangements to the cavities and technical openings; and
- adequacy of the licensee's forward work plan.

Conclusions

Based on the evidence sampled, I am satisfied with NNB GenCo's case for the acceptance of this design change. ONR has identified one Level 4 Regulatory Issue for follow-up, but this does not prevent ONR giving its agreement under LC 20(1) for this design modification to go ahead (ONR ranks Regulatory Issues as Level 1 to Level 4, with Level 4 being the lowest level of importance).

Recommendation

I recommend that ONR issue licence instrument LI514 giving its Agreement under LC 20(1) to NNB GenCo's proposed modification to the design of Hinkley Point C that is currently under construction.

LIST OF ABBREVIATIONS

AR	Assessment Report
ALARP	As Low As Reasonably Practicable
CMF	Change Management Form
DDM	Décision du modification
EDF	Électricité de France
EMIT	Examination, Inspection, Maintenance and Testing
EPR	European Pressurised Water Reactor
EVR	Containment Cooling Ventilation System
FDM	Fiche de modification
FICA	Future Intelligent Customer Activities
FTT	Fuel Transfer Tube
GDA	Generic Design Assessment
HOW2	(ONR) Business Management System
HPC	Hinkley Point C
HVAC	Heating, Ventilation, Air Conditioning
ITA	Independent Technical Assessment
LC	Licence Condition
LSS	Licence Summary Statement
NIC	Nuclear Island Concrete
NNB GenCo	NNB Generation Company (HPC) Ltd
NSC	Nuclear Safety Committee
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
PCSR	Pre-Construction Safety Report
PSA	Probabilistic Safety Analysis
RC	Reference Configuration
RD	Responsible Designer
RGP	Relevant Good Practice
SDCC	Safety Design Change Committee
SFP	Spent Fuel Pool
SSC	Structure, System and Component
TSC	Technical Support Contractor

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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 document titled *'Modification of the Diverse Openings on the Fuel Path, the Fuel Transfer Tube and Associated Civil Works to cope with the Design Basis Analysis (DBA) of a Gross Failure'*, numbered HPC-NNBOSL-AU-HRA-LSS-100005, Version 3.0, dated 11 January 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 Fuel transfer compartment and fuel transfer tube

3. The Fuel Transfer Tube (FTT) links the Reactor Building Transfer Compartment and the Fuel Building Transfer Compartment. It is dry when the reactor is operational and is flooded during refuelling operations in order to allow the transfer of fuel assemblies from the Reactor Cavity to the Spent Fuel Pool (SFP) and vice-versa. The FTT is maintained in a dry state during reactor operations by a manual valve on the Fuel Building side and a blind flange on the Reactor Building side. The blind flange is removed and the valve opened prior to fuel transfer operations. The FTT passes through the Reactor Building containment envelope, through the annulus and through the Fuel Building containment envelope. At each end of the FTT is a transfer machine that allows a fuel assembly to be placed in a container and rotated through 90° to allow the container to be pulled, or pushed, through the FTT (Fig. 1).

4. The reactor cavity incorporates a number of 'technical openings' to provide penetrations to facilitate the support systems such as Heating, Ventilation, Air Conditioning (HVAC) and electrical systems. These are primarily to provide the support systems during normal operation and outages.

5. Failure of any of the primary barriers in the reactor or fuel building cavities or compartments (watertight access doors or technical opening hatches within these flooded compartments, FTT or associated civil structures), in the absence of any secondary barrier, could lead to uncovering of the fuel, consequential overheating, fuel damage and release of radioactivity and/or consequential effects of flooding and failure of Structures, Systems and Components (SSCs).

2.2 Reason for modification

6. During the Generic Design Assessment (GDA) Step 4 assessment, it was recognised that the safety case in support of the SFP and associated fuel handling areas/compartments needed further development. ONR requested a comprehensive safety case to cover the potential failure of the penetrations/openings in the SFP and connected compartments, which was previously excluded from the safety analysis of the UK EPR™. ONR considered that an analysis should be carried out to review the consequences of a major failure of these penetrations and openings, which could lead to overheating of fuel assemblies and flooding that had not been included as design basis events. GDA Issue UKEPR-FS-03 (Ref. 4) was raised requiring Électricité de France (EdF) and AREVA to provide such a case.

7. The main deliverables provided in response to this GDA Issue (Ref. 5) included a suite of reports, which presented a deterministic analysis of failures of penetrations in the walls of pools that could potentially result in dewatering of fuel assemblies leading to

fuel overheating. The safety submission considered the internal flooding consequences of the postulated leakages from the pools, and the radiological consequences for operators involved in plant recovery and repair, and identified additional procedures that may be required in moving the stranded fuel assembly into a safe location prior to taking recovery action. The safety submission also reviewed the operations performed within the spent fuel pool area and examined a number of options to evaluate the relevant safety benefits and mitigations to reduce the overall risk to the plant in fault conditions.

8. As a result, the GDA requesting parties proposed a number of modifications to the design of the UK EPR to improve the performance of different compartments in flooded conditions, thus reducing the initiating events leading to challenging consequences. These changes became part of the reference design for the UK EPR. The relevant changes to the reference design were recorded by the requesting parties on Change Management Forms CMF-72 and CMF-73 (see Fig. 2):

   - CMF-72 Modification to provide leak tight containment of the FTT;
   - CMF-73 Modification to remove personnel access doors to the Reactor Cavity & Fuel Transfer Compartments.

9. CMF-72 considers the changes to the FTT and the surrounding civil structure for which it is claimed the consequences of a gross failure of a FTT have been mitigated.

10. The original focus of CMF-73 concerned the removal of the personnel access doors and identification of alternative access solutions to the Reactor Cavity and Transfer Compartments. Through NNB GenCo's initial optioneering studies it was questioned how safe access and egress would be provided when the doors were removed. It was recognised by NNB GenCo that a study of the access solutions would be needed to include identification of the preferred solution, evaluating nuclear safety, industrial safety, licensing and schedule risks.

11. At the end of the optioneering studies, NNB GenCo decided that personnel access doors within the Reactor Building provided the balance between Nuclear and Conventional Health Safety and was the preferred solution. Accordingly, this modification focuses on modifications needed to mitigate the consequences of the failure of the personnel access doors. In contrast, NNB GenCo decided that the personnel access doors within the Fuel Building transfer compartment would be removed as originally intended and an alternative access arrangement would be implemented.

12. The remainder of modification CMF-73 focuses on the modifications to be implemented to mitigate the consequences of failure from the technical openings (e.g. HVAC penetrations and plug boards).

2.3 Proposed modifications

13. The details of the subsequent design modifications described in the Licence Summary Statement (LSS – see Ref. 2) are:

   - Reactor cavity access will introduce a secondary barrier, with access through two water tight doors providing two barriers to leakage with leak detection within the interspace.
   - Access to the cavities in the fuel building and fuel building transfer compartment is to be changed to use of a self-elevating platform which is shared with the cask loading pit with transfer facilitated by the fuel building auxiliary crane.
   - Access to the reactor building transfer compartment is to be via two water tight access doors.

- For the reactor cavity technical openings (for example, the containment cooling ventilation system (EVR) outlet hatch) secondary barriers are to be installed to prevent leakage from the EVR inlet openings in the reactor cavity.
- Introduction of valves to leak detection pipes: Each interspace between the reactor cavity technical opening hatches and the EVR duct / steam generator overflow are fitted with a leak detection pipe. This could potentially flood the leak detection room via these pipes; therefore, valves have been introduced before the detection cabinet, which will remain closed and only opened to check if a leakage is occurring.
- In order to remove the clash between the technical openings and reactor cavity missile slab, the sizes of these openings have been reduced to occupy a lower space beneath the reactor cavity missile slabs.
- Due to the introduction of access to the reactor building transfer compartment via a water tight door, and to remove a possible clash between the door and FTT, the door acting as a secondary barrier to the FTT has been relocated and now provides a secondary barrier to the FTT and the door used for access to the reactor building fuel transfer compartment.
- Designation of water resistant rooms within the existing building layout, which includes the introduction of water tight seals to spaces between independent civil structures surrounding the FTT to prevent the loss of large quantities of water.

14. The purpose of the modifications is essentially to provide a second barrier to leakage from gross failure of the primary barriers during refuelling when the reactor cavity access and fuel transfer compartments are flooded with water.

15. The safety case is based on the principle of the introduction of a water resistant secondary barrier to the low-level pond penetrations. This ensures that even in the event of a gross failure of the primary barrier, water will be contained to mitigate any flooding and prevent the pond water falling to an unacceptable level.

16. For the high-level pond penetrations, which can only cause drainage to a level of 16.7 m and will not cause uncovery of a fuel assembly being handled (maximum height 16.2 m), the provision of water resistant secondary barriers is the preferred solution to prevent drainage and hence prevent internal flooding and a reduction in shielding.

17. The modification has been designated by NNB GenCo as nuclear safety Category 1. This means that NNB GenCo has judged that it is a modification that affects nuclear safety which results in a significant alteration to a fundamental safety principle or basic safety requirement, or that could result in a serious increase in risk of a radioactive hazard if inadequately conceived or implemented.

18. The LSS has been prepared in line with NNB GenCo's Licence Condition (LC) 20 arrangements (see Section 3.3 below); its purpose is to provide confidence that the design change is sufficiently mature to be included within the reference configuration. The LSS acknowledges, however, that the full justification for these modifications was not available at the time of the LSS preparation. In light of this aspect, a number of future intelligent customer activities (FICA) are defined, which identify points that require resolution to fully substantiate the modifications.

3 ASSESSMENT CARRIED OUT BY ONR IN CONSIDERATION OF THE REQUEST

3.1 Scope

19. 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). Thus ONR's assessment of this design modification is set against its current understanding

of the state of evolution of the safety case, and the extant Reference Configuration (RC1.2) design.

20. 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 RC1.2 design 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

21. ONR's ONR fault studies (Ref. 8), internal hazards (Ref. 9), structural integrity (Ref. 10), mechanical engineering (Ref. 11) and civil engineering (Ref.12) inspectors have carried out an assessment of the safety justification for the proposed modifications.

22. These assessments focused on the technical and safety justification for the modification, a comparison with RGP and consideration of ALARP, and have also considered NNB GenCo's commitments in relation to implementation of the modification.

23. The following were sampled during ONR's assessments:

- fault studies aspects of the claim that a safe shutdown state will be achieved following gross failure of the FTT during refuelling;
- adequacy of the design changes in relation to prevention of internal flooding hazards;
- mechanical engineering aspects of the secondary barriers / doors;
- structural integrity aspects relevant to the FTT;
- civil engineering aspects, including impacts on the nuclear island structure;
- demonstration that the level of risk will be reduced ALARP in relation to the personnel access arrangements to the cavities and technical openings; and
- adequacy of the licensee's forward work plan.

24. For convenience in reporting, summaries of each of the ONR technical assessments for this LC20 modification have been included in the ONR Design & Safety Case cornerstone report (Ref. 13) which informs 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 primarily drawn from the relevant sections of that cornerstone report.

3.2.1 Fault studies assessment

25. The ONR fault studies inspector (Ref. 8) considered the structure and content of the safety case, the bounding case analysed, and the protection and mitigation in place. Although the inspector considered that the LSS presented a set of reasonable design improvements, aiming to provide the safety of the fuel assemblies contained in the reactor pool and in the spent storage pool, it did not provide sufficient detail regarding a fuel assembling entering, inside or leaving the FTT at the time of failure of the FTT. Although the inspector considered that the LSS could have been improved in this and other areas, subsequent engagement with NNB GenCo provided the inspector with assurance that such shortfalls will be satisfactorily addressed in the future HPC safety case.

3.2.2 Internal hazards assessment

26. The ONR internal hazards inspector (Ref. 9) focused on flooding resulting from failure of the FTT and cavity access arrangements. The inspector did not raise any significant concerns, but noted that further evidence will be required to support the claims being made. This particularly related to operational procedures, which have not yet been fully developed; and the assertion that a small leakage from the cavity access barriers would have no safety consequence, will need to be verified by the planned hazard verification and validation studies. Overall, the inspector considered that, once the claims are substantiated, from an internal hazards perspective the modification will meet the requirements of the ALARP principle.

3.2.3 Mechanical engineering assessment

27. The ONR mechanical engineering inspector (Ref. 11) focused on operability of the secondary barriers, the proposed solutions and qualification of secondary barriers and doors, independence between the primary and secondary barriers, and measures to install leak detection between primary and secondary barriers. Overall, the inspector was satisfied with the claims, arguments and evidence laid down within the LSS, and that subject to its successful implementation, the contribution to overall plant risk of the proposed modification will reduce the level of risk ALARP.

28. In particular, the inspector reviewed the various ‘commitments’ to further work listed in the LSS and was satisfied that:

- they capture the key activities that need to completed during the detailed implementation of the modification;
- completion post NIC is unlikely to result in the foreclosure of potential options; and
- they can be completed in a timely manner.

29. The ONR mechanical engineering inspector noted that the commitments will be followed up by ONR as part of routine regulatory business as appropriate.

3.2.4 Civil engineering assessment

30. The ONR civil engineering inspector (Ref. 12) considered the effects of the civil engineering changes on the nuclear island structure as well as the interface with the civil engineering design, in particular regarding: access to the reactor cavity and reactor building transfer compartment using two doors; access to the fuel building transfer compartment; elimination of the trap door clash with the reactor cavity missile slabs at 16.7 m; and the introduction of water resistant rooms including watertight seals between independent civil structures.

31. The inspector considered the modification and claims, arguments and evidence presented are adequate for the current maturity of the design. However, the inspector noted that further work is required to fully substantiate the design in certain areas where the performance of the modification will depend heavily on the design, detailing and installation. The inspector raised a Level 4 Regulatory Issue (No. 6699; see Table 1): ONR ranks Regulatory Issues as Level 1 to Level 4, with Level 4 being the lowest level of importance. Regulatory Issue 6699 captures three areas where further regulatory interaction is required as the design progresses, and which NNB GenCo has captured as a future area of work:

- The structure-to-structure seal arrangement is considered novel due to the large width and challenging nature of engineering requirements placed upon them. Further justification is therefore required to support this proposal as the preferred solution;

- The inspection and testing regime to provide assurance that these rooms are water resistant to specified requirements, both after construction and through life, requires further justification;
- The design for water-tightness of the water resistant rooms requires clarification, taking into consideration that the ETC-C design code contains limited concrete water-tightness provisions.

3.2.5 Structural integrity assessment

32. The ONR structural integrity inspector (Ref. 10) considered the proposed revised design of the FTT, which removes the longitudinal seam weld and minimises orbital welds, represents a reduction in the risk from gross failure. Furthermore, this coupled with a design where consequences of failure are tolerable was considered to meet ONR's expectations. Given this increase in integrity of the FTT, the inspector was content for the modification to be incorporated into the reference design configuration.

3.2.6 Consideration of ALARP arguments

33. The ONR structural integrity inspector (Ref. 10) considered, in consultation with the ONR civil engineering Professional Lead, the ONR fault studies Professional Lead and the ONR conventional health and safety inspector, the overall ALARP position for the technical openings and access to the reactor and fuel building cavities. Specifically, the inspector examined NNB GenCo's consideration of whether reasonably practicable steps to reduce the risk of fuel damage during fuel movement have been taken.

34. The inspector was content that there is a need for the proposed access solution to facilitate normal operation and outage work, and that this represents an acceptable balance between nuclear and conventional health and safety risks. The inspector considered through the inclusion of a secondary barrier, with a high seismic requirement and leak detection in the interspace between the barriers, that, subject to its successful implementation, NNB GenCo has taken reasonably practicable steps to reduce the risk of fuel damage during fuel movement within the reactor building as a result of failure of technical openings or access doors.

35. Regarding access into the fuel transfer compartment in the fuel building, the elimination of the door access to the fuel building transfer compartment and provision of a self-elevating platform, the inspector was content that NNB GenCo has taken reasonably practicable steps to reduce the risk of fuel damage during fuel movement.

3.2.7 Future licensee activities regarding the modification

36. The purpose of the LSS is to provide confidence that the design is sufficiently mature such that it can be included within the reference configuration. The LSS acknowledges that the full justification for these modifications was not available at the time of submission and, consequently the licensee has defined a number of FICA, which identify any points that require resolution to fully substantiate the modifications.

37. All inspectors that assessed the proposed modification were content with the future activities identified by NNB GenCo, which will form a key source of evidence in any future safety case.

38. As capturing and managing FICAs forms an important part of the LSS it was considered proportionate to conduct an intervention on this aspect of the LC 20 arrangements (Ref. 14). The ONR structural integrity inspector in collaboration with an ONR organisational capability inspector conducted an intervention to review NNB GenCo's arrangements to capture, manage and deliver FICAs. Through this intervention the inspectors were content that, while this process uses a system not intended for this purpose, the process appeared robust. The inspectors also observed

evidence of its use and while they noted some areas where the process could be strengthened, the general intent and use was adequate.

3.2.8 Conclusion on ONR assessments

39. As noted in the Design & Safety Case cornerstone report for NIC (Ref.13), 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 proposed modification to the HPC UK EPR described in the LSS.

3.3 NNB GenCo internal assurance and governance

40. 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. 15). The arrangements involve activities within both the Responsible Designer (RD) and NNB GenCo.

41. 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. 16 and 17). 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) team assesses all Category 1 modifications. NNB GenCo's modification control process requires that an LSS is produced for all proposed Category 1 and 2 design modifications.

42. 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. 18), 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.

3.3.1 Safety Design Change Committee

43. The LSS for the proposed modification has been presented to three meetings of the SDCC. NNB GenCo's request letter (Ref. 1) was accompanied by the minutes of SDCC meetings held on 21 June 2017, 06 September 2017 and 18 October 2017 (Refs. 19, 20, 21).

44. The minutes record the discussions at the three meetings and the Acceptance Statements agreed at each of these are:

- 21 June: *LSS not accepted given concerns over ALARP and closure of verification comments. The LSS needs to develop why the preferred solution is selected. LSS not ready for NSC consideration*;
- 6 September: *LSS not accepted as comments from ITA and SDCC need to be taken into consideration. It is noted that the ALARP is improved and that SDCC agree with the category of the LSS. Once ITA comments are addressed the SDCC do not require a full representation, only confirmation that all comments have been addressed*;
- 18 October: *LSS … accepted as nuclear safety category 1 and ready for NSC once ITA have confirmed closure of all comments.*

45. Having reviewed the minutes of the SDCC I am satisfied that the proposed modification was subject to a thorough consideration of the proposal, as required by

the licensee's LC20 arrangements, and that the SDCC's final acceptance statement was justified by those considerations.

3.3.2 Nuclear Safety Committee

46. A draft version of the LSS (Revision 1.7) was submitted to the September 2017 NSC for "early advice and influence" (Ref. 22). Specifically, the NSC was asked to advise on:

- "*the acceptability of the proposed modifications to the Reactor and Fuel buildings, and the ALARP position, particularly in regards to the judgment made on the balance of risks between Nuclear and Conventional safety;*
- *the adequacy of the safety justification supporting the modifications; and*
- *the adequacy of the future work programme and NNB surveillance during the detailed design phase, in particular the split between conditions of acceptance and additional activities*".

47. The minutes of the meeting indicate a detailed and informed discussion took place, with the committee concluding that the proposed modifications "appeared to be an acceptable way forward", but with a number of recommended improvements to the draft LSS.

48. A revised version of the LSS (Revision 2.1) was submitted to the October 2017 NSC for consideration and advice, with the committee being asked to give advice in relation to the same three points as at the September meeting. NNB GenCo's presentation to the NSC indicated that the points raised by the committee in the previous meeting had been addressed in the revised version of the LSS. At the same meeting the ITA manager confirmed that the ITA's assessment of the LSS had been completed and that it had been accepted without conditions. Following discussion, the committee concluded, with suggestions for some improvements in clarity in the LSS, that it supported the proposed modification (Ref. 23).

3.3.3 Independent Technical Assessment

49. The Independent Technical Assessment (ITA) report from NNB GenCo's assurance function (Ref. 24) provides a thorough and frank narrative on the process of bringing the LSS to a fit state to support the modification. ITA accepted the final version of the LSS without conditions.

3.3.4 Conclusions on NNB GenCo internal assurance & governance

50. I am satisfied that the proposed modification has been subject to NNB GenCo's rigorous due process, including a number of reviews by the SDCC and the NSC, and engagement and sign-off by the NNB GenCo ITA function.

4 MATTERS ARISING FROM ONR'S WORK

51. Arising from ONR's assessment of the proposed design modification, the ONR civil engineering inspector raised one Level 4 Regulatory Issue which is set out in Table 1. This issue did not prevent the civil engineering inspector from supporting ONR giving Agreement to the proposed modification.

5 CONCLUSIONS

52. This report 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 3.3 above examines the adequacy of NNB GenCo's application of its governance and assurance processes in its consideration and approval of the proposed modification.

53. Having considered the matters discussed above, I am satisfied that:

- NNB GenCo has completed its due process for the proposal.
- The technical assessments support ONR giving agreement to the proposal.

54. I have prepared the Hinkley Point C Licence Instrument LI514 in accordance with published ONR guidance, which gives ONR's agreement to NNB GenCo implementing the proposed modification described in NNB GenCo's Licence Summary Statement HPC-NNBOSL-AU-HRA-LSS-10005, Version 3 (Ref. 2).

6 RECOMMENDATIONS

55. I recommend that the Head of ONR's EPR sub-Division:

- accepts this Project Assessment Report to confirm support for the ONR technical and regulatory arguments that justify Hinkley Point C Licence Instrument LI514;
- approves this Project Assessment Report for publication, after redaction where appropriate; and
- signs Hinkley Point C Licence Instrument LI514.

7 REFERENCES

1. NNB-209-RIO-001913 - Licence Condition 20(1): Request for Acknowledgement or Agreement under LC20(1) - Category 1 design change – 19 March 2018. TRIM 2018/99208
2. Licence Summary Statement - HPC-NNBOSL-AU-HRA-LSS-100005, Version 3.0, 11 January 2018. TRIM 2018/99239
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. GDA Issue GI-UKEPR-FS-03 Revision 2. Spent Fuel Pool Safety Case. ONR, July 2011. TRIM 2011/361954
5. ONR-GDA-AR-12-012 GDA Close-out for the EDF and Areva UK EPR™ Reactor GDA Issue GI-UKEPR-FS-03 TRIM 2013/115947
6. ONR-NR-AR-17-038 Hinkley Point C (HPC) Pre-Construction Safety Report 3 (PCSR3), PCSR3 – Summary Assessment Report, Revision 0, February 2018, TRIM 2017/356172
7. ONR, Design and Safety Case Cornerstone Assessment Report – Hinkley Point C Pumping Station, ONR-NR-AR-17-051, Revision 0, June 2018, TRIM 2017/465156
8. ONR, NNB Generation Company (HPC) Ltd – Commencement of Unit 1 Nuclear Island Concrete and Modification to the Hinkley Point C Design, Fault Studies and Severe Accident Analysis Assessment, ONR-NR-AR-17-054, Revision 0, October 2018, TRIM 2018/239556
9. ONR, NNB Generation Company (HPC) Limited – Commencement of Unit 1 Nuclear Island Concrete and Modification to the Hinkley Point C Design, Internal Hazards Assessment, ONR-NR-AR-18-006, Revision 0, October 2018, TRIM 2018/122425
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17. Responsible Designer Instruction: INS-UKEPR-313 UK EPR Management of Design Changes UKX-ECUKXX-XX-000-INS-000808 TRIM 2018/27305

18. NNB-202-TOR-000003 Version 2.0. Safety Design Change Committee Terms of Reference. November 2015 TRIM 2018/295612

19. HPC-HPC-NNBOSL-XX-000-MOM-100124 Minutes of the 21st June 2017 Safety Design Change Committee TRIM 2018/70805

20. HPC-HPC-NNBOSL-XX-000-MOM-100133 Minutes of the 6th September 2017 Safety Design Change Committee TRIM 2018/70806

21. HPC-HPC-NNBOSL-XX-000-MOM-100137 Minutes of the 18th October 2017 Safety Design Change Committee TRIM 2018/99235

22. NNB-102-MOM-000625 Nuclear Safety Committee Minutes September 20th 2017. TRIM 2017/372115

23. NNB-102-MOM-000637 Nuclear Safety Committee Minutes December 7th 2017. TRIM 2018/14133

24. NNB-103-REP-000260 Independent Technical Assessment of LSS on FTT/Cavity Openings. March 2018 TRIM 2018/100396

Figure 1: **Cross Section of Reactor Cavity and Fuel Building Pools during fuel operations**

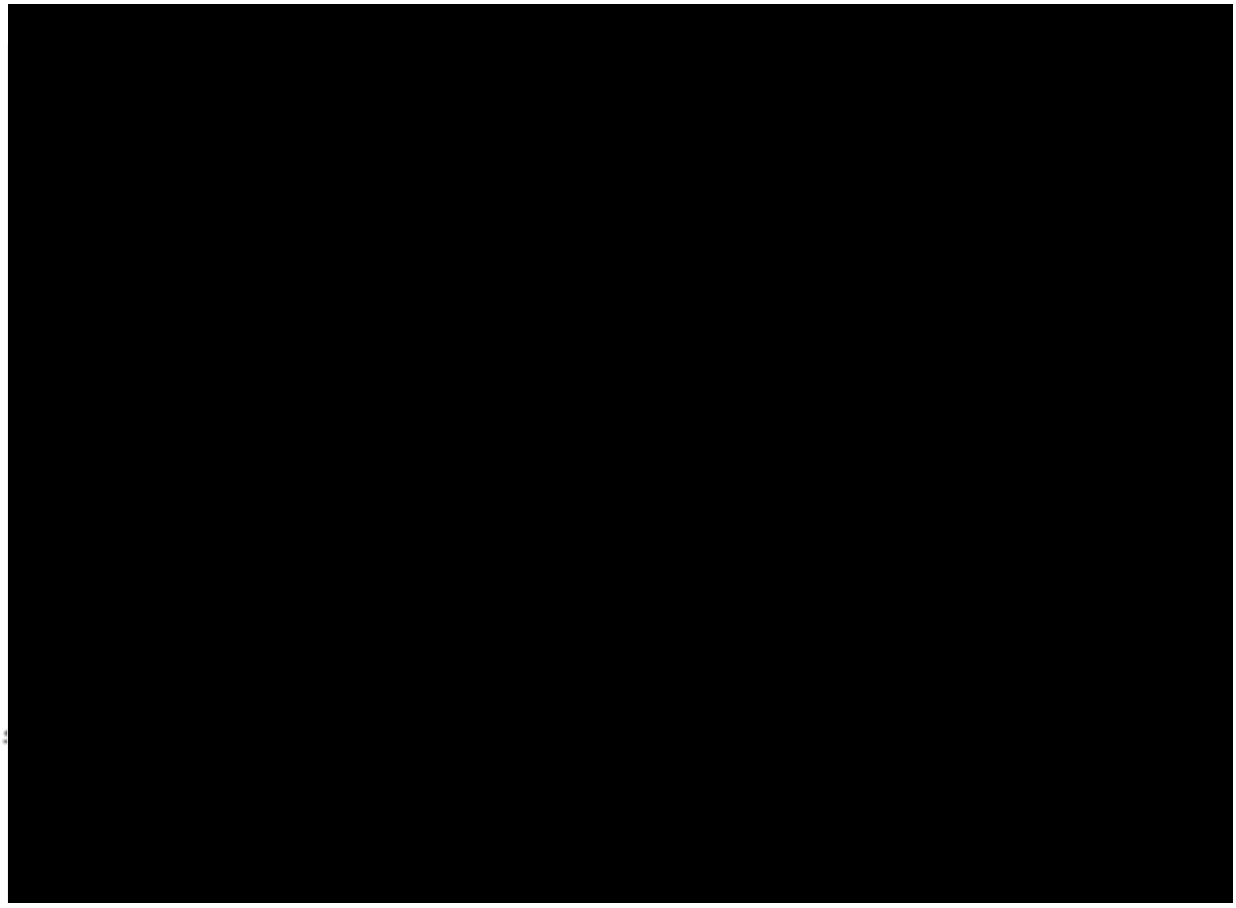

Figure 2. Cross Section of Reactor Cavity and Fuel Building Pools showing areas of modification

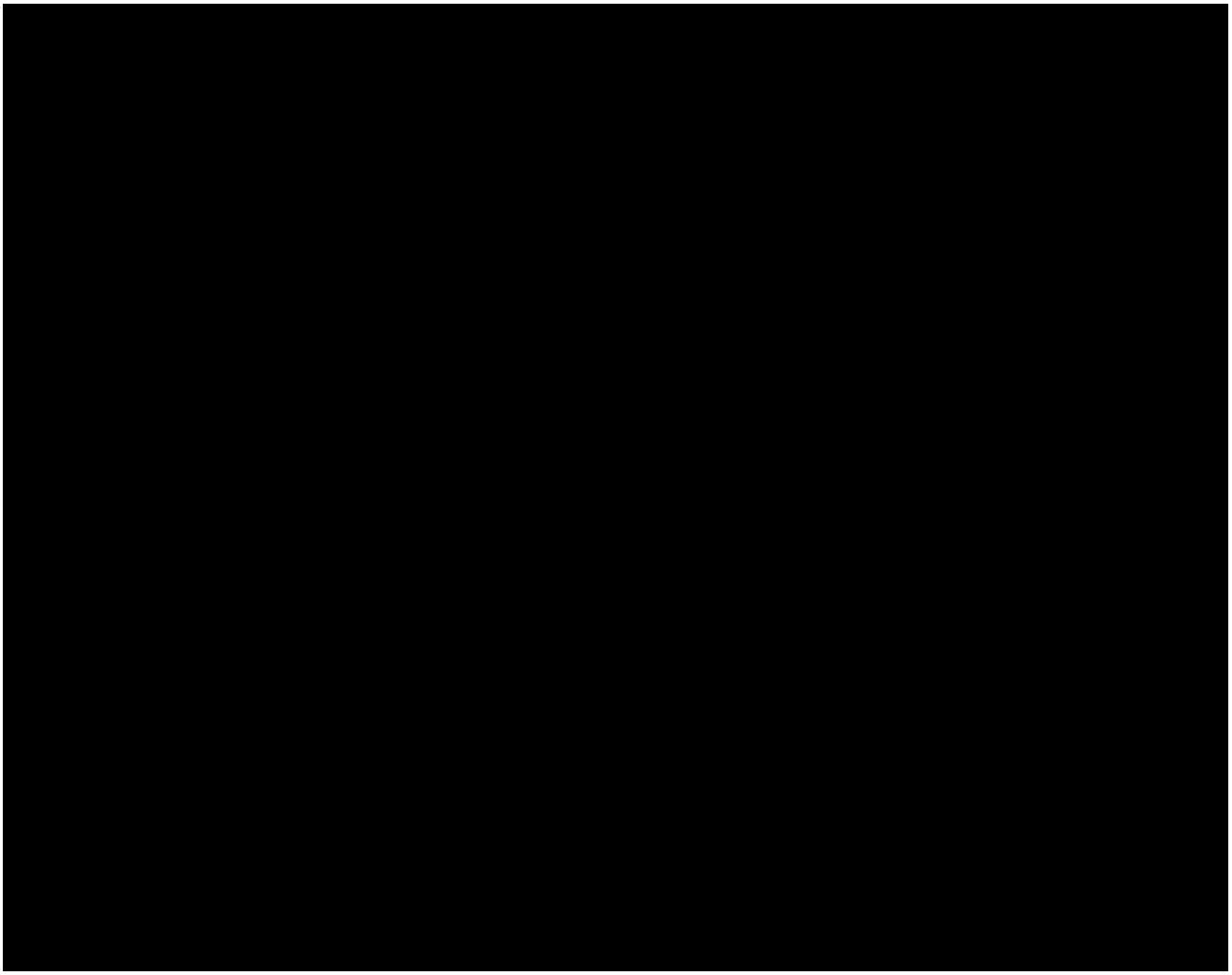

Table 1
Level 4 Regulatory Issue

Issue number	Issue level	Milestone	Topic	Issue / actions
6699	4	Target Closure March 2019	Civil engineering	**Issue**: During a civil engineering assessment (see assessment report ONR-NR-AR-18-018 Revision 0) of a LC20 modification to introduce secondary water resistant barriers to openings in the interconnected reactor cavity and spent fuel pool (including fuel transfer tube (FTT)), shortfalls were identified in the proposals put forward as follows: 1. The licensee proposes to use caulking joints for seismic gaps ranging from 50-150mm. This calking is to supply the safety functional requirement 'The integrity of the surrounding rooms is robust' and is to retain water with 13m of hydraulic head. Caulking of this width and required reliability is novel, and therefore further justification is required to assure through life functionality. 2. The licensee proposes that the rooms surrounding the FTT are to be 'water resistant'. The design is stated to use ETC-C which has limited water tightness provisions for concrete without liners and therefore further clarity on the design of these rooms is required. Additionally, the inspection and testing regime to assure that these rooms are water resistant to a specified requirement, both after construction and through life, requires further justification. **Actions**: 1. NNB GenCo should provide further justification on the use of a wide (50-150mm) caulking for structure to structure sealing, specifically on the points below: · If construction tolerances are considered, the largest seal may exceed the 150mm tested seal and would therefore be outside the tested capacity. · Consideration as to whether the laboratory tested seal can be constructed to the same standard on site, including site tests to verify this.

				· Consideration of the long term effects of the local climate – local temperatures and radiation exposure · The extent of EMIT inspections and the testing required to assure leak tightness are yet to be confirmed. · The limited practicality of inspection and replacement of any degraded caulking products if defects are found following inspection and testing to deliver full life reliability - Closure date March 2019 2. NNB GenCo should justify how the water tight rooms will be defined for water resistance given ETC-C has limited provisions for leak tightness of concrete without liners - Closure date March 2019 3. NNB GenCo should provide an outline of construction and through life inspection and testing to confirm the rooms are water resistant to support the safety functional requirement - Closure date March 2019