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Civil Nuclear Reactor Programme

New Civil Reactor Build

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EXECUTIVE SUMMARY

Background

- 1 This report presents the findings of the Office for Nuclear Regulation's (ONR) Licence Condition (LC) 21 'Commissioning' workstream intervention in support of Nuclear New Build Generation Company's (NNB GenCo) application for a Nuclear Site Licence (NSL) to install and operate two European Pressurised Water Reactors (EPR) units at Hinkley Point C (HPC).
- 2 The report will inform the HPC Site Inspector's overall assessment of the adequacy of NNB GenCo's LC compliance arrangements.

Assessment and Inspection Work Carried Out By ONR

- 3 The intervention has sought to confirm that NNB GenCo has identified adequate principles of compliance for LC21 that can be developed post granting of the licence and that general preparatory activities in support of commissioning are satisfactory. It has not been possible to perform a compliance inspection for LC21 since the arrangements have not yet been prepared as they are not required until the commencement of inactive commissioning.
- 4 The intervention focussed on the following areas and included a number of level 4 progress meetings with the NNB GenCo Start-up Manager:
 - LC compliance matrix;
 - Hold Points;
 - Resources;
 - Commissioning Guide;
 - Interactions with the Architect Engineer;
 - Operating Experience;
 - Support to the procurement process;
 - Development of the Site Specific HPC Pre-Construction Safety Report

Matters Arising from ONR's Work

- 5 There have been no issues raised that require resolution prior to the ONR decision on granting of a NSL at HPC.

Key Findings

- 6 Compliance arrangements for LC21 do not need to be fully developed at the time of granting the NSL as they are not required until the commencement of active commissioning. I consider that the HPC Compliance Matrix entries for LC21 are adequate for the purpose of granting the licence identifying where existing arrangements are applicable and where detailed commissioning arrangements will be necessary.
- 7 I have reviewed the draft list of Hold Points with respect to LC21 and am content that it is adequate for the purpose of granting a licence for HPC noting that there will be an opportunity to revisit it post licensing as the project matures.

- 8 I consider that adequate commissioning support is being provided to the early procurement activities despite the Start-up Manager also temporarily acting as the Independent Assessment, Challenge and Oversight Manager. It is understood that the additional responsibilities will be relinquished by the end of October 2012; I will follow this up during the permissioning intervention.
- 9 I consider that good progress is being made in the development of the Pre-Operations resourcing strategy with evidence that international good practice is being adopted in planning for operations staff to play a significant role in commissioning activities thereby gaining familiarity with the plant.
- 10 The Start-up Manager has in recent months visited both the Flamanville 3 and the Hongyanhe, China new build sites, the latter as part of an IAEA Pre-Operational Safety Review Team visit during hot functional testing. This is something that I fully support as it provides an opportunity to learn from diverse experiences.
- 11 I consider that the Commissioning Guide provides a useful means for capturing the project's intentions with respect to commissioning activities and for identifying those enablers that need to be put in place early in the project. The Guide reflects good practices from the International Atomic Energy Agency's safety standards.
- 12 The forward work plan includes the transfer of control of the Commissioning Schedule to NNB GenCo; I consider that this demonstrates that NNB GenCo are striving to be the controlling mind for the project as expected in its role as an Intelligent Customer.

Conclusions

- 13 To conclude, I am satisfied that the LC21 section of the NNB GenCo compliance matrix and the draft HPC Hold Points list are adequate for the purpose of granting the HPC NSL and that good progress is being made in terms of preparatory activities for commissioning.
- 14 On the basis of the intervention I am content for ONR to grant NNB GenCo a NSL for HPC.

Recommendation

- 15 I recommend from the perspective of the LC21 workstream that ONR should grant NNB GenCo a NSL for HPC.

LIST OF ABBREVIATIONS

AE	Architect Engineer
AWE	Atomic Weapons Establishment
BMS	(ONR) How2 Business Management System
CNEN	Comissão Nacional de Energia Nuclear
CNEPE	Centre National d'Equipement de Production d'Electricité
CWP	Commissioning Working Party
DIN	Division Ingenierie Nuclear (Nuclear Engineering Division)
EDF	Electricite de France
EPR	European Pressurised Water Reactor
FA3	Flamanville 3
HP	Hold Point
HPC	Hinkley Point C
HSE	Health and Safety Executive
IACO	Independent Assessment, Challenge and Oversight
IAEA	International Atomic Energy Agency
IC	Intelligent Customer
IPR	Intervention Project Record
ITT	Invitation to Tender
LC	Licence Condition
NNB GenCo	Nuclear New Build Generation Company
NSL	Nuclear Site Licence
ONR	Office for Nuclear Regulation (an agency of HSE)
OPEX	Operating Experience
OSART	Operational Safety Review Team
PCSR	Pre-construction Safety Report
SAP	Safety Assessment Principle(s) (HSE)
SS	Site Specific
SZC	Sizewell C
TAG	Technical Assessment Guide(s) (ONR)
TIG	Technical Inspection Guide(s) (ONR)

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1 INTRODUCTION

1.1 Background

16 This report presents the findings of the Office for Nuclear Regulation's (ONR) Licence Condition (LC) 21 'Commissioning' workstream intervention in support of Nuclear New Build Generation Company's (NNB GenCo) application for a Nuclear Site Licence (NSL) to install and operate two European Pressurised Water Reactors (EPR) units at Hinkley Point C (HPC). The intervention was undertaken in accordance with the requirements of the ONR's How2 Business Management System (BMS) procedure AST/001 (Ref. 1).

17 The report will inform the HPC Site Inspector's overall assessment of the adequacy of NNB GenCo's LC compliance arrangements.

1.2 Scope

18 Ref. 2 provides ONR's overarching intervention strategy setting out the general approach to be taken to inform the decision on whether or not a NSL should be granted for HPC. In the area of LC compliance arrangements the strategy recognises that at the early stages of the project the arrangements for certain LCs relating to activities which are not being undertaken or do not present a challenge to nuclear safety may be less well developed. For the plant operating related LCs, including LC21, ONR is seeking only nominal arrangements at the point of granting a licence.

19 A LC21 Intervention Project Record (IPR) was prepared (Ref. 3) to support the granting of the NSL in line with the overarching strategy (Ref. 2). The intervention has sought to confirm that NNB GenCo has identified adequate principles of compliance for LC21 that can be developed post granting of the licence and that general preparatory activities in support of commissioning are satisfactory. It has not been possible to perform a compliance inspection for LC21 since the arrangements have not yet been prepared as they are not required until the commencement of inactive commissioning.

1.3 Methodology

20 I held a number of level 4 meetings with the NNB GenCo Start-up Manager to gather evidence to support the LC21 workstream intervention. Additional evidence as to the adequacy of the commissioning support to the early procurement activities was sought during the mechanical engineering topic meetings (Ref. 4).

21 Ref. 2 notes that NNB GenCo's NSL application dossier need not include a Site Specific HPC Pre-Construction Safety Report (SS HPC PCSR). At the time of NSL granting the prospective licensee need only demonstrate that there is a high level of confidence in a number of key topics that the HPC site can support the licensable activity. These key topics do not directly relate to commissioning activities and therefore the LC21 workstream intervention has not reviewed any of the documentation.

2 ASSESSMENT STRATEGY

22 This section identifies the standards and criteria that have been applied during the assessment.

2.1 Standards and Criteria

23 The relevant standards and criteria applicable to ONR assessments are principally the ONR Safety Assessment Principles (SAP), Ref. 5, internal ONR Technical Assessment/ Inspection Guides (TAG/ TIG), Ref. 6, relevant national and international standards and relevant good practice informed from existing practices adopted on UK nuclear licensed sites.

2.2 Safety Assessment Principles

24 The key SAPs applied within the assessment are included within Table 1 of this report.

2.3 Technical Assessment/ Inspection Guides

25 The following TAGs/ TIGs have been considered within this assessment (Ref. 6):

- T/AST/009 'Maintenance, Inspection and Testing of Safety Related Systems, Structures and Components' (draft)
- T/AST/028 'Control and Instrumentation Aspects of Nuclear Plant Commissioning'
- T/AST/057 'Design Safety Assurance'
- T/INS/021 'LC21 – Commissioning'

2.4 National and International Standards and Guidance

26 The following international standards and guidance have been used as part of this assessment (Ref. 7):

- SSR-2/2 'Safety of Nuclear Power Plants: Commissioning and Operation Specific Safety Requirements'
- NS-G-2.9 'Commissioning for Nuclear Power Plants'

2.5 Integration with other Assessment Topics

27 Additional evidence as to the adequacy of the commissioning support to the early procurement activities was obtained during the mechanical engineering topic meetings (Ref. 4).

3 ONR ASSESSMENT

28 This assessment has been carried out in accordance with ONR's How2 BMS document AST/001, "Assessment Process" (Ref. 1).

3.1 Scope of Assessment Undertaken

29 The LC21 workstream intervention focussed on the following areas and included a number of level 4 progress meetings with the NNB GenCo Start-up Manager (Refs. 8-11):

- LC compliance matrix;
- Hold Points (HP);
- Resources;
- Commissioning Guide;
- Interactions with the Architect Engineer (AE);
- Operating Experience (OPEX);
- Support to the procurement process;
- Development of the SS HPC PCSR.

3.2 Assessment

30 As indicated in section 1.2, the intervention has sought to confirm that NNB GenCo has identified adequate principles of compliance for LC21 that can be developed post granting of the licence and that general preparatory activities in support of commissioning are satisfactory.

3.2.1 Licence Condition Compliance Matrix

31 In support of the application for a NSL for HPC NNB GenCo has prepared a compliance matrix that demonstrates how compliance is, or will be, achieved with the 36 standard LCs. The matrix refers to the high level compliance procedures to demonstrate control of all activities that affect safety on the HPC site.

32 The matrix categorises LC21 as a Group 2 LC whose requirements do not need to be met through implemented arrangements at the time of licensing, with the matrix identifying future arrangements and their implementation phase(s). It is understood that the document will be revised before each lifecycle phase (Construction, Non-Active Commissioning, Radioactive Commissioning, Operation and Decommissioning) to reflect compliance.

33 The compliance matrix provides the following information:

- Post(s), primarily responsible for maintaining and making adequate provisions for compliance;
- Procedure and, if appropriate, section number references; and
- Commentary, where appropriate.

34 During the July 2012 meeting (Ref.11) the entries against the various clauses of LC21 in Version 1.13 of the HPC Compliance Matrix were discussed. I was generally content that NNB GenCo has made an adequate first attempt at identifying where existing arrangements are applicable to LC21 and where detailed commissioning arrangements will be necessary. Examples of the former include:

- 21(4): Define, Manage & Release Key Hold Points (NNB-OSL-PRO-000012);
- 21(5): Management of Competency (NNB-OSL-PRO-000018);
- 21(6): Document & Records Management Procedure (NNB-OSL-PRO-000009).

35 It is understood that the detailed commissioning arrangements will be available at least 12 months ahead of the start of non active commissioning; defined as the energisation of the first auxiliary transformer. During the commissioning of Sizewell B there was a regulatory issue associated with a crane with future nuclear safety significance being set to work before the LC21 hold point permissioning was requested; the rigour of the HPC commissioning arrangements will be reviewed during the permissioning intervention in light of this.

36 I highlighted some areas of the matrix which would benefit from the inclusion of additional information and/ or amendment to more fully demonstrate compliance. The Start-up Manager agreed to discuss the LC21 part of the matrix with the licensing group. Following the meeting an amended draft version of the matrix was provided (Ref. 12); I consider that this is adequate for the purposes of granting the HPC NSL.

3.2.2 Hold Points

37 NNB GenCo has submitted Version 2.2 of the HPC Hold Point List (NNB-OLS-LST-000006) that sets out their current proposals for Primary and Secondary Hold Points (HPs). The list identifies a subset of these as HPs for the purposes of either LC19(4) - Construction and Installation, or LC21(4) - Commissioning, giving ONR the primary power to specify that NNB GenCo seek consent to proceed.

38 One observation relates to the low number of HPs proposed for active commissioning and yet this is the time that the plant is subjected to some quite onerous tests (e.g. loss of off site power and load rejections). I will pursue this with NNB GenCo during the permissioning intervention to determine whether it would be appropriate to include a number of additional HPs during power raising and prior to performing some of the more onerous tests.

39 I have reviewed the draft list of HPs with respect to LC21 and am content that it is adequate for the purpose of granting a licence for HPC noting that there will be an opportunity to revisit it post licensing as the project matures.

3.2.3 Resources

40 NNB GenCo has appointed a Start-up Manager responsible for the development and implementation of LC21 arrangements along with the preparation of commissioning processes and procedures. The role is separate to that of the Commissioning Manager's for the individual new build sites who will be appointed later in the project.

41 The Start-up Manager currently reports to the Pre-Operations Director and is identified as a nuclear safety significant post with an Intelligent Customer (IC) Role in the pre-construction Nuclear Baseline document (NNB-HRE-AS-000001). The commissioning Role Profile associated with the Start-up Manager post has been reviewed (Ref. 13) from which it is apparent that appropriate responsibilities and competencies have been identified. It is understood that the competency assessment for the post holder has been completed with the only gap relating to attendance on the NNB GenCo fundamentals and foundation courses.

42 During the April 2011 meeting (Ref. 9) Version 0.2 of the Commissioning Guide (NNB-OSL-GUI-000040) was presented which included the early thoughts on the

commissioning team resourcing and structure. This shows approximately 40% of proposed commissioning resource (~ 150 in total) being made up of station staff including 4 of the 8 team leaders; I consider this to be in line with International Atomic Energy Agency (IAEA) guidance that recommends station staff play a significant role in commissioning.

- 43 Revision 5 (draft) of the Pre-Operations Staffing Strategy was discussed during the July 2012 meeting (Ref. 11) and the following points noted:
- there is evidence of IAEA guidance being adopted in terms of the strategy recognising the need to directly involve a sufficient number of qualified operations staff, at all levels and in all areas, in the commissioning activities to allow them to gain physical plant experience (IAEA SSR-2/2, (Ref. 7));
 - the need to recruit Pre-Operations staff taking account of the training lead times to support construction and commissioning activities is recognised;
 - due cognisance is being taken of lessons learnt from the Flamanville 3 (FA3) new build;
 - the requirement for commissioning expertise developed for HPC to be transferred to Sizewell C (SZC) is recognised;
 - preliminary resource requirements have been identified for commissioning activities made up from 3 groups:
 - NNB GenCo commissioning specialists;
 - Station's operational staff (operations and maintenance);
 - contract staff.
- 44 The Start-up Manager is understood to have regular meetings with Operations, Maintenance and Procurement addressing a range of topics including:
- identification of the role of station staff during commissioning that can be reflected in Role Profiles and training;
 - the involvement of station staff in routine preservation/ maintenance activities and the monitoring of discharges once equipment/ systems are installed to develop a full understanding of the plant;
 - embedding NNB GenCo staff in FA3 for commissioning from Hot Functional Testing onwards (this is now delayed until late 2013);
 - the involvement of Operations' staff in Factory Acceptance Tests to facilitate early understanding of equipment.
- 45 The Start-up Manager has also been temporarily acting as the Independent Assessment, Challenge and Oversight (IACO) Manager for most of 2012. This had the potential to be detrimental to the provision of commissioning support to the early procurement activities. However, from discussions at other Level 4 meetings supporting the ONR mechanical engineering intervention (Ref. 4) it would appear that this has not been the case. A number of candidates have been shortlisted for the IACO Manager's post and it is anticipated that someone will be in post by the end of October 2012.
- 46 A control and instrumentation Commissioning Manager whom previously worked at Atomic Weapons Establishment (AWE) was taken on as a contractor early in 2012 and
-

additional resource became available in April 2012 when a NNB GenCo secondee returned to take the lead on the turbine hall work area.

3.2.4 Commissioning Guide

- 47 Following the April 2011 meeting (Ref. 9) NNB GenCo provided a copy of the Commissioning Guide (Ref. 14). The document is intended to capture and document NNB GenCo's understanding of the commissioning process and provide guidance on the management organisation and processes to be implemented in the commissioning of HPC and follow on units at SZC. It recognises that the UK new build programme is closely linked with the new build at FA3. Accordingly the guide will evolve as the commissioning of FA3 progresses, lessons learnt are incorporated into the UK build programme and as processes and interfaces with the AE (Electricite de France, Division Ingenierie Nuclear (EDF DIN)) further develop.
- 48 At the July 2012 meeting (Ref. 11) it was noted that the Guide is undergoing an extensive rewrite and should be re-issued by the end of the year. The intent is to reflect NNB GenCo's current understanding from the past 36 months including intelligence from FA3, new build in China and recent Combined Cycle Gas Turbine new build in the UK.
- 49 The Guide makes it clear that commissioning will be divided into a number of distinct stages with as much testing as possible completed during inactive commissioning before the introduction of radioactive substances. I consider this to be good practice in accordance with IAEA guidance (IAEA, NS-G-2.9 (Ref. 7)) and SAP ECM.1 which states that "*Before operating any facility or process that may affect safety it should be subject to commissioning tests to demonstrate that, as built, the design intent claimed in the safety case has been achieved*".
- 50 I consider that the Guide provides a useful means for capturing the projects intentions with respect to commissioning activities and for identifying those enablers that need to be put in place early in the project such as support for contract tendering, securing sufficient operations resource and training of station staff including secondments to FA3. I will revisit the Guide during the permissioning intervention to determine the extent to which it is reflecting international good practice.

3.2.5 Interactions with the Architect Engineer

- 51 The AE is a key organisation supporting NNB GenCo and a significant amount of the commissioning documentation for the UK EPRs will be based on that produced by EDF DIN for FA3. As such it is necessary for good interactions to be established early in the project and maintained throughout the project lifecycle.
- 52 A Commissioning Working Party (CWP) has been established with representatives from NNB GenCo, EDF CNEN and CNEPE (part of the AE). There is a programme of bi-monthly meetings and the intention is to hold 2 of the meetings per year focussing on FA3.
- 53 The recent focus of the CWP has included the generic Commissioning Attachment Specifications for the procurement enquiry documents, the SS HPC PCSR and further amendments to the Commissioning Guide. Future topics include an instrumentation and control sub-meeting and completion of Issue 2 of the Commissioning Guide.
- 54 The CWP meeting in May 2012 was held at FA3 and included a presentation on their commissioning processes, commissioning schedules and lessons learnt from interactions with suppliers. The future integration and training opportunities for NNB GenCo staff was also discussed.

55 During the July 2012 meeting (Ref. 11) it was noted that the forward work plan includes the transfer of control of the Commissioning Schedule to NNB GenCo; I consider that this demonstrates that NNB GenCo are striving to be the controlling mind for the project as expected in its role as an IC.

3.2.6 Operating Experience (OPEX)

56 It is understood from the July 2012 meeting (Ref. 11) that a number of visits to other new build projects have taken place:

- FA3: 2 visits to date by NNB GenCo Start-up Manager and Pre-Operations staff are embedded in the maintenance area;
- Taishan: conference attended by EDF CNEN commissioning engineer;
- Hongyanhe project: NNB GenCo Start-up Manager attended an IAEA pre-Operational Safety Review Team (OSART) visit during Hot Functional Testing in advance of fuel receipt.

57 The permissioning intervention will seek evidence that NNB GenCo is continuing to interact with other new build projects and to learn from their commissioning experiences.

3.2.7 Support to Procurement Activities

58 During both the LC21 meetings and the meetings in support of the mechanical engineering intervention (Ref. 4) it was evident that NNB GenCo's relationship with contractors and suppliers with respect to commissioning has commenced during the tendering stage. The Start-up Manager has been involved with the various working groups preparing tender documentation to ensure that the commissioning requirements are adequately reflected. The procurement contracts are to be let by the AE on NNB GenCo's behalf.

59 Generic commissioning appendices (OSL-SOR-000005) have been prepared by NNB GenCo for including with the Invitations to Tender (ITT); it is understood that they are more detailed than those produced for FA3, particularly with respect to management arrangements and providing an oversight of contractors' involvement in commissioning along with their responsibilities. The documents have been reviewed by the CWP discussed in section 3.2.5 above.

60 Separate appendices have been prepared for the different procurement strategies reflecting whether the contracts are supply only or include installation and commissioning. As would be expected the appendices cover a range of issues including:

- the roles of the Commissioning Governance Committee, the working parties and test teams;
- contractors responsibilities;
- compliance with statutory regulations;
- resource requirements;
- descriptions of the main commissioning stages;
- documentation requirements.

61 It is noted that the appendix for installation and commissioning contracts includes the requirement for maintenance activities prior to handover of the plant, including but not limited to:

- preventative maintenance such as plant greasing and lubricating, installation and removal of temporary filters, etc;
- preservation/ layup of plant;
- corrective maintenance such as repairing defective plant during testing.

62 This ensures that the plant remains in good condition and is capable of meeting the original design intent when handed over to the station; I consider this to be an example of good practice being captured in the contract documents.

63 Following tender discussions the intention is for the generic commissioning appendices to be refined to produce contract specific requirements documents reflecting UK context; such documents are available for the turbine hall contract and are in preparation for the AREVA contract.

64 During the July 2012 meeting (Ref. 11) the commissioning support to the AREVA single tender contract negotiations were discussed. It was explained that NNB GenCo have held a number of meetings with EDF CNEN/ AREVA to understand the standard commissioning documentation/ processes and issues encountered with the current FA3 contract model. NNB GenCo is also understood to have provided clarification as to the changes required for HPC with the tender submission due in the autumn of 2012.

3.2.8 Development of the Site Specific HPC Pre-Construction Safety Report (SS HPC PCSR)

65 Chapter 19 of the SS HPC PCSR2 addresses commissioning and identifies the specific forward work activities for the subsequent stages of the safety case. Commissioning activities are separated into two sub-chapters:

- 19.0 'Commissioning Safety Requirements'
- 19.1 'Plant Commissioning Programme'

66 I understand that at the time of writing this report the above sub-chapters are at various stages of production and will be available to support issuing of the PCSR2 in October 2012. I have not sampled any of the new material during the current intervention; however this will be addressed in the intervention to support permissioning activities.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

- 67 This report presents the findings of the ONR LC21 'Commissioning' workstream intervention in support of NNB GenCo's application for a NSL to install and operate two EPR units at HPC.
- 68 The intervention has sought to confirm that NNB GenCo has identified adequate principles of compliance for LC21 that can be developed post granting of the licence and that general preparatory activities in support of commissioning are satisfactory.
- 69 A number of actions have been placed with NNB GenCo during the various level 4 meetings and inspections; these have all been satisfactorily closed.
- 70 To conclude, I am satisfied that the LC21 section of the NNB GenCo compliance matrix and the draft HPC HP list are adequate for the purpose of granting the HPC NSL and that good progress is being made in terms of preparatory activities for commissioning. The preparatory activities include support to procurement tendering activities, commissioning team resource planning, identification of the role of operations staff in commissioning activities and engagement with the AE and international new build projects.
- 71 On the basis of the intervention I am content for ONR to grant NNB GenCo a NSL for HPC.

4.2 Recommendations

- 72 I recommend from the perspective of the LC21 workstream that ONR should grant NNB GenCo a NSL for HPC.

5 REFERENCES

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Table 1
Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
ECM.1	Commissioning: commission testing	Before operating any facility or process that may affect safety it should be subject to commissioning tests to demonstrate that, as built, the design intent claimed in the safety case has been achieved.