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Office for Nuclear Regulation

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**CNRP Hinkley Point C Nuclear Site Licence Application**

**Hinkley Point C – Human Factors Topic Report to Inform Nuclear Site Licensing**

Assessment Report: ONR-CNRP-AR-12-086  
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## EXECUTIVE SUMMARY

### Background

This report presents the findings of the Office for Nuclear Regulation (ONR) Human Factors (HF) assessment of NNB Generation Company's (NNB GenCo) application, including supporting information and arrangements, for a nuclear site licence (NSL) at Hinkley Point C. It informs both ONR's organisational capability intervention, and safety report and the associated substantiation intervention from ONR's licensing strategy. As such this assessment supports ONR's decision whether to grant a nuclear site licence or not for NNB GenCo to install and operate two EPR units at Hinkley Point C.

### Assessment and inspection work carried out by ONR

ONR has engaged with NNB GenCo since January 2011 on Human Factors, via regular level 4 meetings, assessment of relevant documentation where available and inspection of HF arrangements in May 2012. For HF this engagement had the objective of verifying that NNB GenCo had established the following:

- An adequate HF capability to produce the necessary safety documentation to support the NSL application;
- An adequate overall HF programme and HF Integration Plan (HFIP);
- A sufficiently robust HF resource plan to support the initial phases of the overall programme;
- Satisfactory discharge (or progress) of the HF Assessment Findings from the GDA UKEPR Human Factors Step 4 Assessment report (Ref. 7) that relate to the first structural concrete milestone.

Based on the interventions carried out and my assessment of available documentation, and taking account of the point in time in the build programme, I have the following key conclusions in terms of nuclear site licensing:

- NNB GenCo has established a satisfactory Intelligent Customer (IC) capability within its Design Authority (DA) via 2 permanent HF specialists supported by a suitably qualified and experienced person (SQEP) embedded contractor;
- NNB GenCo has secured adequate HF SQEP resource from two experienced UK contractor companies and EDF, the architect-engineer (AE) for the HF work programme up to the first hold point;
- NNB GenCo has established effective working arrangements with the AE on HF to ensure continuity from GDA and on-going support for the necessary HF programme;
- NNB GenCo has made adequate progress in developing its HF strategy and HF Integration Plan (HFIP). This includes governance and assurance arrangements for contractors and AE work;
- NNB GenCo's PCSR HF strategy is capable of producing a HF safety case for PCSR2 and PCSR3 that meets ONR's SAP and TAG expectations (see Table 1 and Ref. 3);
- NNB GenCo's competency assessment process for DA HF specialists specifies the necessary competences; the assessment process has been appropriately implemented for the individuals in post;

- NNB GenCo has made satisfactory progress on addressing GDA HF Assessment Findings linked to the first structural concrete.

I therefore conclude that NNB GenCo's HF arrangements appear adequate to manage nuclear safety for the point in time at which the nuclear site licence is to be granted.

From my assessment I judge that it is important for NNB GenCo to progress the overall HF Strategy and HF Integration Plan further so that they are formally incorporated into the overall HPC project management arrangements. This will ensure that there is systematic consideration of HF in the design and safety case development.

It is noted that the areas above are still being developed by NNB GenCo and ONR will continue to engage with it to monitor and encourage progress in these areas and indeed all other areas of work referred to in this report.

### **Recommendations**

For the HF topic area I consider that NNB GenCo has developed satisfactory HF arrangements that are sufficient to enable ONR to grant a Nuclear Site Licence to NNB GenCo to install and operate two EPR units at Hinkley Point C.

ONR should continue to engage with NNB GenCo to ensure that it continues to develop its overall HF arrangements, and undertake the necessary HF detailed design and safety case development.

**LIST OF ABBREVIATIONS**

AE	Architect-engineer
ALARP	As low as is reasonably practicable
BSL	Basic Safety level (in SAPs)
BSO	Basic Safety Objective (in SAPs)
BMS	(ONR) How2 Business Management System
DA	Design Authority
GDA	Generic Design Assessment
HF	Human Factors
HFIP	Human Factors Integration Plan
HPC	Hinkley Point C
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
IC	Intelligent Customer
LC	Licence Condition
NSL	Nuclear Site Licence
ONR	Office for Nuclear Regulation (an agency of HSE)
PCER	Pre-construction Environment Report
PCSR	Pre-construction Safety Report
PID	Project Initiation Document
PSA	Probabilistic Safety Assessment
PSR	Preliminary Safety Report
RGP	Relevant Good Practice
SAP	Safety Assessment Principle(s) (HSE)
SFAIRP	So far as is reasonably practicable
SQEP	Suitably Qualified and Experienced Person
SSC	System, Structure and Component
TAG	Technical Assessment Guide(s) (ONR)
TSC	Technical Support Contractor
WENRA	Western European Nuclear Regulators' Association

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## 1 INTRODUCTION

### 1.1 Background

1 NNB Generation Company (NNB GenCo) has submitted its formal application for a nuclear site licence to install and operate two EPR units at Hinkley Point C (HPC). The Office for Nuclear Regulation's (ONR) intervention strategy to inform a decision on whether, or not, a nuclear site licence should be granted to NNB GenCo in respect of Hinkley Point C is set out in Ref. 6.

2 ONR's approach to licensing is informed by interventions that considered the adequacy of NNB GenCo's:

- Organisation capability;
- Licence condition compliance arrangements;
- Safety report and associated substantiation; and
- Licensing documentation and ONR's associated legal and statutory consultation due process.

3 As part of the safety report and associated substantiation intervention ONR Pre Construction Safety Report (PCSR) technical topic leads were required to develop and carry out an intervention focused on their topic. Human Factors (HF) is one such topic listed in Appendix C of ONR's Hinkley Point C licensing intervention strategy (Ref. 6). This report presents the findings of the assessment of Human Factors (HF) topic area in support of ONR's wider consideration of EDF NNB GenCo's application for a nuclear site licence (NSL) for Hinkley Point C.

4 The assessment has been undertaken in accordance with the requirements of the Office for Nuclear Regulation (ONR) How2 Business Management System (BMS) procedure AST/001 (Ref. 1). The ONR Safety Assessment Principles (SAP) (Ref. 2), together with supporting Technical Assessment Guides (TAG), Ref. 3) have been used as the basis for this assessment.

5 My assessment of HF has been undertaken following a period of providing advice and guidance to NNB GenCo in order to assist them understand, and develop the necessary HF capability and HF programme for the HPC project. This period of early engagement enabled me to determine the main challenges for NNB GenCo in establishing its HF capability and overall HF programme.

6 The Generic Design Assessment (GDA) Step 4 HF Assessment report (Ref. 7) identified a significant gap in the HF safety case for the UK EPR. A GDA Issue GI-UKEPR-HF01 (Ref. 8) was raised that requires both a significant amount of substantiation of Human Based Safety Claims (HSBCs) and a major revision of the HF safety case in the PCSR. I am leading on the GDA close-out programme; and consequently this understanding of the GDA HF safety case is a key element in my assessment of the HF safety case for the HPC NSL.

### 1.2 Scope

7 The scope of this report covers my assessment of two main aspects of HF that related to the granting of a site licence to NNB GenCo. These are:

- The provision by NNB GenCo of necessary safety case documentation required to support the NSL application;

- NNB GenCo's overall HF capability and preparedness to undertake the necessary design and safety HF related development work required in the early stages of construction to the first hold point.

8 The scope of this report informs the organisational capability intervention, and the safety report (Ref. 10) and the associated substantiation intervention outlined in ONR's licensing intervention strategy (Ref. 6).

9 The scope of this assessment is influenced by the extensive on-going GDA HF close-out work and the reliance of NNB on the GDA HF safety case that is being revised as part of this close-out work. NNB has not presented any additional HF safety case documentation at this point; hence the focus of this assessment on their intended HF work plans and particularly on its state of readiness to undertake the future necessary work.

### 1.3 Methodology

10 The methodology for the assessment follows ONR BMS document AST/001, Assessment Process (Ref. 1), in relation to mechanics of assessment within the Office for Nuclear Regulation (ONR).

11 This assessment has been focussed primarily on NNB GenCo's HF capability and preparedness to undertake the necessary design and safety HF related development work required in the early stages of construction to the first hold point. I have also considered NNB GenCo's preparedness for the site specific HF aspects of the PCSR. Ref. 10 provides an overall assessment of NNB GenCo's Organisational Capability.

## 2 ASSESSMENT STRATEGY

12 The intended assessment strategy for the licensing of NNB GenCo with respect to Hinkley Point C for the PSA topic area is set out in this section. This identifies the standards and criteria that have been applied and the scope of the assessment.

### 2.1 Standards and Criteria

13 The relevant standards and criteria adopted within this assessment are principally the Safety Assessment Principles (SAP), Ref. 2, internal ONR Technical Assessment Guides (TAG), Ref. 3, relevant national and international standards and relevant good practice informed from existing practices adopted on UK nuclear licensed sites. The key SAPs and relevant TAGs are detailed within this section. National and international standards and guidance have been referenced where appropriate within the assessment report. Relevant good practice, where applicable, has also been cited within the body of the assessment.

### 2.2 Safety Assessment Principles

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

#### 2.2.1 Technical Assessment Guides

15 The following Technical Assessment Guides have been used as part of this assessment (Ref. 3):

- T/AST/049 Licensee use of contractors and intelligent customer capability;
- T/AST/058 HF Integration;
- T/AST/065 Function and content of the Nuclear Baseline;
- T/AST/079 Licensee design authority capability.

#### 2.2.2 HF Assessment Strategy

16 The approach for this assessment has been based on the HF Intervention Plan (Ref. 11) and its implementation I undertook earlier this year; along with separate consideration of the production of HF elements of the HPC site specific PCSR.

17 I identified four key areas for assessment from my interactions with NNB GenCo and developed the Intervention Plan to aid my assessment. The four areas were ensuring:

- An adequate HF capability to produce the necessary safety documentation to support the NSL application (i.e. the specific PCSR chapter and additional key references);
- An adequate overall HF programme and HF Integration Plan (HFIP) that ensures HF inputs into the design, procurement and safety analyses;
- A sufficiently robust HF resource plan to support the initial phases of the overall programme – including ensuring an sufficient HF capability to fulfil the near term Intelligent Customer and nuclear baseline requirements and adequate plans to ensure adequate resourcing to match the HF programme requirements in the medium term;

- Satisfactory discharge (or progress) of the HF Assessment Findings from the GDA UKEPR Human Factors Step 4 Assessment report (Ref. 7) that relate to first structural concrete milestone.

18 These four key areas stem from those aspects that I judge relevant for NNB GenCo's HF future work programme and are derived from the TAGs listed in section 2.2.1. TAGs 049, 065 and 079 set out expectations for Intelligent Customer capability; relationships and reliance on contractors, safety significant nuclear baseline requirements, and Design Authority capability. The HFI TAG (058) sets out expectations for the HF programme during major project phases; and consequently provides an indication of the extent of HF work that NNB GenCo will need to undertake post-NSL granting and development post-GDA.

19 The assessment has been based on my intervention which comprised the following main elements:

- A series of L4 meetings to examine development of HF programme (HFIP) and resourcing;
- Submission & assessment of key supporting documentation – HFIP; PCSR HF site specific statements; IC and nuclear baseline & future plans;
- Sampling of evidence of processes to secure early HF control of procurement, manufacture, construction and installation of safety related structures systems and components;
- Sampling evidence that the GDA Assessment Findings tied to first structural concrete have been or will be sufficiently addressed

### 2.3 Use of Technical Support Contractors

20 No support was used in this assessment.

### 2.4 Integration with other Assessment Topics

21 This assessment has contributed to both ONR's overall consideration of Organisational Capability and the Safety report and associated documentation.

### 2.5 Out-of-scope Items

22 The focus of this assessment has mainly been on the HF capability and programme arrangements not on detailed HF safety analyses at this point. This is as expected given the point in time in the programme, current progress and reliance on the GDA HF safety case that is still being completed.

**3 LICENSEE'S SAFETY CASE**

23 NNB GenCo formally applied for a nuclear site licence for Hinkley Point C in letter ONR-HPC-20143R, dated 29 July 2011 (Ref. 12). This was supported by an application dossier (Ref. 13) that supports NNB GenCo's application. ONR agreed (Ref. 14) that this dossier did not need to include a Hinkley Point C site specific PCSR. For the purposes of granting a nuclear site licence ONR indicated to NNB GenCo that it would accept a document that illustrates the structure of the Hinkley Point C site specific PCSR document.

24 Notwithstanding that ONR did not require a Hinkley Point C site specific PCSR as part of the application dossier, ONR expected relevant sections or chapters of the PCSR, not including PSA, to be developed sufficiently to support licence granting, notably around confirmation that the site specific parameters are bounded by the GDA design envelope, with appropriate arrangements in place to address any discrepancies.

25 For the HF safety case to be presented in Chapter 18.1 of the PCSR NNB GenCo provided a head document (Ref. 15) that described the approach for developing the PCSR sub-chapter and addressing the necessary forward work plan. This document:

- Indicates that the initial HF safety case PCSR2 will be based on the current GDA PCSR; but that PCSR3 will be based on the updated HF safety case produced at the end of the GDA HF Issue close-out programme;
- Provides a summary of the proposed HF forward work plan to ensure an acceptable HF safety case based on three elements:
  - Substantiation of HSBCs;
  - HF Design substantiation;
  - Substantiation of HF Integration process.
- Indicates how the eight GDA HF related Assessment Findings linked to the first structural concrete are to be addressed;
- Identifies that no specific Fukushima recommendations arising from the ONR Chief Inspector report (Ref. 16) related to HF need to be addressed at this point for HPC.

26 In order to aid my assessment, NNB GenCo provided presentations on work plans, resourcing and examples of work undertaken. It also provided project documentation on the following:

- The overall HF strategy and programme;
- The arrangements for HF governance and assurance;
- The HF Integration plan;
- The HF Design Authority (DA) Lead Engineer role profile and individual candidate assessment;
- The HF strategy working group – terms of reference, notes of meetings.

## 4 ONR ASSESSMENT

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

### 4.1 Scope of Assessment Undertaken

28 The scope of the assessment has followed the PSA strategy described in Section 2 of this report. The following areas have been considered and are discussed in Section 4.3 of this report:

- NNB GenCo IC capability and HF resourcing;
- HF strategy, overall HF programme and HFIP;
- HF support to early procurement activities;
- Measures to ensure GDA Assessment Findings are addressed;
- Preparedness to produce the PCSR and safety documentation.

### 4.2 Interventions with NNB GenCo

29 Given that HF is not an explicit part of the dossier supporting NNB GenCo's application for a nuclear site licence and significant HF deliverables are not anticipated until post licensing, only a limited assessment of HF documentation has been carried out to form a view on whether from the HF topic area to recommend, or not, granting a nuclear site licence. This has included sampling a limited number of HF project documents. The recommendation on granting a nuclear site licence is predominantly based on the outcome of the level 4 meetings, outlined in Table 2, and a HF inspection carried at NNB GenCo's Qube office (Ref.17).

### 4.3 Assessment

30 This section summarises ONR's assessment and the conclusions and findings for each of the broad topic areas listed in Section 4.1.

#### 4.3.1 NNB GenCo IC capability and HF resourcing

31 My assessment is based on consideration of three main elements:

- NNB GenCo's IC capability for HF – both for SQEPness and totality of the resource;
- The additional SQEP contractor support secured to support the overall HF programme;
- The HF support available within the Architect-Engineer (AE) to undertake necessary design and safety case development.

32 At the time of my inspection on May 2012 I found that NNB GenCo had secured a considerable SQEP capability both internally within the Design Authority (DA) and via contractor support. In summary this was:

- Two full time experienced HF specialist engineers within NNB GenCo DA as HF co-leads;
- Contractor support from two leading UK HF consultancies (Synergy and Greenstreet Berman) with support from eight individuals including a near permanent contractor as an embedded contractor within the DA working on detailed HMI development;

- A dedicated HF engineer supporting NNB GenCo from the AE – supporting the AE lead HF engineer who supports both GDA close-out and the HPC project.

- 33 Both Synergy and Greenstreet Berman have been assessed by ONR and are judged to be SQEP (they supported the GDA Step 4 assessment work). The individuals providing key support on the overall HF programme and strategy have very considerable nuclear HF experience.
- 34 From my series of Level 4 meetings, and May 2012 intervention I find that NNB GenCo has established a close relationship with the AE; and that the AE has recognised the need to provide additional support on HF for the HPC project. This led to the assignment of the additional AE HF engineer to work with the NNB GenCo HF lead to progress the HF work. The NNB HF lead is also involved in working with EDF and AREVA in the GDA close-out programme, hence ensuring a full understanding of the developing HF safety case for the UK EPR.
- 35 In support of ONR's overall competency assessment (ref. 24) I reviewed the implementation of NNB GenCo's competency assurance arrangements for the HF specialist role during my May 2012 intervention. The overall assessment had looked at the general arrangements and concluded these were acceptable. I looked at both the HF lead engineer role profile and the assessment of one of the NNB GenCo HF lead engineers. I considered that the role profile and corresponding discrete competencies requirements were appropriate and at an appropriate level. The competence assessment of the individual appeared to me to be appropriate and had identified one area for further development (HRA). Measures had been put in place to address the identified development need.
- 36 During this intervention NNB GenCo HF specialists provided a clear overview of the SQEP arrangements as applied to the HF specialist role; and they were aware of the appropriate procedure "Management of Competency" (NNB-OSL-PRO-000018) and "NNB Nuclear Baseline" (NNB-HRE-ASS-000001).
- 37 In my early interactions with NNB GenCo I expressed the view that NNB were likely to need at least three HF specialists internally to provide a satisfactory IC capability for a major project of the scale of HPC. NNB has successfully recruited two SQEP HF specialists and an embedded contractor. Although this team of three lacks experience of the HF demands of this scale of nuclear project they are additionally supported in the key strategy and programme development by individuals with that experience. This experience is primarily required in the early phases of the project to ensure an adequate overall HF strategy is devised that encompasses all the detailed HF design development and safety case support work required. I consider the development of this strategy is progressing satisfactorily (see section 4.3.2. below). Consequently I am satisfied that NNB has adequate IC capability at this point for NSL granting.
- 38 The overall resource level is dependent on the HF programme of work (see section 4.3.2 below). The detailed HF programme has still to be determined but NNB GenCo has secured sufficient support to ensure development of the near term programme and undertake important HF activities.
- 39 My overall view is that NNB GenCo has secured both an adequate HF IC capability and contractor resource to support the NSL application and near term work programme (see below).
-

#### 4.3.2 HF strategy, overall HF programme and HFIP

40 At my intervention in May I examined and discussed several documents that NNB were in the process of being developed (including Refs 18-22). This included:

- HF strategy and HF governance arrangements;
- A goal level based HF programme analysis;
- A draft HFIP document (based on the above);
- Additional draft documents addressing key early action AFs:
  - Development of a Target Audience Description (TAD);
  - Development of a HF Issues and Assumptions Register – a policy document and draft register;
  - Work scope for Human-Machine-Interface (HMI) development.

41 These documents and the intervention came at the end of a series of earlier documents and Level 4 meeting discussions on the development of an adequate HF strategy, programme and HFIP where I had expressed concerns on the lack of progress.

42 From my review and discussion I found that NNB had put in place high level 'goal' analysis for the HF programme that had then further broken the goals down into necessary work activities. I consider that the goals identified match my ONR's expectations for the near term HF design and safety case work requirements based on the requirements stemming from ONR's HF SAPs and TAGs (Refs. 2 and 3) particularly the HF scope expectations shown in Annex 1 of the TAG on HF Integration T/AST/058. I was disappointed to find that a detailed HF strategy and accompanying HFIP had not yet been fully developed and with a formal status in HPC project management documentation. However it was evident from the documentation provided, and the discussions with the HF team and their supervising managers that satisfactory progress is being made.

43 I regard the production of a formal HFIP and HF Strategy (that meets ONR's SAP and TAG expectations) within the overall HPC project management documentation an important step to ensuring adequate consideration of HF aspects are incorporated into the HPC design and safety case development. NNB GenCo needs to address this speedily.

44 My review of the supplied documentation, and discussion showed that NNB GenCo has progressed several discrete elements that are needed as early activities, and were identified as AFs at Step 4. NNB GenCo were able to show reasonable progress in the following:

- Developing a TAD – which is a key element into equipment and system requirements to ensure HF requirements are identified;
- Developing an HF Issues and Assumptions register – this will track HF issues and assumptions from the safety case that need resolution or appropriate implementation. This will be important to ensure that key HF issues and assumptions from the GDA HF safety case are properly taken forward into the HPC HF work programme;
- Development of an initial work scope for the HMI – there is likely to be a considerable amount of detailed HF work required to develop the detailed HMI displays for the UK EPR from the FA3 initial bases.



My overall view is that adequate progress is now being made in developing an appropriate overall HF strategy and HFIP. From my review of the documentation and discussions I consider the key 'shift' has been better understanding of the overall scale of the work required; and the goal based analysis being used to develop the overall HF programme.

45 All of the key documentation I reviewed was at draft status which I judged was acceptable at that point in time. However I consider that it is important for NNB GenCo to incorporate an overall HF Strategy and HFIP into its project management documentation to ensure that there is systematic consideration of HF across the project from its early stages.

#### **4.3.3 HF support to early procurement activities**

46 In my GDA Step 4 HF Assessment (Ref 7) I judged that there was a lack of evidence of adequate consideration of HF requirements into equipment and system design specifications. Consequently I have engaged with NNB GenCo to take measures to address this issue in advance of an HF Strategy and HFIP being in place.

47 From the level 4 meetings and May 2012 intervention (Ref. 17) it is apparent that NNB GenCo's HF lead has taken several measures to ensure that HF requirements are identified and incorporated into early procurement specifications. The key steps have been:

- Identification of the main areas of early procurement;
- Engagement with key topic groups to identify potential HF requirements.

48 At this point the potential areas of interest are the Nuclear Steam Supply System (NSSS); Civil Structures, Control & Instrumentation (C&I). NNB GenCo has indicated that no detailed specifications requiring a detailed HF requirements specification have yet been let. Basic access, special and inspection related requirements were considered at GDA, consequently I judge that the measures taken to date are adequate. I consider that it is important that the HPC project establishes requirements for the consideration and inclusion of HF requirements into equipment and systems specifications. This should stem from the HFIP and HF Strategy documents.

#### **4.3.4 Measures to ensure GDA Assessment Findings are addressed**

49 NNB GenCo has already embarked on addressing several of the AFs that are linked to first structural concrete (see section 4.3.2 above). Additionally NNB GenCo's draft head document for Chapter 18.1 of the PCSR (Ref 23) identifies the eight GDA HF AFs that need to be addressed. These are:

- AF-UKEPR-HF-06 - to establish and maintain a log of current assumptions from the safety case. Additional assumptions should be added as they emerge from subsequent HF analysis work. All assumptions shall be substantiated as part of the forward work programme for HF.
- AF-UKEPR-HF-24 - to develop and submit a HFIP for UK EPR construction.
- AF-UKEPR-HF-25 - to ensure that sufficient SQEP HF resource is identified and deployed to meet the demands of the ongoing design and safety case work for UK EPR.
- AF-UKEPR-HF-26 - to produce a user definition document that contains relevant anthropometric details and has considered the impact of secular trends in the operating community.

- AF-UKEPR-HF-27 - to establish and maintain a consolidated HF Issues Register for the future design and safety case development beyond PCSR.
- AF-UKEPR-HF-28 - to ensure that there is full integration between the remaining Human Factors Engineering (HFE) programme, the HRA and the overall safety case.
- AF-UKEPR-HF-29 - The licensee shall establish a process for addressing ALARP requirements for HF aspects of the design and safety case for the UK EPR.
- AF-UKEPR-HF-36 - The licensee shall provide a HMI style guide (or equivalent); using recognised modern standards to guide detailed design and justification of the interfaces and displays for the UK EPR.

50 My assessment to date indicates that NNB GenCo has made considerable progress against all these issues apart from AF-UKEPR-HF29 and 36. I noted that the HMI Style Guide development forms part of the detailed HMI work scope being developed.

51 Overall I judge that NNB GenCo is making satisfactory progress to address the GDA HF AFs prior to the linked hold point.

#### 4.3.5 Preparedness to produce the PCSR and safety documentation

52 The Generic Design Assessment Step 4 HF Assessment report (Ref. 7) identified a significant gap in the HF safety case for the UK EPR. A GDA Issue GI-UKEPR-HF01 (Ref. 8) was raised that requires both a significant amount of substantiation of Human Based Safety Claims (HSBCs) and a major revision of the HF safety case in the PCSR.

53 NNB GenCo has indicated that for PCSR2 it intends using the current GDA Chapter 18 of the PCSR (March 2012); and that at PCSR3 it will incorporate the substantially revised Chapter 18 produced at the end of the GDA HF Issue close-out. ONR has considered the adequacy of safety documentation proposals within Ref. 10. The GDA process has addressed the adequacy of the generic design for the UK EPR™; NNB GenCo will need to address the site specific and operational aspects for the project.

54 From my involvement in the Step 4 HF assessment and in leading on the resolution of the GDA HF Issue close-out I consider that the key site specific HF issues that NNB GenCo need to address are:

- The overall operating philosophy and staffing levels;
- Confirmation of the intention to use State Orientated Approach post-fault procedures and supporting HMI;
- Development of the detailed UK EPR HMI and procedures;
- The arrangements for 2 unit operations, and implications on the GDA safety case including consideration of emergency and severe accident arrangements.

55 The current GDA HF safety case is strongly based on use of SOA operation, FA3 operating roles (operator action, strategy, a shift supervisor, safety engineer and field operator). NNB GenCo has indicated that it does not have any intention at this point to modify this approach. I consider that if NNB GenCo did want to move significantly from this assumed operating approach then it would have significant impact on both the detailed HMI and procedure development work; and on the HF safety case which would need substantial re-justification.

- 56 None of the site specific issues I identified above pose a threat to the provision of an acceptable PCSR at PCSR2 and 3. From my assessment I consider that NNB GenCo has:
- Adequate control of the HF programme and safety case;
  - Demonstrated an adequate intelligent customer capability;
  - Suitably Qualified and Experienced Personnel (SQEP) to deliver adequate HF safety case for the second Pre Construction Safety Report (PCSR2) and later;
  - Satisfactory HF arrangements being developed to support the design development and safety analysis.
- 57 Consequently I consider that NNB GenCo is making adequate progress against its HF plan for PCSR2 and 3.

## 5 CONCLUSIONS AND RECOMENDATIONS

### 5.1 Conclusions

58 This report presents the findings of the ONR HF topic assessment of NNB GenCo's application, supporting information and arrangements for a nuclear site licence at Hinkley Point C. This assessment supports ONR's decision whether to grant a nuclear site licence, or not, for NNB GenCo to install and operate two EPR units at Hinkley Point C.

59 This report has been produced in line with ONR's overall licensing strategy (Ref. 6) and the HF IPR: NNB-HPC1-IPR17 (Ref. 11). It informs both ONR's organisational capability intervention, and safety report and the associated substantiation intervention from ONR's licensing strategy.

60 Based on the interventions carried out and preliminary assessment of available documentation, and taking account of the point in time in the build programme, the following key conclusions are made in terms of nuclear site licensing:

- NNB GenCo has established a satisfactory IC capability within its Design Authority via 2 permanent HF specialists supported by a SQEP embedded contractor
- NNB GenCo has secured adequate HF SQEP resource from two experienced UK contractor companies and EDF, the architect-engineer (AE) to meet the likely demands of the HF work programme up to the first hold point
- NNB GenCo has established effective working arrangements with the AE on HF to ensure continuity from GDA and on-going support for the necessary HF programme
- NNB GenCo has made adequate progress in developing its HF strategy and HF Integration Plan (HFIP). This includes governance and assurance arrangements for contractors and AE work.
- NNB GenCo's PCSR HF strategy is capable of producing a HF safety case for PCSR2 and PCSR3 that meets ONR's SAP and TAG expectations (see Table 1 and Ref. 3)
- NNB GenCo's competency assessment process for DA HF specialists specifies the necessary competences; the assessment process has been appropriately implemented for the individuals in post
- NNB GenCo has made satisfactory progress on addressing GDA HF Assessment Findings linked to the first structural concrete.

61 I therefore conclude that NNB GenCo's HF arrangements appear adequate to manage nuclear safety for the point in time at which the nuclear site licence is to be granted. In particular for HF:

- NNB GenCo has demonstrated that there is a high level of confidence that the Hinkley Point C site can support the licensable activity.
- NNB GenCo has demonstrated that it is capable of producing a site specific safety report and relevant design substantiation to support the construction and installation of two EPR units at Hinkley Point C.

62 From my assessment I have identified that NNB GenCo needs to progress the overall HF Strategy and HF Integration Plan further. I judge that it is important that these are formally incorporated into the overall HPC project management arrangements to ensure that there is systematic consideration of HF in the design and safety case development.

63 It is noted that some of the areas above are still being developed and ONR will continue to engage with NNB GenCo to monitor and encourage progress in these areas and indeed all other areas of work referred to in this report.

## 5.2 Recommendations

64 For the HF topic area I consider that NNB GenCo has developed satisfactory HF arrangements that are sufficient to enable ONR to grant a Nuclear Site Licence to NNB GenCo to install and operate two EPR units at Hinkley Point C.

65 ONR should continue to engage with NNB GenCo to ensure that it continues to develop its overall HF arrangements, and undertake the necessary HF detailed design and safety case development.

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Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
EHF.1	Integration with design, assessment and management	A systematic approach to integrating human factors within the design, assessment and management of systems should be applied throughout the entire facility life-cycle.
EHF.2	Allocation of safety functions	When designing systems, the allocation of safety actions between humans and technology should be substantiated and dependence on human action to maintain a safe state should be minimised.
EHF.3	Identification of actions impacting safety	A systematic approach should be taken to identifying human actions that can impact on safety.
EHF.4	Identification of administrative controls	Administrative controls used to remain within the safe operating envelope should be systematically identified.
EHF.5	Task analysis	Analysis should be carried out of tasks important to safety to determine demands on personnel in terms of perception, decision making and action.
EHF.6	Workspaces	Workspaces in which plant operations and maintenance are conducted should be designed to support reliable task performance, by taking account of human perceptual and physical characteristics and the impact of environmental factors.
EHF.7	User Interfaces	User interfaces, comprising controls, indications, recording instrumentation and alarms should be provided at appropriate locations and should be suitable and sufficient to support effective monitoring and control of the plant during all plant states.
EHF.8	Personnel competence	A systematic approach to the identification and delivery of personnel competence should be applied.



**Table 1**

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
EHF.9	Procedures	Procedures should be produced to support reliable human performance during activities that could impact on safety.
EHF.10	Human Reliability	Risk assessments should identify and analyse human actions or omissions that might impact on safety.

**Table 2**

Interventions carried out related to the HF topic

Date	Topic	Intervention report TRIM reference
11 January 2011	Level 4 HF Progress Meeting	2011/61766
5 May 2011	Level 4 HF Progress Meeting	2011/281972
12 July 2011	Level 4 HF Progress Meeting	2011/378236
26 October 2011	Level 4 HF Progress Meeting	2011/607083
13 December 2011	Level 4 HF Progress Meeting	2011/551922
17 February 2012	Level 4 HF Progress Meeting	2012/184804
28 May 2012	ONR HF Intervention	2012/267886

