Office for Nuclear Regulation

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Civil Nuclear Reactor Programme

Fuel & Core and Spent Fuel Storage Work Streams – NNB GenCo Hinkley Point C Licensing

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ASSESSMENT REPORT

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EXECUTIVE SUMMARY

This report presents the findings of Office for Nuclear Regulation's (ONR) assessment of the fuel & core and spent fuel work streams in support of the licensing of the Hinkley Point C (HPC) site to Nuclear New Build Generation Company (NNB GenCo).

This assessment was unusual for ONR because it was not an assessment of a safety case against the standard assessment criteria. The main aim was to gain reassurance that NNB GenCo was responding to Generic Design Assessment (GDA) assessment findings in an appropriate manner, to understand its plans for developing safety cases and facilities for fuel & core and spent fuel and to scrutinise how it was discharging its responsibilities as an Intelligent Customer.

The conclusion was that ONR has not identified any issues in the course of this assessment in the fuel & core and spent fuel areas that would preclude a nuclear site licence being granted for the HPC site.

ONR will continue its engagement with NNB GenCo and its contractors as required through the working systems that have now been established.

LIST OF ABBREVIATIONS

AF	Assessment finding
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
GDA	Generic Design Assessment
HPC	Hinkley Point C
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
IC	Intelligent Customer
ISFS	Interim Spent Fuel Store
LC	Licence Condition
NNB GenCo	Nuclear New Build Generation Company Ltd
MOX	Mixed Oxide Fuel
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
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 This report presents the findings of the Office for Nuclear Regulation (ONR) assessment of fuel & core and spent fuel storage work streams in support of the licensing of Hinkley Point C. The assessment was undertaken in accordance with the requirements of the Office for Nuclear Regulation 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.

2 It should be noted at the outset that there is little new information on either of the two work streams above that are considered in the GDA process. I am content with this position because both fuel & core and spent fuel storage are “back end”, long lead items that will not be required on site for several years. The intervention Strategy has therefore concentrated on understanding NNB GenCo plans and scrutinising its technical organisation and capability.

1.2 Scope

3 The scope of this report covers the assessment undertaken by ONR under the fuel & core and spent fuel work streams within ONR’s HPC licensing project.

4 At the point of licensing fully developed arrangements under LC14 are not necessary but they will be developed subsequently in a timely manner to satisfy key milestones such as the receipt of fuel to site, first reactor criticality, first spent fuel being placed into storage etc..

1.3 Methodology

5 This assessment was unusual in that it was not an assessment of a specific technical case, but was instead carried out to confirm that the proposals are feasible, that they are in accordance with ONR expectations and to provide confidence that NNB GenCo is a suitable organisation to receive a nuclear site licence. The methodology for the assessment follows ONR BMS document AST/001, Assessment Process (Ref. 1), in relation to the mechanics of assessment within ONR.

2 ASSESSMENT STRATEGY

6 The intended assessment strategy for fuel & core and spent fuel storage work streams in support of the licensing of HPC is outlined in this section. This identifies the scope of the assessment and the standards and criteria that have been applied.

7 As noted above, there is little new information above that presented and considered by ONR as part of the GDA process. As a result my assessment has focussed primarily on the following topics:

- Developing a common understanding between NNB GenCo and ONR of the status of GDA work, assessment findings and issues.
- Defining NNB GenCo's plan for fuel and core.
- Defining NNB GenCo's plan for spent fuel storage.
- ONR scrutiny of NNB GenCo technical capability.

2.1 Standards and Criteria

8 The relevant standards and criteria adopted within this assessment are principally the ONR Safety Assessment Principles (SAP), (Ref. 2), internal ONR Technical Assessment Guides (TAGs), (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

9 The key SAPs applied within the assessment were:

- Key principles EKP.1 to EKP.3.
- Reactor core ERC.1 to ERC.4.
- Strategies for nuclear matter ENM1

10 Further details are given in Table 1.

2.2.1 Technical Assessment Guides

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

- T/AST/024 – Management of radioactive materials and radioactive waste on nuclear licensed sites
- T/AST/023 – Control of processes involving nuclear matter
- T/AST/049 – Licensee use of contractors and Intelligent Customer capability
- T/AST/051 – Guidance on purpose, scope and content of safety cases
- DRAFT TAG 81 – Safety aspects specific to storage of spent nuclear fuel (Ref 4)

2.2.2 National and International Standards and Guidance

12 The following international standards and guidance have been used as part of this assessment (Refs 5, 6):

- WENRA. Waste and Spent Fuel Storage – Safety Reference Level report

- IAEA SSG No15 – Storage of Spent Nuclear Fuel

2.3 Use of Technical Support Contractors

13 No Technical Support Contractors were used for this assessment.

2.4 Integration with other Assessment Topics

14 Clear interfaces exist between a number of ONR specialist teams such as fuel, radiological consequences, severe accident and fault studies, and where possible joint meetings have been held with NNB GenCo to improve efficiency.

2.5 Out-of-scope Items

15 The following items are outside the scope of the assessment.

- Environmental discharges
- Final disposal of spent fuel
- MOX (mixed oxide) fuel and other items identified as out of scope in GDA

3 LICENSEE'S SAFETY CASE

16 The licensee's safety case is essentially that presented in the UK EPR Pre-construction Safety Report (PCSR) (Ref 7).

17 The GDA assessment of the fuel and core aspects are given in the step 4 assessment report (Ref 8). The ONR assessor was broadly satisfied with the claims, arguments and evidence laid down within the PCSR and supporting documentation for the fuel and core design. The assessor concluded that from a fuel and core design view point, the EDF and AREVA UK EPR design is suitable for construction in the UK. However, this conclusion was subject to assessment of additional information that may become available as the GDA Design Reference is supplemented with additional details on a site-by-site basis. Such information is not available at this time, and in my view, is not required for site licensing purposes.

18 The GDA assessment of the radioactive waste and spent fuel aspects are given in the step 4 assessment report (Ref 9). The assessor was broadly satisfied with the claims, arguments and evidence laid down within the PCSR and supporting documentation for the RW&D (radioactive waste and decommissioning). The assessor concluded that from a RW&D view point, the EDF and AREVA UK EPR design was suitable for construction in the UK. However, this conclusion was subject to satisfactory implementation, on a site specific basis, of the proposed plan for the development of waste management facilities put forward in GDA. The plan will need to be updated as the GDA Design Reference is supplemented with additional details on a site-by-site basis. Such information is not available at this time, and in my view, is not required for site licensing purposes.

19 The licensee's safety case presented within GDA was accepted by ONR.

4 ONR ASSESSMENT

20 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

21 As noted above, there is little new information above that presented and considered by ONR as part of the GDA process. Consequently my assessment has focussed on the following topics:

- Developing a common understanding between NNB GenCo and ONR of the status of GDA work, assessment findings and issues
- Defining NNB GenCo's plan for fuel and core.
- Defining NNB GenCo's plan for spent fuel storage.
- ONR scrutiny of NNB GenCo technical capability.

4.2 Assessment

22 The assessment involved scrutiny of NNB GenCo documentation and company procedures via a number of targeted Level 4 meetings and other communications.

4.2.1 NNB GenCo Post GDA Response

23 The GDA step 4 reports made nearly 500 assessment findings (AF) and additional AFs may be raised as the GDA process comes to a close. NNB GenCo is considering how to deal with them and has developed a Company Standard on the management of GDA findings (Ref 10). This is based on three key principles, namely plan, do and review. NNB GenCo has decided that it must address each of the findings to its own satisfaction as part of its licensing responsibility. The GDA AF process has a dedicated programme management, oversight and assistance through the role of a project office, and this is built on experience with EDF NGL with well developed PSR (Periodic Safety Review) processes. ONR will sample some of the key responses.

24 The AFs have been prioritised into two main categories:

- Those that require resolution before first nuclear island concrete, or require early start due to contract constraints
- Those required after first nuclear island concrete

25 Preliminary analysis has suggested that all of the AFs relating to fuel and core fall into the second category. The situation regarding spent fuel is more complex, in that assessment findings were made by a number of technical disciplines and around 30 AFs will require resolution. At this time only three are considered to require resolution before first nuclear island concrete is poured, but the analysis is not yet fully complete.

26 I am content with the approach that NNB GenCo has proposed to deal with GDA assessment findings and the processes that it has developed.

4.2.2 Fuel & Core Workstream

27 NNB GenCo has developed its plans for fuel & core management and has proposed that the safety case development will be split into two phases:

- Adjustment phase (approximately two years). This is essentially a series of sensitivity studies to better define the Hinkley Point C (HPC) core design within the bounds of the existing GDA parameters. The output of the adjusting phase will

enable a better understanding of the proposed operating conditions, fuel product and fuel management requirements. The adjusting phase will not result in a safety case for core operation; that will come later. The current intention is to conclude the adjusting phase by the middle of 2013 and if possible, include the output in PCSR3.

- Realisation phase (approx 3 years). This will provide all of the safety studies required for the pre-commissioning safety report (PCmSR). The realisation phase will commence when the adjusting phase is over. This will include detailed studies leading to a generic safety case. It is anticipated to start around 2014.

28 The bulk of the analysis work will be contracted out to AREVA, but NNB GenCo has established surveillance procedures to monitor the work and its output. NNB GenCo will fulfil the role of Intelligent Customer (see section 4.2.4).

29 There is clearly a need for ongoing dialogue between ONR and NNB GenCo as its plans develop, and this will take place under the auspices of the fuel & core work stream.

30 I am content with the plans that NNB GenCo has proposed regarding the development of a fuel & core safety case. I note that, based on current predictions a generic safety case may be available around 2017, and this is in agreement with my previous comment that fuel and core designs are longer lead items that necessarily occur towards the back end of the overall programme plan.

4.2.3 Spent Fuel Storage

31 NNB GenCo has produced a strategy justification document (Ref. 11) to present the optioneering and technical factors that drove its choice of wet spent fuel interim storage technology, and also to present a high level case for the Interim Spent Fuel Store (ISFS). I have reviewed that strategy justification document and I am content with NNB GenCo's choice of a wet interim spent fuel storage facility for the HPC site.

32 The ISFS (interim spent fuel store) is currently being designed and I note that NNB GenCo has:

- Considered the 5 key safety functions identified by IAEA (control of sub-criticality, residual heat removal, containment, radiation shielding and retrievability).
- Is considering a number of resilience enhancements following the Fukushima event
- Is aware of GDA issues relating to fuel handling and storage

33 There is clearly a need for ongoing dialogue between ONR and NNB GenCo as its plans develop; this will take place under the auspices of the spent fuel work stream (it has been agreed that spent fuel does not fall within the radwaste work stream).

34 I am content with the plans that NNB GenCo has proposed regarding spent fuel storage. I note that, based on current predictions, spent fuel will not be generated until several (at least 5) years after the start of reactor operation. This is in agreement with my previous comment that handling spent fuel is a long lead item that necessarily occurs towards the back end of the overall programme plan. However, it should also be noted that in order to minimise disruption to its HPC neighbours, NNB GenCo has proposed early construction of the ISFS as part of the main construction activities.

4.2.4 NNB GenCo Organisational Capability

35 The ONR SAPs define an Intelligent Customer (IC) as the capability of an organisation to have a clear understanding and knowledge of the product or service being supplied. In terms of this assessment the product relates to fuel & core and spent fuel storage.

36 To fulfil the IC role, NNB GenCo has established a Design Authority department which currently contains 7 Divisions. Spent fuel is part of the Nuclear Island Systems Branch, whilst fuel and core matters belong to the Nuclear Technology Group.

37 Division Ingénierie Nucléaire (DIN) is the Architect Engineer for the EPR, and also provides central engineering support function for the French fleet of nuclear power stations. It comprises of over 6000 people arranged in six centres across France:

- CNEN - Centre National d'Équipement Nucléaire. This department is responsible for the design and construction of the EPR. It also oversees nuclear projects in other countries.
- SEPTEN - Service d'Etudes et Projets Thermiques et Nucléaires. This department provides front end design engineering services for DIN. It is responsible for technical policy, for the design and implementation of preliminary projects, and for forward-planning. It is accountable for adherence to nuclear safety standards, improved reactor core performance and improved fuel performance.
- CNEPE - Centre National d'Équipement de Production d'Électricité. This department provides support for short-term issues and oversees plant modifications for conventional parts such as turbine building and pumping stations.
- CEIDRE - Centre d'Expertise et d'Inspection dans les Domaines de la Réalisation et de l'Exploitation. This department provides expertise in a large number of areas (metallurgy, chemistry, radiochemistry, geology, civil engineering, non-destructive testing, and electrical systems).
- CIPN - Centre d'Ingénierie du Parc Nucléaire en exploitation. This department provides engineering support services for the nuclear components of plants such as the reactor building and nuclear island.
- CIDEN - Centre d'Ingénierie Déconstruction et Environnement. This department is responsible for the dismantling and decontamination of several French decommissioned nuclear power plants, and it produces strategies for the processing of waste produced by decommissioned plants.

38 NNB GenCo has developed a Company Procedure for design, review and acceptance purposes (Ref 12). The procedure describes the processes which enable NNB GenCo to exercise control of proposed design changes for the procurement, construction, and commissioning of the UK EPR. NNB GenCo claims that adherence to the procedure provides:

- Control over the approval route of designs for progression through contract hold points, and implementation through procurement, construction and commissioning.
- The ability to maintain and demonstrate intelligent customer capability through the review of design deliverables provided by the Architect Engineer and other contracted suppliers.

39 I also reviewed the training profile for the lead NNB GenCo fuel and core specialist. The training requirements are extensive and the profile was very clear on what experience is required to achieve the necessary status within the organisation.

40 I have attended a number of NNB GenCo – ONR level 4 technical meetings. DIN supplied support to virtually all of these meetings, and it was clear that a good working relationship and a clear understanding of what is required in the UK is developing between NNB GenCo and its contractors. I also noted that many of the NNB GenCo staff had transferred from the EDF existing fleet support structure, and that I have had

dealings with them in their previous employment. At that time I was of the view that they were diligent and professional and those characteristics are evident in their new postings.

41 I have reviewed a number of key documents and attended meetings with NNB GenCo and its contractors. I am content that NNB GenCo has developed a suitable organisation and that it is exercising its responsibilities as an Intelligent Customer.

4.3 Comparison with Standards, Guidance and Relevant Good Practice

42 I note that NNB GenCo is following IAEA guidance regarding spent fuel storage and is taking cognisance of the ONR SAPS.

43 I also note that fuel design and manufacturing is based on the French RCC-C design and manufacturing rules, and that these are being compared to the UK context. I consider his to be an example of good practice.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

44 This report presents the findings of the ONR assessment of NNB GenCo proposals for fuel & core and spent fuel work streams in support of the HPC project.

45 To conclude, I am satisfied with the claims, arguments and evidence laid down within the Licensee's safety case, and I have not identified any issues in the course of this assessment, from the fuel & core and spent fuel perspectives that would give rise to concerns for granting a nuclear site licence for the HPC site.

5.2 Recommendations

46 From the fuel & core and spent fuel perspectives, no issues have been identified that give rise to concerns over granting a nuclear site licence for the HPC site.

47 ONR will continue its engagement with NNB GenCo and its contractors as required through the working systems that have now been established.

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10 *NNB Generation Company Ltd Company Procedure: Management of GDA findings. NNB-OSL-PRO-000104.* May 2012. TRIM 2012/342817.

11 *The Choice of Interim Spent Fuel Management Storage Technology for the Hinkley Point C UK EPRs*, *Issue 1). NNB-OSL-STR 000034*. October 2011. TRIM 2012/50463.

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Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
EKP.1	Inherent safety	The underpinning safety aim for any nuclear facility should be an inherently safe design, consistent with the operational purposes of the facility.
EKP.2	Fault tolerance	The sensitivity of the facility to potential faults should be minimised.
EKP.3	Defence in depth	A nuclear facility should be so designed and operated that defence in depth against potentially significant faults or failures is achieved by the provision of several levels of protection.
ERC.1	Design and operation of reactors	The design and operation of the reactor should ensure the fundamental safety functions are delivered with an appropriate degree of confidence for permitted operating modes of the reactor.
ERC.2	Shutdown systems	At least two diverse systems should be provided for shutting down a civil reactor.
ERC.3	Stability in normal operation	The core should be stable in normal operation and should not undergo sudden changes of condition when operating parameters go outside their specified range.
ERC.4	Monitoring of safety-related parameters	The core should be designed so that safety-related parameters and conditions can be monitored in all operational and design basis fault conditions and appropriate recovery actions taken in the event of adverse conditions being detected.
ENM.1	Strategies for nuclear matter	The strategies should be consistent with Government policy and integrated with other national strategies.