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Civil Nuclear Reactor Programme (CNRP)

NNB Hinkley Point C: Internal Hazards Workstream Assessment to inform the nuclear site licensing of two UKEPR™ Reactor Units at Hinkley Point C

Assessment Report: ONR-CNRP-AR-12-082
Revision 1
13 February 2013

ASSESSMENT REPORT

Site:	Hinkley Point C
Project:	NNB Hinkley Point C – Assessment of Nuclear Site License Application by EdF NNB
Title:	Internal Hazards Workstream Assessment to inform the nuclear site licensing of two UKEPR™ Reactor Units at Hinkley Point C
Licence Number:	n/a
Licence Condition(s):	n/a
IIS Rating:	3
COIN Service Order:	SVC4174270

Document Identifier

Identifier	Revision	TRIM Reference(s)
ONR-CNRP-AR-12-082	1	2012/324747

Step-based Document Review

Step	Description	Role	Name	Date	TRIM Revision *
1	Initial draft, including identification and mark-up of SNI/CCI	Author	[redacted]	15 August 2012	1
2	Main editorial review	Author	[redacted]	22 August 2012	2
3	Peer Review in accordance with AST/005 Issue 1	Peer Reviewer	n/a		
4	Assessor update / sentencing of comments and return to Peer Reviewer	Author	n/a		
5	Final editorial / clean draft review	Author	n/a		
6	Acceptance review in accordance with AST/003 Issue 4	AUH	[redacted]	04 Sept 2012	3
7	Report Sign-off (Revision 0)	Author / Peer Reviewer / AUH	[redacted]	19 Sept 12	6
8	Pre-publications review comments on Revision 0	Reviewed	[redacted]	07 Jan 2013	7
9	Review comments incorporated – Revision 1	Author	[redacted]	22 Jan 2013	8
10	Final version after NNB review for SNI and CCI	Author	[redacted]	13 Feb 2013	11

* TRIM revision to be identified upon completion of activity and incorporation of any changes to document.

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Document Acceptance (Revision 0)

Role	Name	Position	Signature	Date
Author	[redacted]	HM Inspector HM Principal Inspector	[redacted]	19 September 2012
Peer Review†	N/A	N/A	N/A	N/A
Acceptance‡	[redacted]	HM Superintending Inspector	[redacted]	19 September 2012

Document Acceptance (Revision 1)

Role	Name	Position	Signature	Date
Author	[redacted]	HM Inspector HM Principal Inspector	[redacted]	22 January 2013
Peer Review for Publication	[redacted]	HM Principal Inspector	[redacted]	23 January 2013
Acceptance	[redacted]	HM Superintending Inspector	[redacted]	26 February 2013

Revision History

Revision	Date	Author(s)	Reviewed By	Accepted By	Description Of Change
0	19/09/12	[redacted]	[redacted]	[redacted]	First formal issue.
1	26/02/13	[redacted]	[redacted]	[redacted]	Revised for publication

Circulation (latest issue)

Organisation	Name
ONR	[redacted]
ONR	[redacted]
ONR	[redacted]
ONR	[redacted]
ONR	[redacted]
ONR	[redacted]

† Where required in accordance with ONR HOW2 AST/005 Issue 1.

‡ Hard-copy of document signed-off, TRIM version updated with authors / approver / acceptor names and dates and record finalised.

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EXECUTIVE SUMMARY

Background

This report presents the findings of an internal hazards assessment of NNB Generation Company Limited (NNB) for its suitability to hold a nuclear site licence. The assessment has been principally based on evidence gathered from attendance at meetings with NNB and on briefing material and presentations at those meetings. This has allowed ONR visibility of the steps that NNB have been taking to develop their capability in the subject area of internal hazards in preparation for holding a site licence.

Cognisance has been given to the generic design assessment (GDA) of the UKEPR™ which considered internal hazards for the nuclear island facilities and a number of the associated facilities e.g. the diesel buildings.

Early site specific safety case documentation has been made available by NNB. However, although the internal hazards principles and some of the claims and arguments being made with respect to the resistance of the design to internal hazards are apparent in this early site specific documentation, there are some aspects where the detail is limited. This is not unexpected as the design is still being developed for many of the buildings (other than the nuclear island, covered by the GDA).

ONR guidance on Licensing of Nuclear Installations clarifies that a detailed design and associated safety case is not necessary at the point of granting a nuclear site licence, although appropriate information is needed before construction activities commence. The site licence application however must have sufficient information on the design that the suitability of the site can be judged.

Assessment and Inspection work carried out by ONR

Organisational Capability

The ONR assessment of the suitability of NNB to hold a nuclear site licence with respect to internal hazards has been undertaken through a number of different interactions. This included Level 4 technical meetings on internal hazards, meetings on the GDA project where NNB has been present as an observer, Level 4 meetings on general fire precautions, and a specific inspection at NNB Offices to review suitably qualified and experienced person (SQEP) and intelligent customer capability for internal hazards within NNB Design Authority. NNB has been supported by the Architect Engineer/Responsible Designer and technical support contractors as appropriate at these meetings.

Safety Report

For the purposes of this assessment, ONR reviewed early submissions of site specific Pre-Construction Safety Report (PCSR) sections relevant to the site suitability[4], and supplementary documents. ONR raised comments from this limited internal hazards assessment, but they were not viewed as critical to the judgements made for licence granting.

Matters arising from ONR's work

ONR has reached the view that the evidence in the topic area of internal hazards is sufficient to support granting of a nuclear site licence. There will be areas of Hinkley Point C (HPC) design development which will need internal hazards safety cases, at later phases of design and

[4] NNB have subsequently provided ONR with a full PCSR for Hinkley Point C, “HPC PCSR 2012”, but this was received after the granting of a Nuclear Site License, and after this Assessment Report was written.

construction, and some may be prior to the first nuclear safety concrete Consent. For each of the later phases on the project the internal hazards claims, arguments and evidence will need to be at an appropriate stage of development.

GDA assessment findings for the topic of internal hazards are to be managed by NNB as licensee, and will be resolved through design development and construction phases, but all will need to be resolved prior to bringing plant into service. ONR will monitor the development of the plant design and safety case in the internal hazards area. The aim is to maintain confidence in the robustness of the internal hazards safety case; and, by early engagement, ensure that ONR queries are addressed in a timely manner at all stages of the project, so that future consents are not delayed.

Conclusions

ONR has gained sufficient confidence in the NNB organisational capability in the area of internal hazards with the technical support of the Responsible Designer and appropriate technical support contractors for nuclear site licence granting.

NNB recognises that it will need to develop the design and the safety case in many areas relating to internal hazards as the project progresses and understands that no nuclear safety related construction can take place following the granting of a licence without the Consent of ONR.

Internal hazards safety claims and arguments made so far by NNB for constructing and operating a UKEPR™ twin unit facility at Hinkley Point C are sufficient at this stage for nuclear site licence granting.

Recommendation

In the topic area of internal hazards, it is recommended that a nuclear site licence is granted to NNB for Hinkley Point C.

I recommend that ONR's intervention strategy for Hinkley Point C should include continuing interactions with NNB on their internal hazards safety cases during subsequent project phases; and these will be of greatest effectiveness if they include continuing early engagement to a sufficient detailed level at relevant points throughout the project, and linked to appropriate NNB project hold points.

LIST OF ABBREVIATIONS

ALARP	As low as is reasonably practicable
AE	Architect Engineer[5]
BSL	Basic Safety level (in SAPs)
BSO	Basic Safety Objective (in SAPs)
DA	Design Authority
DAC	Design Acceptance Certificate (
GFP	General Fire Precautions
GDA	Generic Design Assessment
HSE	Health and Safety Executive
IACO	Independent Assessment Challenge and Oversight
IAEA	International Atomic Energy Agency
ITA	Independent Technical Assessment
LC	Licence Condition
LNI	"*Licensing Nuclear Installations*", an ONR publication – see references
NGL	EdF Energy Nuclear Generation Limited
NIO	Nuclear Inspection and Oversight (part of EdF NGL)
NNB	NNB Generation Company Limited
NSDAP	Nuclear Safety Design Assessment Principles
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
RD	Responsible Designer[6]
SAP	Safety Assessment Principle(s) (HSE)
SFAIRP	So far as is reasonably practicable
SQEP	Suitably Qualified and Experienced Personnel

[5] The Architect Engineer role is a role during design and construction, which ceases following initial operation, and is covered in the Assessment Report on NNB GenCo Organisational Capability Arrangements (Ref.13).

[6] The Responsible Designer role is a continuing role through the lifecycle of the project, and is covered in the Assessment Report on NNB GenCo Organisational Capability Arrangements (Ref.13).

LIST OF ABBREVIATIONS

SRD	Safety and Regulatory Department (part of EdF NGL)
SSC	System, Structure and Component
TAG	Technical Assessment Guide(s) (ONR)
TSA	Technical Support Alliance
TSC	Technical Support Contractor
WENRA	Western European Nuclear Regulators' Association

TABLE OF CONTENTS

Tables

1 INTRODUCTION

1.1 Background

1 This report summarises assessment activities within the internal hazards workstream to provide supporting information into a collated ONR project view of the suitability of NNB to be granted a nuclear site licence for two UKEPR™ reactors at Hinkley Point C.

2 The assessment has been principally of information gathered from attendance at meetings with NNB and on briefing material and presentations at those meetings. This has allowed ONR visibility of the steps that NNB have been taking to develop their capability in the subject area of internal hazards in preparation for holding a site licence.

3 Cognisance has been given to the generic design assessment (GDA) of the UKEPR™ which considered internal hazards for the nuclear island buildings and the diesel buildings.

1.2 Scope

4 The scope of the assessment covers NNB's intelligent customer and SQEP capability in the area of internal hazards. It also covers consideration of the adequacy of the Hinkley Point C site with respect to those aspects relating to internal hazards. NNB's organisational capability includes its own staff but also can include access to the designer (Responsible Designer) and external support via contractors.

5 The purpose of the assessment is to inform ONR on the suitability of NNB for receipt of a nuclear site licence in respect to the internal hazards aspects for both its organisational capability and site suitability. In considering the adequacy of the site for the proposed UKEPR™ reactors, it should be noted the impact that the internal hazards safety case has on the site suitability is not considered to be significant. This is because the internal hazards safety case is associated more with the specific design aspects, such as layout and sensitivities from plant failures. External hazards, by contrast are much more site-dependent.

1.3 Methodology

6 The assessment methodology has been developed to take account of a recent publication by ONR titled "*Licensing Nuclear Installations*" (Ref.1). The assessment within the internal hazards work stream has been focussed primarily on the adequacy of the potential licensee - in particular the NNB intelligent customer and SQEP capability – in this technical area. Evidence has been gathered though interactions with NNB personnel (Level 4 meetings and other interactions), many of which NNB have been supported by the Architect Engineer/Responsible Designer and external technical support contractors.

7 Assessment has taken account of the requirements of the Office for Nuclear Regulation (ONR) HOW2 procedure AST/001 (Ref.2).

2 ASSESSMENT STRATEGY

8 The intended assessment strategy for internal hazards is set out in this section. This identifies the scope of the assessment and the standards and criteria that have been applied.

2.1 Scope of assessment

9 The scope of the assessment activities is derived from the intervention strategy described in the IPR (Intervention Project Record) for the Internal Hazard assessment work stream (Ref.3), which was written to be compatible with the overall project intervention strategy for nuclear site licensing for Hinkley Point C.

10 The scope of assessment covers:

- NNB's intelligent customer and SQEP capability in the area of internal hazards, its access to the Architect Engineer, Responsible Designer, and technical support contractors.
- Consideration of the adequacy of the Hinkley Point C site with respect to those aspects relating to internal hazards, as reflected in safety submissions to ONR.

2.2 Standards and Criteria

11 The relevant standards and criteria adopted within this assessment are principally ONR guidance on Licensing Nuclear Installations (Ref.1), the SAPs (Ref.4), internal ONR TAGs, (Ref.5), 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.

2.3 Safety Assessment Principles

12 The key SAPs considered within the assessment are included within Table 1 of this report, and a check against them has been incorporated into the ONR Assessment section of this report, section 4.

2.3.1 Technical Assessment Guides

13 The following Technical Assessment Guides have been considered as part of this assessment (Ref.5 and 7):

- T/AST/014: Internal Hazards (Ref.5)
- T/AST/049: Licensee use of contractors and intelligent customer capability (Ref.6)
- T/AST/079: Licensee Design Authority capability (Ref.7).

2.3.2 National and International Standards and Guidance

14 The following national standards and guidance have been used as part of this assessment:

- Safety Assessment Principles for Nuclear Facilities. 2006 (Ref.4)
- Internal Hazards T/AST/014 Issue 2 August 2008 (Ref.5)
- ONR Licensing Nuclear Installations (Ref.1):

15 Theses have been supplemented by consideration of the following international standards and guidance:

- WENRA Reactor Reference Safety Levels. WENRA. January 2008 (Ref.8)
- International Atomic Energy Agency (IAEA). Safety Standards Series No. SSR 2/1, NSG2.1, NSG1.7, NSG1.1 (Ref.9 to 12))

2.4 Use of Technical Support Contractors

16 No technical support contractors have been used for this assessment

2.5 Integration with other Assessment Topics

17 This assessment is relevant to the ONR assessments of NNB's organisational capability (Ref.13) and of the safety report (Ref.14), and will be made available to the authors of the PARS (Project Assessment Reports) for these areas.

2.6 Out-of-scope Items

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

- GDA Assessment and GDA Issues, since these are being addressed elsewhere in ONR, within the GDA project.
  [However, these issues become part of the overall safety case as it develops, and will come within scope for future Internal Hazard assessments for HPC]

3 LICENSEE'S SAFETY CASE

3.1 NNB Organisational Capability for Internal Hazards Safety Assessment

19 In Oct 2010 NNB appointed an Internal Hazards Lead within NNB Design Authority. His role is to operate within NNB as an intelligent customer and to provide expertise in the internal hazards area. A Level 4 meeting held in October 2010 (Ref.15) detailed the activities of the EdF SA DIN/France organisation and how it was supporting both the design of the generic UKEPR™ and NNB in its site specific activities. An NNB specific organisation chart had been supplied to ONR prior to the meeting and an updated chart was provided in January 2011 (Ref.16). This showed the position of the Internal Hazards Lead within the Operation Safety and Licensing directorate of NNB Design Authority.

20 Since that date NNB have further developed the role and capability. They now have a team working under the Hazards Lead, and access to external contractor resource.

21 During 2011 NNB engaged a fire precautions specialist to operate as the Design Authority with respect to general fire precautions and to ensure that a perspective was being applied that was consistent with the current UK legal framework and existing good practices.

3.2 Hinkley Point C Safety Cases

22 NNB, as the proposed licensee, will produce a safety case for site specific activities and facilities at Hinkley Point C (HPC). This will supplement the EDF and AREVA PCSRs produced as part of Generic Design Assessment (GDA).

23 Early site specific safety case documentation (see sections 3.2.1 and 3.2.4) has been made available by NNB. However, although the internal hazards principles and some of the claims and arguments being made with respect to the resistance of the design to internal hazards are apparent in this early site specific documentation, there are some aspects where the detail is limited. This is recognised in these documents and NNB have declared a significant number of areas requiring further detailed assessment.

24 The site specific safety case considers the site specific activities not considered in the GDA PCSR submission (Ref.17), and also compares the effect of placing two UKEPR™ units on the same site with the GDA safety case to identify areas where the GDA safety case is not applicable. The safety case will be developed as the project progresses such that the level of detail within it is intended to grow to support the various stages of construction, inactive commissioning, active commissioning, operation and ultimately decommissioning. Also NNB have a series of hold points throughout the HPC project where the development of the safety case will be required to be at an appropriate stage before the hold point is released.

3.2.1 Site-specific Pre-Construction Safety Report

25 NNB provided a master document "*Hazards protection design basis and verification*" NSL_B_TECH_10_524 (Ref.18). This report has since been updated and internal hazards have been separated from external hazards and placed into a specific report titled "*Hinkley Point C Internal Hazard Protection Summary Report*"(Ref.19) (see below).

3.2.2 Hinkley Point C Internal Hazard Protection Summary Report

26 The summary report (Ref.19) aims to:

- Confirm the continuing applicability of the GDA PCSR with respect to internal hazards

- Identify changes to the GDA design and any consequences on the applicability of the GDA PCSR
- Present preliminary safety arguments associated with the early concept designs of site specific structures which are additional to the GDA
- Identify a list of outstanding issues to be addressed during further development of the design

The summary report concludes that the internal hazards assessment presented in the GDA is currently applicable to HPC. However it also states that a comprehensive analysis of internal hazards is required for the site specific buildings for both normal operation and during construction.

- Bounding cases for each hazard should be identified and assessed to determine if there will be any consequential hazards to other facilities.
- It states that a number of internal hazards specific outstanding issues have been identified and declares that these issues will be resolved during design development.
- It states that there is no reason to expect that the internal hazards associated with the HPC station design cannot be addressed satisfactorily by appropriate engineering design.

3.2.3 Hinkley Point C PCSR: Batch 5 submission: Heat Sink summary document

27 This document (Ref.20) summarises the proposed design of the heat sink and the associated nuclear safety arguments.

28 It considers a number of internal hazards challenges to the design with a number of them to be detailed in other reports such as turbine disintegration. Consideration has been given to pipework leaks and breaks, failures of tanks, pumps and valves, internal missiles, dropped loads, fire and internal flooding.

29 The main safety claim is that the basic infrastructure of the heat sink design has inbuilt segregation, redundancy and some diversity against internal hazards. The submission identifies a significant number of areas that have been identified as requiring further work. There are also some claims which are derived from the GDA PCSR (Ref.17).

3.2.4 Hinkley Point C PCSR: Batch 3.1 submission: Justification that the site is of a sufficient size

30 This submission (Ref.21) includes:

- A memorandum (ECUK120137) considering the management of hazards generated by a plant under construction on the neighbouring nuclear plant in operation.
- Hinkley Point C PCSR Sub chapter 2.3 Site Plot Plan Summary, HPC-NNBOSL-U0-ALL-RET-000001 version 2
- U.K. Hinkley Point Project: Identification and Review of the Safety Implications of a Twin reactor Design for Hinkley Point C, CN376-700-00002 issue 6

31 All three documents refer to internal hazard challenges:

- The memorandum contains a high level discussion on internal hazards but recognises the need to consider internal hazards as the project progresses.
- The site plot plan summary identified only missiles explosions and fire as internal hazards challenges and goes on to make some initial claims and arguments relating

to the protection against these internal hazards challenges but identifies the need for further work.

- The report "Identification and review of the Safety Implications of a Twin reactor Design for Hinkley Point C" discusses the potential implications of a twin reactor site and considers the hazards associated with shared facilities and one reactor on the other. The internal hazard discussions include broad claims and arguments but no detailed evidence.

3.3 NNB Management of GDA Issues and GDA Assessment Findings

32 For the purposes of this assessment, ONR have taken note of the assessment work done for GDA; in particular the outstanding GDA issues and assessment findings.

33 GDA issues and GDA Assessment are described below:

- GDA Issues
  - The GDA project description of these is:
    A GDA issue is an observation of particular significance that requires resolution before the Office for Nuclear Regulation (ONR), an agency of HSE, would agree to the commencement of nuclear safety related construction of the UK EPR™ within the U.K.
  - GDA issues have been monitored by NNB in respect of the effect on the site specific design. Within ONR the GDA issues are being managed by the GDA project team and their resolution is required prior to the issue of a Design Acceptance Certificate (DAC).
- GDA assessment findings
  - The GDA project description of these is:
    An assessment finding results from a lack of detailed information which has limited the extent of assessment and as a result the information is required to underpin the assessment. They are to be carried forward as part of normal regulatory business.
  - Since these findings are to be resolved over a longer time scale, they do not require resolution prior to the issue of a DAC, or to a nuclear site licence. The prospective licensee (NNB in the case of HPC) will resolve these findings during the site specific design of the UKEPR™.

34 NNB have formulated a procedure for addressing and resolving the GDA assessment findings which has been discussed both at project level, and at Level 4 meetings in the different ONR assessment work streams.

35 NNB's process means that, where possible, GDA Assessment findings have been associated with NNB hold points in the design, construction, installation or operational phases. Hold Point controls will mean that NNB management will require confirmation of successful resolution of associated GDA assessment findings before clearing the Hold Point.

4 ONR ASSESSMENT

36 This assessment has been carried out based upon ONR HOW2 document AST/001, "Assessment Process" (Ref.2) and taking account of the guidance given in ONR document "Licensing of Nuclear Installations" (Ref.1)

4.1 Scope of Assessment Undertaken

37 The scope of the assessment has been described in outline in section 2 of this report.

38 The assessment of internal hazards has focussed on two main areas :

- Organisational capability (see section 4.2.1)
- Consideration of the adequacy of the Hinkley Point C site with respect to those aspects relating to internal hazards. as reflected in safety submissions to ONR (see section 4.2.2)

39 The ONR assessment of NNB for its suitability to hold a nuclear site licence with respect to internal hazards aspects has been undertaken through a number of different interactions:

- Level 4 internal hazards meetings with NNB supported by the Responsible Designer/Architect Engineer and technical support contractors as appropriate.
- A specific inspection of the NNB Internal Hazards Lead to review SQEP and Intelligent Customer capability.
- Attendance of GDA internal hazards interactions between ONR and EDF and AREVA, with NNB representatives present as observers.
  This allowed ONR to see NNB taking an important Intelligent Customer role. NNB is not responsible for GDA delivery, but will need to use the safety case resulting from the GDA Process (i.e. an updated version of the March 2011 GDA PCSR – Ref.17) as a basis for the safety cases for Hinkley Point C.
- Level 4 meetings have taken place with respect to general fire precautions as there is a significant interface of this technical area with internal hazards.
  General fire precautions has also been an agenda item for most of the internal hazards level 4 meetings.

4.2 Assessment

4.2.1 Organisational Capability

4.2.1.1 Structure of organisation

40 The Structure of the NNB organisation, as it relates to internal hazards safety assessments has been described in section 3.1. There is an Internal Hazards Lead within NNB Design Authority, who has a team in support, and access to external contractors. Significant design support comes from EdF DIN/France. NNB also have a fire precautions specialist, and fire issues are discussed with the Internal Hazards Lead.

41 ONR have had routine periodic Level 4 meetings with NNB's Hazards Lead (Ref. 15, 22, 23 and 24), In addition there have been interactions with respect to general fire precautions which has an effect on the building structure and therefore interfaces with the internal hazards safety case. Interactions in this area have provided additional opportunities for ONR to test the ability of the NNB organisation to stand as an independent design authority.

4.2.1.2 SQEP capability and Intelligent Customer role

42 I undertook an inspection of NNB (Ref.25) in order to evaluate the NNB intelligent customer and the SQEP capability for the purposes of informing a decision regarding the suitability of NNB for receipt of a site licence.

43 NNB provided evidence that the Internal Hazards Lead is challenging work done by the Architect Engineer/Responsible Designer and TSA; and that improvements have been made to their submissions as a result.

44 I consider that the internal hazards capability within NNB will have sufficient SQEP capability to act as an intelligent customer on behalf of NNB at the point of licensing. However, there has been no requirement for NNB to produce internal hazards safety cases in house. This is because of the current state of the project. As the project develops, ONR may choose to examine the capability of NNB to generate internal hazards safety cases themselves. I do not view the lack of evidence of this capability to date as a reason to withhold issue of a site licence as the degree of licensee maturity is compatible with ONR guidance (Ref.1).

4.2.1.3 General Fire Precautions

45 There have been a significant number of interactions between ONR and EDF and AREVA relating to general fire precautions over the past 3 to 4 years even though this was not an area specified within the generic design assessment. It was originally perceived that it would be addressed during and beyond the licensing phase.

46 It was recognised by EDF and AREVA and also by NNB as they became involved that there were significant differences in the approach to general fire precautions in the U.K. to those identified for FA3 (Flamanville 3) and it was important to involve a UK specialist to help develop an acceptable approach for the UKEPR™. In response NNB engaged such a person on a full time basis.

47 I considered that this appointment was a positive step towards resolving some of the general fire precaution issues. This also indicates a maturing organisation heading towards a licensing position.

4.2.1.4 Internal challenge

48 At a Level 4 meeting on 19th June 2012 (Ref.24), NNB described how the internal challenge function was being developed.

- A team had been formed within NNB, IACO, to provide the internal challenge and Independent Technical Assessment (ITA) functions. These equate to the roles carried out by Nuclear Inspection and Oversight (NIO) and Assessment Division within Safety and Regulation Division (SRD) in EDF Nuclear Generation Ltd (NGL).
- The IACO team is small and the organisation is in its early stages but NNB intend that this function will grow and will operate in a similar manor to SRD in NGL.

49 NNB presented an example of a safety submission that they decided would benefit from an ITA, and described the temporary arrangements they had put in place. This allowed for an internal challenge (an ITA) while the IACO team was still being developed.

- The temporary arrangements involved use of another team within the Design Authority and a different external consultant. This arrangement was intended to ensure independence between the team carrying out the work and the team that carried out the ITA.
- This example demonstrated that NNB had an organisation which recognised the need to have an appropriate internal challenge position at the licensing stage, and

implemented appropriate measure to achieve this aim. I consider this to be a positive step forward in the development of the NNB organisation.

4.2.1.5 Company processes and procedures relevant to internal hazards

50 At a Level 4 meeting on 15th Feb 2011 (Ref.22), NNB provided details of the strategy and specification for Hinkley Point C Pre-Construction Safety Reports (particularly in the context of the internal hazards aspects).

51 Since the level 4 meeting on the 15 February 2011 the strategy and programme has changed but the intention to develop suitable and sufficient site specific safety cases at appropriate stages of the project has been maintained. This was recognised by ONR to be a sign that the NNB organisation was developing its own internal capability to develop safety cases.

52 At a Level 4 meeting on 8h June 2011 (Ref.23), NNB provided details on the following issues:

- How the Design Authority (DA) are integrated into procurement process.
- NNB procedures for assessing design changes and modifications to the UKEPR™ design
- NNB and AE strategy for dealing with GDA Findings - proposed strategy
- internal hazards for twin-unit nuclear site
- Fire Studies
- General Fire Precautions (GFP)

4.2.2 Safety Submissions with respect to internal hazards

4.2.2.1 Safety Submissions

53 The “Licensing Nuclear Installations” (LNI) document clarifies that ONR do not require a “full site specific PCSR” at the time of granting a nuclear site licence. NNB have adopted this approach – although safety cases will be developed to an appropriate level of detail prior to starting nuclear construction (and each subsequent stage of construction). This is partly driven by the need for detailed plant design prior to completing the PCSR safety studies.

54 ONR therefore will not carry out detailed internal hazards assessment of the site specific documentation until it has been developed beyond its current state. Nevertheless, although detailed assessment has not been undertaken, I have carried out a review of early submissions in order to develop an understanding of the current state of design and of development of the safety case.

4.2.2.1.1 Site-specific Pre Construction Safety Report

55 The site specific PCSR was described in section 3.2.1, This was reviewed shortly after receipt, in particular sections relating to internal hazards, i.e. “*Hazards protection design basis and verification*” NSL_B_TECH_10_524 (Ref.18).

56 This document covered both internal and external hazards, but at a very high level.

4.2.2.1.2 Hinkley Point C Internal Hazard Protection Summary Report

57 The Internal Hazard Protection Summary Report (Ref.19) was described in section 3.2.2. This document considers site specific aspects of the HPC project and makes comparison with the March 2011 GDA PCSR (Ref.17).

58 My review of this recognised that the qualitative arguments within the report are intended as a high level review of internal hazards, with some consideration of the limits of applicability of the GDA PCSR to the HPC site.

59 Claims and arguments are made but no evidence is provided to support those claims and arguments. However the principles adopted in the consideration of internal hazards provides me with some confidence that the challenges from these hazards will be possible to be engineered out as the design progresses. I judge that these will not affect the design sufficiently to challenge licensing of HPC site.

4.2.2.1.3 Hinkley Point C PCSR: Batch 5 submission: Heat Sink summary document

60 This early submission of documents (Ref.20) in support of PCSR was described in section 3.2.3. It summarises the proposed design of the heat sink and associated nuclear safety arguments.

61 Some of the claims and arguments presented in the heat sink report relate to internal hazards. However currently there is no substantive evidence to fully support these claims and arguments. No detailed evidence is provided for the claims and arguments made, and the submission itself identifies significant further work. ONR provided a number of high level internal hazards comments on these to NNB (Ref.26). Responses have been provided by NNB (Ref.27).

62 None of ONR's comments on this submission are considered to represent major challenges to the appropriateness of the Hinkley C site or to the proposed design of the heat sink arrangements. These comments and ONR consideration of NNB responses are therefore not considered to be directly applicable to the issuing of a nuclear site licence. Further development of the internal hazards safety case for these facilities relate to development of detailed design and will be considered by ONR as part of later project permissioning phases.

4.2.2.1.4 Hinkley Point C PCSR: Batch 3.1 submission: Justification that the site is of a sufficient size

63 This early submission of documents (Ref.20) in support of PCSR was described in section 3.2.4.

64 ONR internal hazards assessors have had several PowerPoint presentations on the documents at Level 4 meetings. Additionally, I have looked at their content, scope and conclusions of the documents. This has provided me with sufficient knowledge of the documents to make the judgement that - with respect to internal hazards - ONR do not need to review this batch of safety documentation for the purposes of licensing. No ONR internal hazards comments have been made on this submission to NNB.

65 The documents in these submissions look at the whether the site size is adequate for the plant intended, and include consideration of various hazards. A Site Plot Plan is presented, and this includes information on the likely orientation and distance between the major buildings, the general approach has been to follow established UKEPR™ layout principles, allowing for the exigencies of the site,

66 This means for example, that the turbines are parallel to each other. There is a small probability that – in the unlikely case of major turbine disintegration – this layout option may lead to missiles impacting on the reactor containment and buildings containing safety plant. The safety case made at the moment is that there is robustness in the containment aircraft impact shell, and that other plant is distributed around the site in all safety divisions. This means that it is highly unlikely that plant in all divisions will be affected by the missiles. The safety case being described may be acceptable, since it is

likely that the nuclear risks will be demonstrated to be very low. This will be an issue for discussing at a later phase of the design and safety case development; at which stage I will look for the degree of robustness of plant against missiles as guided by the ONR Internal Hazard TAG (Ref.5).

67 As with the other safety submissions from NNB the internal hazards claims and arguments are fairly broad and little evidence is provided at this stage. However the level of discussion within the documents provides evidence to allow me to make judgements on NNB's developing competency with respect to the nuclear site licensing stage.

4.2.2.2 GDA Assessment

68 For the purposes of this assessment, ONR have taken note of the assessment work done for GDA; in particular the outstanding GDA issues and assessment findings. The definition and interpretation of GDA issues and GDA assessment findings has been described in section 3.3.

69 It is not the intention of this assessment to reconsider those areas covered as part of the GDA that have been undertaken by the ONR GDA team. However it is important that NNB fully understand the scope of the generic design and that this includes the GDA issues and GDA assessment findings. This was discussed during the Level 4 interactions with NNB (for example, Ref.24).

70 During later project stages, ONR intend to monitor the resolution of the internal hazards related GDA assessment findings on a sample basis focussing on those that carry a greater significance. This applies to internal hazards assessment findings, as well as other ONR work streams. As discussed earlier (section 3.3), none of the GDA assessment findings relating to internal hazards require resolution prior to granting a nuclear site licence.

4.2.2.3 Hold points

71 For constructions on nuclear licensed sites that may affect safety LC 19 requires the licensee to make and implement adequate arrangements to control the construction or installation of new plant. Hold points are such a means of achieving a level of control to ensure ordered and sequential progress is made in a safe manner between defined steps of the construction and installation programme.

72 NNB have identified hold points at a number of stages throughout the HPC project. Some relate to project stages where ONR have indicated that primary powers under the site license may apply. The majority of Hold Points are likely not to correspond to ONR consents under primary powers.

73 ONR may intervene at various stages throughout the construction or installation phases either by the use of primary or derived powers if they are not content with the activities being proposed. These powers can only be exercised once a licence has been granted.

74 In the case of the internal hazards work stream, discussions have taken place at the regular Level 4 interactions on the overall project programme and the work content that may relate to each of the NNB Hold Points. There are advantages both to the potential licensee and to ONR as Regulator in early engagement so that there is continuing confidence from both sides. This will require a continuing programme of detailed interactions and discussions over the timing of design work packages, safety studies, formal safety submissions and ONR assessment.

4.2.2.4 General Fire Precautions

75 The General Fire Precautions (GFP) development was not subject to assessment within the GDA Project, and was specifically excluded from the GDA scope,

76 It was recognised by ONR and EDF and AREVA during GDA that it was an area that presented a risk to the project if it was not considered early. Discussions were arranged in order to ensure that appropriate consideration was being given to this area during the design development of the UKEPR™.

77 A number of areas were discussed in some detail at a workshop on 27th Oct 2010 (presentations, Ref.28) and Level 4 meetings held on, 10th Oct 2011 (Ref.29), 29th Nov 2011 (Ref. 30), 12th March 2012 (Ref. 31) and 18th Jul 2012 (Ref. 32) as examples of areas that represented challenges to life safety from fire e.g. selected areas within the reactor building, the fuel building, the diesel buildings and the technical galleries.

78 Other interactions have also taken place at internal hazards Level 4 meetings due to the relationship between GFP and internal hazards.

79 GFP is not specifically linked to the ONR judgements for licensing NNB. However ONR has had the opportunity to see a significant improvement in the approach that initially EDF and AREVA and later NNB have taken with respect to GFP. There is still a considerable amount of work to be done in the area of GFP for the UKEPR™ and site specific facilities at Hinkley Point C. This work may lead to design changes.

80 As previously discussed, and as described in section 4.3.1, ONR do not require a full Site Specific PCSR at the time of granting a nuclear site licence. It is also the case that their design does not yet need to be finalised with respect to GFP. These issues will become important early in the project – GFP also affects other H&S legislation, such as the Construction Design and Management Regulations (Ref.33). Discussions will therefore continue on this issue, and ONR need also to consider the relationships between GFP considerations, security constraints, and the effects on the internal hazards safety cases. Nevertheless, because this issue relates to design and project implementation phases, it is not a matter which affects the advice in this assessment report relating to the granting of a nuclear site license to NNB for HPC.

4.3 Comparison with Standards, Guidance and Relevant Good Practice

4.3.1 ONR document Licensing Nuclear Installations

81 The principal guidance used in this internal hazards assessment report to help make a judgment as to whether NNB should be issued with a nuclear site licence for Hinkley Point C is the recent ONR document "*Licensing Nuclear Installations*" (LNI - Ref.1).

82 This states:

"ONR considers that there are advantages in granting a nuclear site licence as soon as possible, as this enables regulatory control and influence to be brought to bear under the licence conditions. A licence may be granted when ONR is satisfied that the licence applicant's safety documentation provides assurance that the site will be suitable for the proposed activities if the plant is adequately designed, constructed and operated. A full pre-construction safety case report (PCSR) is not necessary at this stage. The licence applicant must be able to show that it has an adequate organisational capability and arrangements in place to manage nuclear safety and comply with the nuclear site licence conditions when the licence is granted. It also needs to have security of tenure on the site Additional benefits of licensing early in the development of a new site include:

- *formal implementation of a licensee's due processes including, for example, the establishment of the licensee's nuclear safety committee, and time for these to bed in;*
- *formalising licensee responsibilities for the procurement of long lead items;*
- *reassurance to stakeholders that appropriate regulatory controls are in place;*
- *alignment of security and licensing requirements*".

83 As described earlier, NNB does not have a full site specific PCSR at this stage, although ONR internal hazards reviews have been carried out of some of the information currently available (sections 3.2.2 to 3.2.4). The suitability of the site for constructing two UKEPR™ units at Hinkley Point C takes account of the GDA PCSR for the generic design of the UKEPR™, and some early submission on key site specific elements.

84 Although this site specific PCSR has not been fully developed, the earlier parts of this report (sections 4.2.2.1.2 to 4.2.2.1.4) show the judgement of ONR that it is at a stage of development sufficient to permit site licence granting with respect to internal hazards.

85 Also, through regular interactions with NNB in the topic area of internal hazards (as described in section 4.2.1, I have gained confidence in the organisational capability.

86 LNI also states: "*A prospective licensee should be aware that the granting of a nuclear site licence is a significant step but is not itself permission to start nuclear-related construction*".

87 This is an important statement as it makes clear that NNB may only start nuclear related construction when ONR is satisfied that sufficient detailed safety analysis has been undertaken by NNB and they have demonstrated that they have an adequate safety case for the particular activities they wish to undertake.

4.3.2 Safety Assessment Principles

88 The ONR SAPs (Ref.4) have also been considered for this assessment in particular the following are considered to be most relevant:

89 In the introduction of the SAPs in the section entitled "*Application of the SAPs*", Paragraph 30, "*New Facilities*" states; **"***One of the aims of the SAPs is the safety assessment of new (proposed) nuclear facilities. They represent NII's view of good practice and NII would expect modern facilities to have no difficulty in satisfying their overall intent*."

90 NNB have considered a number of ONR SAPs in producing their own NSDAPs which are mainly based on the "Safety Requirements" Chapter of the European Utility Requirements (EUR).

4.3.2.1 Fundamental Principles - FP1, FP2 and FP4

91 Fundamental Principles FP1 states "*The prime responsibility for safety must rest with the person or organisation responsible for the facilities and activities that give rise to radiation risks*", FP2 states "*Effective leadership and management for safety must be established and sustained in organisations concerned with, and facilities activities that give rise to, radiation risks*" and FP4 states "*The dutyholder must demonstrate effective understanding of the hazards and their control for a nuclear site or facility through a comprehensive and systematic process of safety assessment*".

92 Through regular interactions with NNB at internal hazards Level 4 meetings it is clear that they understand that they as the prospective licensee are responsible for safety and they

have set up an organisational structure with a strong safety element to it. The safety submissions seen to date show a systematic process of safety assessment and that when fully developed the safety assessment should be comprehensive.

4.3.2.2 Leadership and management for safety MS2 and MS3

93 MS2 Capable organisation states "*The organisation should have the capability to secure and maintain the safety of its undertakings*" and MS3 Decision making states "*Decisions at all levels that affect safety should be rational, objective, transparent and prudent*"

94 The NNB organisation is growing and maturing fairly rapidly as they approach licensing. The internal hazards discipline is also growing in capability, and is considered to be mature enough for licensing. NNB have put in place systems and procedures to ensure that decisions are being carefully made with many checks and balances in place to ensure that they meet the requirements of MS3.

4.3.2.3 Engineering Principles: External and internal hazards - EHA1 to EHA17

95 Although internal hazards have been considered in detail as part of the GDA, this only addressed the Nuclear Island and diesel buildings. The NNB site specific design is still being developed, so the internal hazards safety cases that deal with site specific aspects are not yet available.

96 I have gained confidence from work seen to date. This has shown that elements of these SAPs have been considered, but there is an absence of detail and there is still significant work required to fully address the SAPs. However, NNB have adopted the PCSR for the generic design and are fully aware of the internal hazards requirements for the development of a complete and comprehensive site specific PCSR for HPC.

97 This position is considered to be sufficient for the licensing phase but more detailed and comprehensive safety cases will be required prior to construction activities taking place.

4.3.2.4 Safety case processes - SC2 to SC8

98 The safety case processes identified by these SAPs are essentially in place for NNB even though the site specific safety case for internal hazards requires significant development. There has been evidence of a number of these processes during discussions at Level 4 interactions, some however, such as periodic review processes would not be appropriate yet. I judge that there will need to be further development in this area, related to further safety case submissions, but these developments are expected over time as the project progresses.

4.3.2.5 Siting: ST5 and ST6

99 Siting ST5 *Effect on other hazardous installations* states "*The safety case should take account of any hazardous installations that might be affected by an incident at the nuclear facility*" and Siting ST6 *Multi Facility Sites* states: *"On multi- facility sites, the safety case should consider the site as a whole to establish that hazards from interaction between facilities have been taken into account*".

100 In addressing ST5 and ST6 NNB have produced preliminary cases that consider the interactions that Hinkley Point C may have with the other sites and facilities adjacent to it, and also the interaction those adjacent facilities may have upon HPC from an internal hazards perspective. NNB have not currently identified any significant issues, although there have been some areas that require further detailed development. Section 4.2.2.1.4 includes some additional discussion on, for example, interactions relating to turbine disintegration and missiles.

101 No threats from internal hazards have currently been identified that I consider provide issues that would prevent the construction of twin UKEPR™ units at Hinkley Point C.

4.3.2.6 Engineering principles: human factors - EHF8

102 EHF8 states "*A systematic approach to the identification and delivery of personnel competence should be applied*".

103 NNB have developed training and competency packages for its employees to ensure that its employees possess appropriate development activities and competencies for undertaking specified roles. In the topic area of internal hazards we have seen evidence of this via the interactions with Design Authority (see section 4.2.1), where I judge that the level of competence to date has met ONR expectation.

4.3.3 ONR Technical Assessment Guides

104 Section 2.3.1 includes a list of the most relevant TAGs to this assessment.

4.3.3.1 T/AST/14 internal hazards

105 This assessment guide (Ref.5) covers the consideration of internal hazards. A significant proportion of the guidance makes reference to the ONR SAPs and references a number of IAEA guidance documents. The principles of segregation, redundancy, and diversity for challenges against internal hazards are detailed, together with the need for licensees to define the deterministic and probabilistic criteria against which the licensee will consider the acceptability of safety arguments for internal hazards. The assessment guide is currently undergoing review and revision, but this is mainly to improve the clarity of the report in giving guidance consistent with ONR SAPs.

106 NNB have developed their NSDAPs which details and echoes these requirements, even though they are not yet a licensee. The site specific safety documentation provided so far has also included elements of the requirements that would be expected at early site specific design stages.

107 The assessment guide (Ref.5) has been used throughout this assessment report as it consititutes ONR corporate guidance.

4.3.3.2 T/AST/079 Licensee Design Authority Capability

108 This assessment guide sets out the ONR's expectations for existing and prospective licensees' Design Authority capability. It considers the licensee's approach to:

- Identification and implementation of organisational arrangements and core competencies to understand and manage the design of its plant and the safety functions that need to be provided;
- The use of contractors as 'Responsible Designers' to provide authoritative advice to the Design Authority;
- The retention of design knowledge in a form that is practically and easily available to the licensee over the full lifetime of the plant until the plant is decommissioned.

109 These aspects have been sampled within the topic area of internal hazards through the regular interactions with NNB at Level 4 meetings. NNB has developed many of its arrangements for satisfying the above requirements and is in the process of testing these arrangements and amending them through learning.

110 The current capability of the licensee with regard to internal hazards has been covered in section 4.2.1, where a judgement has been made that NNB have met our expectations for a licensee at the point of being granted a nuclear site licence.

4.3.3.3 T/AST/049 Licensee use of contractors and intelligent customer capability

111 This TAG provides guidance to help Inspectors assess the suitability of the approaches that the licensee takes to maintaining its in-house capability and to its use and oversight of contractors whose work has the potential to impact upon nuclear safety. It considers the following:

- The licensee's identification of the core competencies and resources that it needs to understand its safety case and deliver nuclear safety
- The licensee's approach to use of contractors to perform functions that have the potential to impact on nuclear safety
- The oversight and management of contractors by licensees to ensure nuclear safety and sustain an 'Intelligent Customer' capability

112 These aspects were considered during an internal hazards inspection carried out at NNB (Ref.25) where NNB provided evidence that they had addressed the aspects detailed above. This was discussed in section 4.2.1.2, where I judge that NNB meets my expectations in this area for a licensee at the point of being granted a nuclear site licence.

4.3.4 IAEA Safety Standards

113 The most relevant IAEA standards to this assessment are the following:

- SSR 2/1: *Safety of Nuclear Power Plants Design: Specific Safety Requirements* (Ref.9)
- NSG1.7: *Protection against Internal Fires and Explosions in the Design of Nuclear Power Plants* (Ref.11)
- NSG1.11: *Protection against internal hazards other than Fires and Explosions in the Design of Nuclear Power Plants* (Ref.12)

4.3.4.1 SSR 2/1: Safety of Nuclear Power Plants Design: *Specific Safety Requirements*

114 *Requirement 17: Internal and external hazards States: "All foreseeable internal hazards and external hazards, including the potential for human induced events directly or indirectly to affect the safety of the nuclear power plant, shall be identified and their effects shall be evaluated. Hazards shall be considered for determination of the postulated initiating events and generated loadings for use in the design of relevant items important to safety for the plant*".

115 For internal hazards this process has not been completed, as the site specific design is not complete. However a significant part of the early work has been done to identify internal hazards for the site specific PCSR for twin UKEPR™ units at Hinkley Point C, and the guidance from the LNI document says that a PCSR is not required at this stage (section 4.3.1). I judge that this is sufficient at the point of being granted a nuclear site licence.

4.3.4.2 NSG1.11: *Protection against internal hazards other than Fires and Explosions in the Design of Nuclear Power Plants*

116 Section 2.3. states "*According to the general principle of defence in depth, the following should be considered in the design of a plant:*

- *The prevention or limitation of the occurrence of potential initiating events (PIEs);*
- *The protection of the SSCs whose availability is necessary to bring the plant into and maintain it in a safe shutdown state, or whose failure could result in unacceptable radioactive releases, against all possible effects caused by the PIEs considered;*
- *The robustness of the SSCs (such as their qualification);*
- *Other features, such as possible inherently safe behaviour, redundant parts of systems important to safety, diverse systems and physical separation.*"

117 NNB have considered the above aspects in the development of their site specific safety case. Further development of the safety case will be required prior to any significant nuclear safety construction, and further PIEs and potential SSCs may be identified during this development. Since the guidance from the LNI document says that a PCSR is not required at this stage (section 4.3.1), I judge that this is sufficient at the point of being granted a nuclear site licence.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

118 ONR has gained sufficient confidence in the NNB GenCo Ltd organisational capability in the area of internal hazards with the technical support of the Responsible Designer and appropriate technical support contractors for nuclear site licence granting. In particular:

- NNB have developed an internal hazards capability to the extent that they have demonstrated an intelligent customer capability. They are currently supported by the Responsible Designer and technical support contractors in delivering site specific internal hazards safety documentation.
- The Responsible Designer supporting Hinkley Point C essentially consists of much of the same team that has been supporting the UKEPR™ generic design (as Architect Engineer). This will certainly provide continuity and will be maintained throughout the detailed design and construction phases of the Hinkley Point C twin reactor site.

119 NNB recognises that it will need to develop the design and the safety case in many areas relating to internal hazards as the project progresses and understands that no nuclear safety related construction can take place even following the granting of a licence without the consent of ONR. We note:

- Once Hinkley Point C moves into operation NNB will be supported by the responsible designer and this should help with the continued development of the NNB internal hazards capability.

120 Internal hazards safety claims and arguments made so far by NNB for constructing and operating a UKEPR™ twin unit facility at Hinkley Point C are sufficient at this stage for nuclear site licence granting; however, we consider:

- NNB have not yet required to develop and generate internal hazards safety case documentation in their own right, but this capability is expected to develop as the project progresses, and will continue to be monitored by ONR.

5.2 Recommendations

121 In the topic area of internal hazards, I recommend that a nuclear site licence is granted to NNB GenCo Ltd for Hinkley Point C.

122 I recommend that ONR's intervention strategy for Hinkley Point C should include continuing interactions with NNB on their internal hazards safety cases during subsequent project phases; and these will be of greatest effectiveness if they include continuing early engagement to a sufficient detailed level at relevant points throughout the project, and linked to appropriate NNB project hold points.

6 REFERENCES

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3 CNRP Intervention Project Record: NNB GenCo – *Hinkley Point C - internal hazards Assessment of the NSL License Application to install and operate two EPR Reactor Units at Hinkley Point C*, NNB-HPC1-IPR35, Revision 01 TRIM 2012/72234

4 *Safety Assessment Principles for Nuclear Facilities*. 2006 Edition Revision 1. HSE. January 2008. www.hse.gov.uk/nuclear/SAP/SAP2006.pdf.

5 *Internal hazards* T/AST/014 Issue 2, August 2008 www.hse.gov.uk/nuclear/operational/tech_asst_guides/index.htm.

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14 Assessment Report ONR-CNRP-AR-12-053 *NNB GenCo: Hinkley Point C Safety Report Sub-PAR for Licensing*. TRIM 2012/291971

15 Level 4 meeting internal hazards held on 4/10/2010 TRIM 2011/112459

16 PowerPoint slides – *Structure of DIN organisation*, January 2011 TRIM 2012/296912

17 *UK EPR GDA Step 4 Consolidated Pre-construction Safety Report* – March 2011. EDF and AREVA.
Detailed in EDF and AREVA letter UN REG EPR00997N. 18 November 2011. TRIM 2011/552663

18 NNB GenCo *UK EPR Nuclear Site Licensing HPC PCSR Master Document Hazards Protection Design and Verification* NSL/B/TECH/10/524

19 *Hinkley Point C Internal hazard protection Summary Report* EDF-700-0001 issue 3

20 *NNB PCSR Batch 5 submission for licensing purposes: Adequate cooling* TRIM 2012/61317

21	*PCSR Batch 3.1 Justification that Hinkley Point C is of a sufficient size for a twin unit EPR station*	TRIM 2012/213435
22	Level 4 meeting internal hazards Held 15/2/2011	TRIM 2011/141270
23	Level 4 meeting internal hazards Held 8/6/2011	TRIM 2011/327943
24	Level 4 meeting internal hazards Held on 19/6/2012	TRIM 2012/297775
25	*ONR Intervention Report IR12164 NNB internal hazards inspection*	TRIM 2012/294350
26	*NNB PCSR Batch 5 submission for licensing purposes Adequate cooling - ONR comments to support Level 4 meeting*	TRIM 2012/142778
27	*Response to ONR comments on PCSR Early Submissions (Batch Documents) to support nuclear site licence (NSL) granting for Hinkley Point C (HPC)*	TRIM 2012/296050
28	GFP Workshop held on 27/10/10: *Agenda* *Presentations*	TRIM 2010/530680 TRIM 2010/535823 TRIM 2011/533105
29	GFP Level 4 meeting held on 10/10/11	TRIM 2011/531529
30	GFP Level 4 Teleconference held on 29/11/11	TRIM 2011/611177
31	GFP Level 4 meeting held on 12/03/12 NNB notes	TRIM 2012/312429
32	GFP Level 4 meeting held on 18/07/12	TRIM 2012/306147
33	*Construction (Design and Management) Regulations 2007*	http://www.hse.gov.uk/construction/cdm.htm

Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
EHA.1	External and internal hazards : Identification	External and internal hazards that could affect the safety of the facility should be identified and treated as events that can give rise to possible initiating faults.
EHA.10	Electromagnetic interference	The design of facility should include protective measures against the effects of electromagnetic interference.
EHA.13	Fire, explosion, missiles, toxic gases etc – use and storage of hazardous materials	The on-site use, storage or generation of hazardous materials should be minimised, and controlled and located so that any accident to, or release of, the materials will not jeopardise the establishing of safe conditions on the facility.
EHA.14	Fire, explosion, missiles, toxic gases etc – sources of harm	Sources that could give rise to fire, explosion, missiles, toxic gas release, collapsing or falling loads, pipe failure effects, or internal and external flooding should be identified, specified quantitatively and their potential as a source of harm to the nuclear facility assessed.
EHA.15	Fire, explosion, missiles, toxic gases etc – effect of water	The design of the facility should prevent water from adversely affecting structures, systems and components important to safety.
EHA.16	Fire, explosion, missiles, toxic gases etc – fire detection and fighting	Fire detection and fire-fighting systems of a capacity and capability commensurate with the credible worst-case scenarios should be provided.
EHA.17	Fire, explosion, missiles, toxic gases etc – use of materials	Non-combustible or fire-retardant and heat-resistant materials should be used throughout the facility.
EHA.3	External and internal hazards : Design basis events	For each internal or external hazard, which cannot be excluded on the basis of either low frequency or insignificant consequence, a design basis event should be derived.

Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
EHA.4	External and internal hazards : Frequency of exceedance	The design basis event for an internal and external hazard should conservatively have a predicted frequency of exceedance in accordance with the fault analysis requirements (FA.5).
EHA.5	External and internal hazards :Operating conditions	Hazard design basis faults should be assumed to occur simultaneously with the most adverse normal facility operating condition.
EHA.6	External and internal hazards : Analysis	Analyses should take into account simultaneous effects, common cause failure, defence in depth and consequential effects.
EHF8	Personnel competence	A systematic approach to the identification and delivery of personnel competence should be applied
FP1	Responsibility for safety	The prime responsibility for safety must rest with the person or organisation responsible for the facilities and activities that give rise to radiation risks.
FP2	Leadership and management for safety	Effective leadership and management for safety must be established and sustained in organisations concerned with, and facilities activities that give rise to, radiation risks,
FP4	Safety assessment	The dutyholder must demonstrate effective understanding of the hazards and their control for a nuclear site or facility through a comprehensive and systematic process of safety assessment
MS2	Capable organisation	The organisation should have the capability to secure and maintain the safety of its undertaking
MS3	Decision making	Decisions at all levels that affect safety should be rational, objective, transparent and prudent

Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
SC.2	The regulatory assessment of safety cases	The safety case process should produce safety cases that facilitate safe operation.
SC.3	The regulatory assessment of safety cases	For each life-cycle stage, control of radiological hazards should be demonstrated by a valid safety case that takes into account the implications from previous stages and for future stages.
SC.4	The regulatory assessment of safety cases	A safety case should be accurate, objective and demonstrably complete for its intended purpose.
SC.5	The regulatory assessment of safety cases	Safety cases should identify areas of optimism and uncertainty, together with their significance, in addition to strengths and any claimed conservatism.
SC.6	The regulatory assessment of safety cases	The safety case for a facility or site should identify the important aspects of operation and management required for maintaining safety.
SC.7	The regulatory assessment of safety cases	A safety case should be actively maintained throughout each of the life-cycle stages.
SC.8	The regulatory assessment of safety cases	Ownership of the safety case should reside within the dutyholder's organisation with those who have direct responsibility for safety.
ST5	Effect on other hazardous installations	The safety case should take account of any hazardous installations that might be affected by an incident at the nuclear facility
ST6	Multi facility sites	On multi facility sites, the safety case should consider the site as a whole to establish that hazards from interactions between facilities have been taken into account