Office for Nuclear Regulation

An agency of HSE

Civil Nuclear Reactors Programme

NNB GenCo: Hinkley Point C Fault Studies and Severe Accident Analysis Topic Report for Licensing

Assessment Report: ONR-CNRP-AR-12-127
Revision 1
14 January 2013

Site:	Hinkley Point C
Project:	Hinkley Point C: Nuclear Site Licensing
Title:	NNB GenCo: Hinkley Point C Fault Studies and Severe Accidents Analysis Topic Report for Licensing
Licence Number:	
Licence Condition(s):	
IIS Rating:	
COIN Service Order:	

Document Identifier

Identifier	Revision	TRIM Reference(s)
ONR-CNRP-AR-12-127	1	2012/387223

Step-based Document Review

Step	Description	Role	Name	Date	TRIM Revision[1]
1	Initial draft, including identification and mark-up of SNI/CCI	Author	[redacted]	23 October 2012	
2	Main editorial review	Author	[redacted]	23 October 2012	
3	Peer Review in accordance with AST/005 Issue 1	Peer Reviewer	[redacted]	3 January 2013	
4	Assessor update / sentencing of comments and return to Peer Reviewer	Author	[redacted]	3 January 2013	
5	Final editorial / clean draft review	Author	[redacted]	14 January 2013	
6	Acceptance review in accordance with AST/003 Issue 4	AUH	[redacted]	14January 2013	
7	Report Sign-off	Author / Peer Reviewer / AUH	[redacted]	14 January 2013	

Document Acceptance (Revision 0)

Role	Name	Position	Signature	Date
Author	[redacted]	HM Principal Inspector HM Inspector	[redacted]	23/10/2012
Peer Review	-	-	-	-
Acceptance	[redacted]	HM Superintending Inspector	[redacted]	25/10/2012

[1] TRIM revision to be identified upon completion of activity and incorporation of any changes to document.

Document Acceptance (Revision 1)

Role	Name	Position	Signature	Date
Author	[redacted]	HM Principal Inspector HM Inspector	[redacted]	16/01/2013
Peer Review for Publication	[redacted]	HM Inspector	[redacted]	16/01/2013
Acceptance for Publication	[redacted]	HM Superintending Inspector	[redacted]	25/01/2013

Revision History

Revision	Date	Author(s)	Reviewed By	Accepted By	Description Of Change
0	25/10/2012	[redacted]		[redacted]	First formal issue.
1	25/01/2013	[redacted]	[redacted]	[redacted]	Review with view to web publication

Circulation (latest issue)

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

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EXECUTIVE SUMMARY

Title

NNB GenCo: Hinkley Point C Fault Studies and Severe Accident Analysis Topic Report for Licensing

Background

This assessment report (AR) reviews work by the New Nuclear Build Generation Company (NNB GenCo) to prepare suitable fault studies (also known as design basis analysis, DBA) and severe accident analysis (SAA) for the proposed Hinkley Point C (HPC) nuclear Power Station. It has been written to support a project assessment report (PAR) that addresses whether to issue a Nuclear Site Licence for the Hinkley Point C site to NNB GenCo.

Assessment and Inspection work carried out by ONR

ONR specialist Fault Studies Inspectors have engaged with NNB GenCo in Level 4 meetings and have reviewed the relevant documentation currently available.

Matters arising from ONR's work

ONR has learned that the second issue of the HPC Pre-Construction Safety Report (PCSR2) will not contain complete Design Basis Analysis (DBA) or Severe Accident Analysis (SAA) for the whole site. However, I judge that the progress made by NNB GenCo is adequate for licensing on the basis that there will be a period before the first construction permissioning decision in which NNB GenCo can improve the scope and detail of DBA and SAA.

NNB GenCo's report on the safety implications of the twin reactor site design proposed for Hinkley Point C found that based on the level of design then available there would be no significant increase in level of risk per reactor unit, compared with the Generic Design Assessment (GDA) baseline. The report addressed internal and external hazards, identifying an increase in risk from internal turbine missiles from one reactor unit striking the other but noting the Air Plane Crash (APC) shell will provide some measure of defence for some safety critical plant. Issues unique to multi-unit sites were also examined, such as the effect of a radiological release from one site on the other, plant lifecycle considerations and staffing issues. Lessons learned from the Fukushima incident were also addressed. I judged this position with regard to twin-site risks to be adequate for licensing but I note that it will be necessary for NNB GenCo to complete the areas of further work it has identified to be required.

The question of whether the site-specific features selected for Hinkley Point C introduce conventional island initiating events that were not covered in the generic PCSR is to be addressed by an action on NNB GenCo. The action, for completion by March 2013, is to provide a programme on how NNB GenCo will show that the list of Hinkley Point C design basis faults is complete and that the associated fault frequencies are appropriate.

There is sufficient evidence, for the purposes of licensing, that design basis analysis will be provided for ex-reactor risks such as on-site fuel handling, transport and storage.

PCSR2 will address risks originating from the nearby Hinkley Point A and Hinkley Point B sites and give evidence that the risks from explosions, chemical releases and radiological releases will not have a material effect on the plot plan for the C site.

NNB GenCo's capability in the fault studies area was judged to be adequate for licensing on the basis of experience of the NNB GenCo staff gained during Level 4 meetings with ONR, their

qualifications and experience, and their active liaison with staff from the Architect Engineer (AE). To date, it is not possible to come to a judgement regarding NNB GenCo's intelligent customer capability for work carried out by the AE as no detailed AE analysis work has yet been formally assessed by ONR. Progress on the findings from GDA is adequate for this very early stage of the project, long before any of the due dates.

NNB GenCo has demonstrated in Level 4 meetings with ONR that it has adequate intelligent customer capability for the purposes of licensing in the severe accident analysis area. It has also demonstrated that adequate specialist support is available from the AE and contractors. I consider that NNB GenCo have demonstrated an appropriate commitment to, and are making reasonable progress towards, developing adequate resolution plans for the GDA Findings. Further, the severe accident lead engineer is actively engaged on the proposed design changes arising from lessons learned from the Fukushima incident.

Conclusions

Although some areas for improvement have been identified, NNB GenCo's work on fault studies and severe accident analysis has been found to be adequate for the purposes of Licensing. Accordingly, this report concludes that, from the perspective of fault studies and SAA, there is no impediment to issuing a Nuclear Site Licence.

Recommendation

The author of the PAR addressing whether to issue a Nuclear Site Licence for the Hinkley Point C site to NNB GenCo should note that from the perspective of fault studies and SAA, there is no impediment to issuing a Nuclear Site Licence.

LIST OF ABBREVIATIONS

AE	Architect Engineer
ALARP	As low as is reasonably practicable
APC	Airplane Crash
AR	Assessment Report
AREVA	Proper Name - one of the requesting parties along with EDF for GDA of the EPR™ nuclear power station design
BMS	(ONR) How2 Business Management System
CI	Conventional Island
DA	Design Authority (NNB GenCo)
DBA	Design Basis Analysis
EDF	Electricite de France
EPR™	The design of pressurised water reactor submitted for GDA by EDF/AREVA
GDA	Generic Design Assessment
GDAF	Generic Design Assessment Finding
HSE	Health and Safety Executive
HPC	Hinkley Point C
HPC1	Hinkley Point C Unit 1
HPC2	Hinkley Point C Unit 2
LC	Licence Condition
NI	Nuclear Island
NNB GenCo	New Nuclear Build Generation Company
NSDAPs	Nuclear Safety Design Assessment Principles (NNB GenCo)
NSL	Nuclear Site Licence
ONR	Office for Nuclear Regulation (an agency of HSE)
PAR	Project Assessment Report (ONR)
PCER	Pre-construction Environment Report
PCSR	Pre-construction Safety Report
PSA	Probabilistic Safety Assessment
RGP	Relevant Good Practice
SAA	Severe Accident Analysis
SAP	Safety Assessment Principle(s) (HSE/ONR)
SAWG	Severe Accident Working Group
SFAIRP	So far as is reasonably practicable

LIST OF ABBREVIATIONS

SQEP	Suitably Qualified and Experienced
SSC	System, Structure and Component
TAG	Technical Assessment Guide(s) (ONR)
TSC	Technical Support Contractor

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1 INTRODUCTION

1.1 Background

1 This assessment report (AR) addresses NNB Genco's work on fault studies (design basis analysis, DBA) and severe accident analysis (SAA) for the proposed Hinkley Point C (HPC) nuclear power station. It has been written to support a project assessment report (PAR) that addresses whether to issue a Nuclear Site Licence (NSL) for the Hinkley Point C site to the New Nuclear Build Generation Company (NNB GenCo).

2 Issue 2 of the Hinkley Point C Pre-Construction Safety Report (PCSR2) comprises of a head document and 21 chapters each consisting of a number of sub-chapters. Many of the sub-chapters were adopted verbatim for HPC from the generic PCSR that has been the subject of the Generic Design Assessment (GDA) process (March 2011 version, Ref. 1).

3 NNB GenCo made some site-specific PCSR2 sub-chapters and other supporting documentation available to Office for Nuclear Regulation (ONR) as 'early batches' in order to inform ONR's decision on whether to grant a NSL. This was done in advance of full issue of PCSR2 which occurred in December 2012. The batches address some of ONR's key criteria regarding site suitability. ONR comments on the early submission batches and NNB GenCo's responses are provided in Ref. 2.

1.2 Scope

4 The scope of this report covers fault studies and SAA. The bulk of the fault studies material in PCSR2 will lie in Chapter 14 Design Basis Analysis whilst that on SAA will lie in Chapter 16 Risk Reduction and Severe Accident Analysis.

1.3 Methodology

5 The methodology for the assessment is that laid down in ONR's How2 Business Management System (Ref. 3, nb. the methodology was formerly published as ONR BMS document AST/001, Assessment Process).

2 ASSESSMENT STRATEGY

6 The assessment strategy for the fault studies and SAA component of the HPC safety report pre-Licensing review is set out in this section. The strategy identifies the scope of the assessment and the standards and criteria that have been applied.

2.1 Standards and Criteria

7 The relevant standards and criteria adopted within this assessment are principally the Safety Assessment Principles (SAP), Ref. 4, internal ONR Technical Assessment Guides (TAG), 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.

8 An ONR guide, 'Licensing Nuclear Installations' (Ref. 6), sets the scene for site licence applications. It states (para 61) that "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 Report (PCSR) is not necessary at this stage."

2.2 Safety Assessment Principles

9 The 'Licensing Nuclear Installations' guide (para 97) cites SAPs SC1 to SC8 as being relevant to assessment of safety cases (see Table 1 of this report). Some of the Fundamental Principle and Fault Analysis SAPs are also relevant as detailed in Table 1.

2.2.1 Technical Assessment Guides

10 The 'Licensing Nuclear Installations' guide identifies the following Technical Assessment Guide as detailing ONR expectations that apply to a PCSR:

- T/AST/051 Guidance on the purpose, scope and content of Nuclear Safety Cases

2.2.2 National and International Standards and Guidance

11 No international standards or guidance has been used as part of this assessment.

12 Note that NNB GenCo has developed its own Nuclear Safety Design Assessment Principles (NSDAPs). A review of the HPC design against the NSDAPs is to be included in PCSR2 as a sub-chapter.

2.3 Use of Technical Support Contractors

13 There has been no use of Technical Support Contractors.

2.4 Out-of-scope Items

14 No items relevant to design basis analysis or severe accident analysis have been identified as lying outside the scope of the assessment.

3 APPLICANTS DOCUMENTATION

15 PCSR2 has not been submitted to ONR yet and hence the documentation available to sample is limited to that in the early batches and a very limited number of supporting documents.

16 Early Batch 4 on NNB GenCo's work on Safety Case Management (Ref. 7) includes the Specification for PCSR2. This specification shows that most of the design basis analysis (i.e. Fault Studies) work will be in Chapter 14 titled 'Design Basis Analysis' and that on Severe Accident Analysis will be in Chapter 16 title 'Risk Reduction and Severe Accident Analyses. ONR has also had sight of the 'Masterlist of PCSR2 sub-chapters that indicates which are to be adopted verbatim from the generic PCSR and which are new, site-specific documents (Ref. 8).

4 ONR ASSESSMENT

4.1 Common Approach to DBA and SAA Assessment

17 The broad objective of the intervention in the Fault Studies and SAA topic area was to assess NNB GenCo's progress noting that there are some Generic Design Assessment Findings (GDAFs) that need to be addressed prior to first nuclear island concrete. More specific objectives were to confirm that NNB GenCo:

- has adequate control of the fault studies and severe accident analysis programmes;
- is able to demonstrate an adequate intelligent customer capability;
- has Suitably Qualified and Experienced Personnel (SQEP) to deliver an adequate safety case;
- is capable of producing the site-specific PCSR and safety documentation;
- is making adequate progress in addressing the relevant GDAFs.

18 The intervention has been included Level 4 meetings specifically addressing either fault studies or severe accidents (see Table 2). However, it has also taken account of the Level 4 meetings covering the wider area of fuel, core, fault studies, radiological consequences and severe accidents, which have addressed the overlap between the different technical areas. The fault studies assessment has also taken account of Level 4 meetings on early batch documents and the comments and responses set out in Ref. 1.

4.2 Fault Studies – Assessment of Available Documentation

19 As PCSR2 has not been published yet, assessment has been limited to gauging whether the available documentation shows that fault studies of adequate scope are to be included in PCSR2.

20 Examination of the Masterlist of PCSR2 sub-chapters (Ref. 8) indicates that no additional site-specific sub-chapters are planned in Chapter 14 'Design Basis Analysis', instead only the generic sub-chapters prepared as part of the generic PCSR are to be included, verbatim, along with a chapter summary document. The impression gained is that there will be no site-specific design basis analysis in PCSR2. Noting that the generic PCSR addressed only risks to the nuclear island of a nominal single reactor site, I therefore queried whether PCSR2 would

- cover the effect of the neighbouring reactor on reactor safety

- fully address initiating events occurring beyond the nuclear island (NI), i.e. on the conventional island (CI)
- address ex-reactor nuclear risks (such as those from on-site fuel handling, transport and storage)
- examine risks originating from the nearby Hinkley Point A and Hinkley Point B sites.

21 The succeeding sub-sections address each of these points in turn. NNB GenCo replied in general (Ref. 2, Section 7) that these points would be addressed directly by a supporting reference to Chapter 1 of PCSR2 titled 'PCSR Compliance with Objectives' and that the PCSR2 head document would clarify any exclusions. Furthermore, details of tasks that are not expected to be completed within the timescales of PCSR2 would be provided in Forward Work Plans (FWP) prepared for each chapter.

22 The comments of Ref. 2 also make it clear that a complete Probabilistic Safety Analysis (PSA) will also not be available by the time PCSR2 is published, I judge that this limitation is likely to apply to SAA. Confirmation that PCSR2 will not contain complete DBA, PSA and SAA for the whole site is an important finding as it indicates that PCSR2 alone will not be sufficient to meet the requirements of several ONR SAPs. The relevant SAPs are FA1 to FA10 inclusive and FA15 (see Table 1 for details).

23 I judge that the progress made by NNB GenCo is adequate for licensing on the basis that there will be a period before the first construction permissioning decision in which NNB GenCo can improve the scope and detail of DBA, PSA and SAA. The subject of adequacy of detail of safety justification is addressed more fully in the safety report AR (Ref. 9).

4.2.1 Influence of the neighbouring reactor on reactor safety

24 The generic PCSR addresses a nominal single reactor unit site. However, a twin-reactor unit site is proposed at HPC. As any additional nuclear risks to each reactor from the presence of its neighbour are clearly not going to be addressed in the generic sub-chapters in Chapter 14, I therefore asked NNB GenCo where they were to be addressed.

25 NNB GenCo responded by supplying a site-specific report on the safety implications of the twin reactor design (Ref. 10, submitted as Attachment 2 to Batch 3.1). The report has not been formally assessed. An NNB GenCo workshop session in January 2012 that identified all shared facilities and services on the twin-reactor site found no significant negative impacts and some benefits.

26 The report (Ref. 8) also addressed internal and external hazards, identifying an increase in risk from internal turbine missiles from one reactor unit striking the other but noting the Air Plane Crash (APC) shell will provide a degree of defence for some safety critical plant.

27 Issues unique to multi-unit sites were examined, such as the effect of a radiological release from one unit on the other, plant lifecycle considerations (e.g. construction of the second unit, termed HPC2 whilst fuel is present at HPC1) and staffing issues. Lessons learned from the Fukushima incident were also addressed. Several items of further work were identified for inclusion in NNB GenCo's FWP, e.g. on internal missiles, radiological release impact on the neighbouring unit and on construction of HPC2 after fuel has arrived at HPC1.

28 The report (Ref. 8) concluded that based on the level of design then available, it was expected that there would be no significant increase in level of risk per reactor unit,

compared with the GDA baseline. I judge this response adequate for licensing but note that it will be necessary for NNB GenCo to complete the identified areas of further work.

4.2.2 Influence of initiating events occurring beyond the nuclear island on reactor safety

29 As the generic PCSR was understood to address only the nuclear island (NI), I questioned whether faults occurring beyond the NI would be fully addressed (note that hazards beyond the NI are clearly addressed).

30 NNB GenCo responded (Ref. 1) that the list of design basis faults to be addressed in PCSR2 would be identical to that in consolidated 2011 GDA PCSR and hence would include a range of conventional island (CI) as well as nuclear island faults. NNB GenCo stated that faults with CI initiators are addressed generically so far as possible in the GDA PCSR because the CI systems are site-specific. Examples given of these generic CI faults included turbine trip and loss of condenser vacuum. Loss of ultimate heat sink (LUHS) faults would be addressed as beyond design basis in PCSR2.

31 This leaves open the question of whether the site-specific features selected for HPC introduce CI initiating events that were not covered in the generic PCSR. To clarify the position with respect to CI faults, NNB GenCo accepted an action for completion by March 2013:

NNB GenCo to provide a programme on how it will show that the list of Hinkley Point C design basis faults is complete and that the associated fault frequencies are appropriate.

I judge this position to be adequate for the purposes of licensing.

4.2.3 Ex-reactor nuclear risks

32 The design basis analysis expected to be in Chapter 14 is restricted to consideration of the nuclear risks from the reactor itself. However, ONR requires that there be a safety case, and hence design basis analysis (fault studies), for any operation on the site that might present a nuclear safety risk. ONR defines operations to extend beyond generation to include *inter alia* storing or carriage of any radioactive material or radioactive waste. Risks from these other ex-reactor activities such as on-site fuel handling, transport and storage must be added to those from each reactor to give the total site nuclear risk. I therefore examined the Masterlist to ascertain whether design basis analysis for these ex-reactor activities were to be included in PCSR2.

33 The masterlist includes generic Sub-chapter 9.1 on fuel handling and storage. “Discharges and Waste/Spent Fuel” forms Chapter 11. There is therefore sufficient evidence for the purposes of licensing that design basis analysis will be provided for ex-reactor risks.

4.2.4 Risks from neighbouring nuclear sites

34 Mindful that they could potentially have an impact on the site plot plan, I queried whether risks originating from the nearby Hinkley Point A and Hinkley Point B sites were to be addressed. NNB GenCo responded (Ref. 1) that it did not consider the risks from explosions, chemical releases and radiological releases from the A and B sites to have a material impact on the plot plan for the C site and that evidence to this effect would be presented in PCSR2. This position was judged to be adequate to support licensing.

4.3 Fault Studies – Assessment of NNB GenCo Capability

35 Based on my experience of the NNB GenCo staff tasked to work on fault studies gained at Level 4 meetings, I judge that they have demonstrated adequate control of the fault

studies programme of work by actively liaising with staff from the AE. Similarly I judge that the staff concerned are SQEP having had previous experience in reactor safety case management. However, it is not possible to come to a judgement regarding NNB GenCo's intelligent customer capability for work carried out by the AE as no detailed AE analysis work has yet been formally assessed by ONR.

36 To date, it is not possible to come to a judgement regarding their intelligent customer capability for work carried out by the AE as no detailed AE analysis work has yet been formally assessed by ONR. Progress on the GDAFs is adequate for this very early stage of the project, long before any of the due dates.

37 Based on the above, NNB GenCo's capability is judged to be adequate for licensing.

4.4 Severe Accident Analysis (SAA)

38 In terms of SAA capability, NNB GenCo's Design Authority (DA) currently has a lead engineer who is supported by one other engineer. I have briefly reviewed the severe accident analysis lead engineer role profile and consider that it provides a reasonable reflection of the role. In addition the competency assessment of the individual appeared appropriate with areas for further development being identified and measures put in place to address the identified development needs.

39 NNB GenCo is also being supported by the AE and AREVA who have been represented at the Level 4 meetings. Based upon these meetings there appears to be a good working relationship between the different organisations.

40 I also note that NNB GenCo have secured contractor support from a leading UK consultancy (AMEC) who have extensive SAA expertise. Representatives of the contractor have attended the Level 4 meetings and are principally involved in supporting NNB GenCo in the development of the GDAF's resolution plans.

41 In the context of licensing my view is that NNB GenCo has demonstrated that it has adequate intelligent customer capability in the severe accident analysis area and that adequate specialist support is available from the AE and contractors.

42 As part of addressing the GDAF's NNB GenCo has created a Severe Accidents Working Group (SAWG). The SAWG is made up of representatives from appropriate organisations and has been set up primarily to ensure the GDAF's are progressed in an appropriate and timely manner. At the most recent Level 4 meeting (see Table 2) NNB GenCo reported that the first drafts of the resolution plans for GDAFs required for first nuclear concrete have been produced. I consider that NNB GenCo has demonstrated an appropriate commitment to, and are making reasonable progress towards, developing adequate GDAF resolution plans.

43 I also note that whilst NNB GenCo's response to the accident at Fukushima and in particular the HM Chief Inspector's Recommendations has been managed separately, it has been discussed at the severe accident Level 4 meetings. From these discussions it has been clear that the severe accident lead engineer is actively engaged with the proposed design changes arising from Fukushima.

44 Overall, for the severe accident topic area I consider that NNB GenCo has developed satisfactory 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.

5 CONCLUSIONS

45 This assessment report reviews NNB GenCo's work on fault studies and severe accident analysis (SAA) for the proposed Hinkley Point C (HPC) nuclear Power Station.

5.1 Key Findings from the Assessment

46 NNB GenCo's report on the safety implications of the twin reactor site design proposed for Hinkley Point C found that based on the level of design then available there would be no significant increase in level of risk per reactor unit, compared with the GDA baseline. The report addressed internal and external hazards, identifying an increase in risk from internal turbine missiles from one reactor unit striking the other but noting the APC shell may provide defence for some safety critical plant. Issues unique to multi-unit sites were also examined, such as the effect of a radiological release from one site on the other, plant lifecycle considerations and staffing issues. Lessons learned from the Fukushima incident were also addressed. Several items of further work were identified. I judged this position with regard to twin-site risks to be adequate for licensing but noted that it will be necessary for NNB GenCo to complete the areas of further work it has identified.

47 The question of whether the site-specific features selected for HPC introduce CI initiating events that were not covered in the generic PCSR is not expected to be addressed in PCSR2. It is to be addressed by an action on NNB GenCo for completion by March 2013 to provide a programme on how it will show that the list of HPC design basis faults is complete and that the associated fault frequencies are appropriate.

48 There is sufficient evidence for the purposes of licensing that design basis analysis will be provided for ex-reactor risks such as on-site fuel handling, transport and storage.

49 PCSR2 will address risks originating from the nearby Hinkley Point A and Hinkley Point B sites and give evidence that the risks from explosions, chemical releases and radiological releases will not have a material effect on the plot plan for the C site. This position is judged to be adequate to support licensing.

50 NNB GenCo's capability in the fault studies area was judged to be adequate for licensing on the basis of experience of the staff gained at Level 4 meetings, their SQEP status and their active liaison with staff from the Architect Engineer.

51 NNB GenCo has also demonstrated in Level 4 meetings with ONR that it has adequate intelligent customer capability for the purposes of licensing in the severe accident analysis area. It has also demonstrated that adequate specialist support is available from the AE and contractors. I consider that NNB GenCo have demonstrated an appropriate commitment to, and are making reasonable progress towards, developing adequate GDAF resolution plans. Further, the severe accident lead engineer is actively engaged with the proposed design changes arising from lessons learned from the Fukushima incident.

5.2 Overall Conclusions

52 Based on sampling of the available documentation, and attendance at Level 4 meetings, there are no outstanding concerns that would preclude issue of a Nuclear Site Licence.

53 Hence, with regard to fault studies and SAA, NNB GenCo's progress is judged adequate to justify issue of a Nuclear Site Licence.

6 RECOMMENDATION

54 The author of the PAR addressing whether to issue a Nuclear Site Licence for the Hinkley Point C site to NNB GenCo should note that from the perspective of fault studies and SAA, there is no impediment to issuing a Nuclear Site Licence.

7 REFERENCES

1 UK EPR Pre-construction Safety Report – March 2011 Submission. Submitted under cover of letter EPR00844N. 31 March 2011. TRIM Ref. 2011/200260 and as detailed in UK EPR Master Submission List. March 2011. TRIM Ref. 2011/200786.

2 Response to ONR Comments on PCSR2 Early Submission Batches to Support NSL Granting, Version 1.0, 23 July 2012, HPC-NNBOSL-U0-000-RES-000080, TRIM 2012/296050.

3 *ONR How2 Business Management System. Assessment Process* (formerly AST/001 Issue 4 HSE. April 2010.) www.hse.gov.uk/nuclear/operational/assessment/index.htm.

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

5 *Technical Assessment Guides (TAGs)*. www.hse.gov.uk/nuclear/tagsrevision.htm

6 Licensing Nuclear Installations, published on the ONR website www.hse.gov.uk/nuclear

7 Specification for the Pre-Construction Safety Report PCSR2 for Hinkley Point C, Issue 2, 10 Feb 2012, HPC-NNBOSL-U0-000-SPE-000002, TRIM 2012/118830

8 HPC PCSR2 Master List update for information as at 12 March 2012, TRIM 2012/120160

9 NNB Genco Hinkley Point C Safety Report AR for Licensing, ONR-CNRP-AR-12-053, Rev 0, October 2012, TRIM 2012/291971

10 UK EPR Hinkley Point Project:Identification and Review of the Safety Implications of a Twin Reactor Design for Hinkley Point C CN376-700-00002 Issue 6 Rolls Royce 7 May 2012 TRIM 2012/213435

Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
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.
FP3	Optimisation of Protection	Protection must be optimized to provide the highest level of safety that is reasonably practicable
FP6	Prevention of accidents	All reasonably practicable steps must be taken to prevent and mitigate nuclear or radiation accidents
SC1	Safety Case Process	The process for producing safety cases should be designed and operated commensurate with the hazard, using concepts applied to high reliability engineered systems.
SC2	Safety Case Process	The safety case process should produce safety cases that facilitate safe operation
SC3	Safety Case Process	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.
SC4	Safety Case Characteristics	A safety case should be accurate, objective and demonstrably complete for its intended purpose
SC5	Safety Case Characteristics	Safety cases should identify areas of optimism and uncertainty, together with their significance, in addition to strengths and any claimed conservatism.
SC6	Safety Case Characteristics	The safety case for a facility or site should identify the important aspects of operation and management required for maintaining safety
SC7	Safety Case Maintenance	A safety case should be actively maintained throughout each of the life-cycle stages.
SC8	Safety Case Ownership	Ownership of the safety case should reside within the dutyholder's organisation with those who have direct responsibility for safety.
FA1	Design basis analysis, PSA and severe accident analysis	Fault analysis should be carried out comprising design basis analysis, suitable and sufficient PSA, and suitable and sufficient severe accident analysis.

Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
FA2	Identification of initiation faults	Fault analysis should identify all initiating faults having the potential to lead to any person receiving a significant dose of radiation, or to a significant quantity of radioactive material escaping from its designated place of residence or confinement.
FA3	Fault sequences	Fault sequences should be developed from the initiating faults and their potential consequences analysed
FA4	Fault tolerance	DBA should be carried out to provide a robust demonstration of the fault tolerance of the engineering design and the effectiveness of the safety measures.
FA5	Initiating faults	The safety case should list all initiating faults that are included within the design basis analysis of the facility.
FA6	Fault sequences	For each initiating fault in the design basis, the relevant design basis fault sequences should be identified.
FA7	Consequences	Analysis of design basis fault sequences should use appropriate tools and techniques, and be performed on a conservative basis to demonstrate that consequences are ALARP
FA8	Linking of initiating faults, fault sequences and safety measures	DBA should provide a clear and auditable linking of initiating faults, fault sequences and safety measures
FA9	Further use of DBA	DBA should provide an input into the safety classification and engineering requirements for systems, structures and components performing a safety function; the limits and conditions for safe operation; and identification of requirements for operator actions.
FA10	Need for PSA	Suitable and sufficient PSA should be performed as part of the fault analysis and design development and analysis.

Table 1

Relevant Safety Assessment Principles Considered During the Assessment

SAP No.	SAP Title	Description
FA15	Fault Sequences	Fault sequences beyond the design basis that have the potential to lead to a severe accident should be analysed.

Table 2

Interventions carried out related to Fault Studies and Severe Accident Analysis

Date	Topic	Contact or Intervention report number and TRIM reference
	Joint Meetings on Fault Studies, SAA and Fuel and Core Topic Areas	
12 October 2011	Level 4 Fault Studies, Fuel & Core Design & Severe Accidents Meeting	IR-11-183 2011/562758
2 March 2012	Level 4 Fault Studies/Fuel & Core Design/Radiological Consequences/Severe Accidents meeting	CR-12-032 2012/206558
	Fault Studies Meetings:	
23 May 2012	Level 4 meeting: Fault Studies (Work Stream 4)	IR-12-103 2012/281925
11 September 2012	Planned intervention at Barnwood to Monitor Progress in Responding to Assessment Findings relating to the Hinkley Point C Design	IR-12-185 2012/368893
	Severe Accident Analysis Meetings:	
6 March 2012	Level 4 Severe Accidents 1st Meeting - NNB GenCo	IR 12-040 2012/263520
6 July 2012	Hinkley Point C: 2nd Severe Accidents ONR Level 4 Meeting	IR 12-146 2012/298877