Office for Nuclear Regulation

PROGRESS REPORT			
Unique Document ID and Revision No:	ONR-CNRP-PR-14-034 Revision 0	**TRIM Ref:**	2014/423794
Project:	Phase 2 – New Civil Reactor Build		
Site:	NNB GenCo: Hinkley Point C		
Title:	First Project Convergence Point at Hinkley Point C – Summary Progress Report for the Design and Safety Case Cornerstone		
Nuclear Site Licence No:	97		
Licence Condition(s):	LC20, LC14		
COIN Service Order:	SVC 4263065		

Step-based Document Review

Step	Description	Role	Name	Date	TRIM Revision*
1	Initial Draft, including identification and mark-up of SNI/CCI	Author	[redacted]	24/11/14	5
2	Main editorial review	Author	[redacted]	24/11/14	5
3	Sentencing and incorporation where appropriate of any factual accuracy review comments from NNB GenCo.	Author	[redacted]	16/12/14	6
4	Final editorial / clean draft review	Author	[redacted]	16/12/14	6
5	Acceptance review in accordance with AST/003 Issue 7	Delivery Lead	[redacted]	18/12/14	7
6	Report Sign-off	Author / Delivery Lead	[redacted]	18/12/14	7

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

Document Acceptance

Role	Name	Position	Signature	Date
Author	[redacted]	Inspector	[redacted]	18/12/14
Acceptance[†]	[redacted]	Delivery Lead	[redacted]	18/12/14

Revision History

Revision	Date	Author(s)	Reviewed By	Accepted By	Description of Change
0	18/12/14	[redacted]	N/A	[redacted]	First formal issue

Circulation (latest issue)

Organisation	Name
ONR	[redacted]
	[redacted]
	[redacted]
	[redacted]
	[redacted]
	[redacted]
	[redacted]
	[redacted]
EA	[redacted]
NNB GenCo	[redacted]

[†] *Hard-copy of document signed-off, TRIM version updated with authors / acceptor names and dates and record finalised*

Civil Nuclear Reactors Programme

NNB GenCo: First Project Convergence Point at Hinkley Point C
Summary Progress Report for the Design and Safety Case Cornerstone

Progress Report ONR-CNRP-PR-14-034
Revision 0
18 December 2014

Published 12/2014

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EXECUTIVE SUMMARY

This Office for Nuclear Regulation (ONR) Progress Report summarises the assessment and intervention findings for the first project convergence point of the construction phase of the Hinkley Point C project for the Design and Safety Case cornerstone theme. As such it is a high level summary of 16 individual Progress Reports and one Assessment Report, the publication of the latter having been delayed from the time of the assessment of the Hinkley Point C Pre-construction Safety Report 2012 (HPC PCSR 2012) earlier this year.

Convergence points are milestones in the Hinkley Point C project at which ONR records its collective judgement of the performance of New Nuclear Build (NNB) GenCo and its readiness to proceed with the project as outlined in ONR's Construction Intervention Strategy for the UK EPR™. It should be noted that this first project convergence point has been introduced prior to the start of construction by agreement between ONR and NNB GenCo, with the objective of exercising licensee and regulatory processes. The aim is to de-risk future key milestones' convergence points such as the first primary hold point for the pour of nuclear safety related concrete at the start of the construction phase. As such this first convergence point will not permission or constrain any activities in respect of NNB GenCo and Hinkley Point C.

In its role as Owner, Licensee and Intelligent Customer for the Hinkley Point C project, NNB GenCo has presented its Management Expectation Document and supporting documentation covering its acceptance strategy for the first project convergence point. The aim of these documents is to demonstrate that NNB GenCo understands the content, completeness and robustness of the design Reference Configuration 1 (RC1 and RC1.1) at the start of the detailed design phase of the HPC project. These documents form part of an evidence pack to support its claim to have completed these acceptance activities.

This progress report is one of four cornerstone summary progress reports presenting ONR's collective view of the adequacy of NNB GenCo's performance and development as a licensee. It covers the Design and Safety Case cornerstone theme, which includes the acceptability of Reference Configuration 1, NNB GenCo's readiness for full License Condition (LC)20 arrangements, and an assessment of progress on its timely production of Construction Safety Justification (CSJ-01) and Pre-Construction Safety Report (PCSR-3). The other cornerstone summary progress reports cover Organisation Capability, License Compliance and Security.

The report's conclusions cover the following three main areas:

- Assessment of developments in the Design and Safety Case;
- Assessment of the Design and Safety Case Shadow Hold Point Process;
- Judgement of the current position compared with expectations for First Consent.

The main purposes of this report are to share ONR's overall judgement of the development of Design and Safety Case since the assessment of HPC PCSR 2012 and to provide a clear view on the areas where NNB GenCo needs to focus in the approach to first Consent.

Assessment of progress with the Design and Safety Case

There is a common theme in many of the progress reports that are summarised in this report in that little new safety case material has been submitted by the Licensee since the submission of HPC PCSR 2012. This reflects the delay in the HPC project while NNB GenCo has been waiting for the Financial Investment Decision (FID) to commit funding for the construction of HPC. While this is understandable, it does mean that ONR has had only limited visibility of the design work carried out in the Design and Safety Case areas. Exceptions to this include some progress with the safety categorisation and classification of safety functions and associated Structures, Systems and Components (SSC), the civil design

of structures, the manufacture of primary pressure circuit components and the performance of the “adjusting phase” studies in the fault studies topic area.

The assessment has also highlighted a number of outstanding design risks that still need to be resolved. These are the introduction of diversity into the safeguard building Heating, Ventilation and Air Conditioning (HVAC) system, concerns with the complexity and sizing of the Control and Instrumentation (C&I) system design in general, the electrical loading demand on the Ultimate Diesel Generators (UDGs), consideration of implementation of a Filtered Containment Ventilation (FCV) system, completion and substantiation of the categorisation and classification process, demonstration of adequate safety margins in design basis faults, adequate progress with the closure of Assessment Findings (AFs) associated with the civil design, the adequacy of the turbine disintegration safety case and the choice of Interim Spent Fuel Store (ISFS) technology.

Assessment of the Design and Safety Case Shadow Hold Point Process

Adequacy of NNB GenCo’s acceptance of RC1

With regard to NNB GenCo’s acceptance of RC1, the feedback from inspectors is generally positive. Nevertheless, it must be recognised that NNB GenCo’s acceptance is a conditional acceptance as there are still outstanding modifications to be included within the design reference and there remain some design risks particularly associated with Generic Design Assessment (GDA) AFs on the C&I aspects of the HVAC system and the sizing of the UDGs. A key design decision is still required over the choice of a wet or dry ISFS and the implementation of the safety categorisation and classification methodology is still to be completed with only one Safety Functional Requirement Note (SFRN) issued at the time of this assessment although a second has now been issued. It is highly desirable that these issues are resolved in order to give full confidence in the RC1.1 design reference as suitable starting point for detailed design work.

Progress with the closeout of GDA assessment findings

With regard to progress in the close-out of GDA AFs, there are a number of assessment areas where in the judgement of the inspectors progress should have been more advanced than it is at this stage. In my judgement this represents one of the biggest regulatory risks to the project. It is urgent that progress is made on the resolution of assessment findings in the areas of civil engineering, electrical engineering, C&I, Equipment Qualification (EQ) for hazards, fault studies, severe accident analysis, and the treatment of hazards within the Probabilistic Safety Analysis (PSA).

Implementation of interim modification process and readiness for LC20

Feedback from those inspectors involved in interventions on the modification process was very positive both with regard to NNB GenCo’s interim modification process and its suitability as a basis for future LC20 arrangements. Nevertheless, it must be remembered that the modification process only identifies the preferred design solution and associated future work activities together with a categorisation for nuclear safety. Detailed implementation and substantiation of modifications through the production of a safety case is left to the design process and so there is an inherent design risk that ill-conceived modifications could be adopted into the reference design that need to be reversed at a later stage. As noted in the fault studies intervention, one way to mitigate this design risk would be for NNB GenCo to improve the quality of the information provided to the technical screening process with the Responsible Designer (RD) being encouraged to identify the potential safety dis-benefits of any modification as well as the safety benefits.

Progress with CSJ-01 and PCSR-3

With regard to the preparation of CSJ-01 and PCSR-3, feedback from the inspectors was generally positive. There are risks associated with the choice of ISFS technology. Nevertheless, the inspectors generally considered that preparation of CSJ-01 and PCSR-3 appears to be going well.

Judgement of the current position compared with expectations for First Consent

The report identifies four areas where NNB GenCo needs to focus to manage its regulatory risk:

- To demonstrate through CSJ-01 and the other CSJs that it has decoupled the outstanding design risks associated with the on-going development of the design sufficiently to allow the start of civil construction in advance of PCSR-3 delivery;
- To adequately progress and hopefully accelerate the closure of significant outstanding GDA AFs and issues to mitigate the associated design risk;
- To develop through its List of Deliverables (LoD) adequate work programmes to ensure detailed design reports and design substantiation reports are delivered in a timely manner to enable ONR assessment and feedback, and;
- Through active surveillance of the RD's design activities to ensure that adequate safety cases are provided to substantiate the design and manage the design risk. The RD needs to recognise that the safety case is a strategic document that has to be used to inform and control the design process including the adequate justification of modifications.

Recommendations

My recommendations are as follows:

- Recommendation 1: Based on the advice given in the civil engineering assessment, ONR should commence a series of interventions focussed on NNB GenCo's arrangements for the control and oversight of nuclear related site activities.
- Recommendation 2: ONR should consider raising a Level 3 Issue with regard to the turbine disintegration safety case to ensure adequate consideration of the site layout plan is taken into account to ensure risks are reduced to ALARP.
- Recommendation 3: ONR should continue to focus on the close out of GDA AFs and HPC PCSR 2012 issues.
- Recommendation 4: ONR should work with NNB GenCo to develop an agreed LoD for each topic area to ensure timescales provide adequate time for ONR assessment and feedback. ONR will need to work with NNB GenCo to ensure it has adequate resourcing plans to meet these commitments.
- Recommendation 5: ONR should commence a series of interventions looking at the interface between NNB GenCo and the RD (and AREVA) to ensure adequate control and understanding of the design process is in place.

LIST OF ABBREVIATIONS

AF	Assessment Finding (from the GDA process)
ALARP	As low as is reasonably practicable
AR	Assessment Report
BDR	Basic Design Reference (for Hinkley Point C)
BMS	(ONR) How2 Business Management System
BNI	Balance of Nuclear Island
BOP	Balance of Plant
C&I	Control and Instrumentation
CI	Conventional Island
CMF	Change Management Form
CNRP	Civil Nuclear Reactor Programme
CSFA	Classification Safety Functional Analysis
CSJ	Construction Safety Justification
DA	Design Authority
DAC	Design Acceptance Confirmation
DACC	Design Assurance Co-ordination Committee
DBA	Design Basis Analysis
DDM	Decision de Modification
DDR	Decided Design Reference
DNB	Departure from Nucleate Boiling
EDF	Electricite de France
EPR™	The generic design of pressurised water reactor submitted for GDA
EQ	Equipment Qualification
FA3	Flamanville-3
FID	Financial Investment Decision
GDA	Generic Design Acceptance
HELB	High Energy Line Break
HF	Human Factors
HIC	High Integrity Component
HLW	High Level Waste
HPC	Hinkley Point C
HSE	Health and Safety Executive
HVAC	Heating, Ventilation and Air Conditioning
IDR	Implemented Design Reference
ILW	Intermediate Level Waste
ISFS	Interim Spent Fuel Store
ITA	Independent Technical Assessment

LC	Licence Condition
LoC	Letter of Comfort
LoD	List of Deliverables
MODEM	Monitoring and Decision Meeting
NCSS	Non-Computerised Safety System
NNB GenCo	New Nuclear Build Generation Company
NSC	Nuclear Safety Committee
NSSS	Nuclear Steam Supply System
ONR	Office for Nuclear Regulation
OPEX	Operational Experience
PCmSR	Pre-commissioning Safety Report
PCSR	Pre-construction Safety Report
PCSR 2012	Pre-construction Safety Report 2012
PCSR-3	Working title for document that will succeed PCSR 2012
PR	Progress Report
PSA	Probabilistic Safety Assessment
RC1	Reference Configuration 1
RC1.1	Reference Configuration 1.1
RC2	Reference Configuration 2
RD	Responsible Designer
RMI	Reflective Metallic Insulation
RPV	Reactor Pressure Vessel
SAA	Severe Accident Analysis
SAP	Safety Assessment Principle(s)
SDMS	Structural Design Method Statement
SDM	System Design Manuals
SFAIRP	So far as is reasonably practicable
SQEP	Suitably Qualified and Experienced Persons
SSC	Structures, Systems and Components
TAG	Technical Assessment Guide(s) (ONR)
TSC	Technical Support Contractor
UK	United Kingdom

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1 INTRODUCTION

1.1 Background

1. This progress report summarises the assessment and intervention findings for the first project convergence point of the construction phase of the Hinkley Point C project for the Design and Safety Case cornerstone theme. It is a high level summary of 16 individual progress reports and one assessment report, the publication of the latter having been delayed from the time of assessment of Hinkley Point C Pre-construction Safety Report 2012 (HPC PCSR 2012) earlier this year. Convergence points are milestones in the Hinkley Point C project at which ONR records its collective judgement of the performance of NNB GenCo and its readiness to proceed with the project as outlined in ONR's Construction Intervention Strategy for the UK EPR™ (Refs 1 & 2). It should be noted that this first project convergence point has been introduced prior to the start of construction by agreement between ONR and NNB GenCo, with the objective of exercising licensee and regulatory processes. The aim is to de-risk future key milestones' convergence points such as the first primary hold point for the pour of nuclear safety related concrete at the start of the construction phase. This first convergence point will not permission or constrain any activities in respect of NNB GenCo and Hinkley Point C.

2. In its role as Owner, Licensee and Intelligent Customer for the Hinkley Point C project, NNB GenCo has presented its Management Expectation Document (Ref. 3) and supporting documentation (Refs 4 to 7) covering its acceptance strategy for the first project convergence point. The principal aim of these documents is to demonstrate that NNB GenCo understands the content, completeness and robustness of the design Reference Configuration 1 (RC1 and RC1.1) at the start of the detailed design phase of the HPC project. These reports (Refs 3 to 7) form part of an evidence pack to support its claim to have completed these acceptance activities.

3. This progress report is one of four cornerstone summary progress reports presenting ONR's collective view of the adequacy of NNB GenCo's performance and development as a licensee in the following four areas:

   - Design and safety case, including the acceptability of Reference Configuration 1 (RC1), NNB GenCo's readiness for full LC20 arrangements, and an assessment of progress on its timely production of Construction Safety Justification (CSJ-01) and Pre-Construction Safety Report (PCSR-3);
   - Organisational capability, covering the development of NNB GenCo as a capable and competent licensee in its current state and its development towards readiness for start of construction;
   - Licence Compliance, including the development and status of NNB GenCo licence condition compliance arrangements and its implementation of the Nuclear Site Licence forward work plan;
   - Security, Conventional and Fire Safety, covering the development of NNB GenCo's arrangement to meet national security requirements, and for conventional and fire safety issues related to both the design and on-site activities.

1.2 Scope

4. This summary progress report for the Design and Safety Case cornerstone theme complements the other cornerstone reports to give ONR's overall view of progress to date at this first convergence point. It is based on the progress and assessment reports covering the following individual assessment topic workstreams:

- Categorisation and Classification (Ref. 8);
- Civil Engineering (Ref. 9);
- Structural Integrity (Ref. 10);
- Mechanical Engineering (Ref. 11);
- Equipment Qualification (EQ) (Ref. 12)
- Electrical Engineering (Ref. 13);
- Control and Instrumentation (C&I) (Ref. 14);
- Fuel and Core Design (Ref. 15)
- Interim Spent Fuel Storage (Ref. 16)
- Radioactive Waste and Decommissioning (Ref. 17);
- Reactor Chemistry (Ref. 18);
- Radiological Protection (Ref. 19);
- Human Factors (Ref. 20);
- Fault Studies (Ref. 21);
- Internal Hazards (Ref. 22);
- External Hazards (Ref. 23);
- Severe Accident Analysis (SAA) (Ref. 21)
- Probabilistic Safety Assessment (PSA) (Ref. 24);

5. With the exception of mechanical engineering workstream, the individual progress reports for each workstream cover the period from the completion of the assessment of the HPC PCSR 2012 in March 2014 to NNB GenCo's completion of the first non-permissioned hold point in mid-October 2014. In the case of the mechanical engineering assessment report, the scope covers the assessment of the HPC PCSR 2012 and honours an ONR commitment to publish this report once it became available.

1.3 Methodology

6. The assessments summarised in this progress report were undertaken in accordance with the requirements of the Office for Nuclear Regulation (ONR) How2 Business Management System (BMS) procedure PI/FWD (Ref. 25). The ONR Safety Assessment Principles (SAP) (Ref. 26), together with supporting Technical Assessment Guides (TAG), (Ref. 27), has been used as the basis for this assessment.

1.4 Structure of Report

7. The structure of the report is as follows. In Section 2, the strategy adopted for the assessment is presented including a description of the standards and criteria that have been applied. Any developments in NNB GenCo's safety case since HPC PCSR 2012 are summarised in Section 3. Section 4 is divided into three sub-sections. The first sub-section presents a summary of the on-going assessment work in each of the technical workstreams. Areas where there have been developments in NNB GenCo's safety case are highlighted. This is followed in the next sub-section by an assessment of NNB GenCo's Design and Safety Case Shadow Hold Point process. This focuses on the NNB GenCo's acceptance of RC1, its management of GDA assessment findings, the adequacy of its interim modifications process and its readiness to implement its LC20 arrangements, and its progress in the preparation of CSJ-01 and PCSR-3. Information from these sub-sections is then pulled together in the final sub-section to inform ONR's expectations for the hold point associated with the First Consent. Section 5 presents the conclusions and recommendations.

2 ASSESSMENT STRATEGY

8. The intended assessment strategy for the Design and Safety Case Cornerstone is set out in this section. This identifies the scope of the assessment and the standards and criteria that have been applied. It contributes to, and is consistent with the overall HPC assessment strategies and guidance (Refs 1 & 2). The assessment has been based on the following interventions:

- Routine Level 4 topic meetings;
- Dedicated interventions into particular topics such as the intervention on categorisation and classification (Ref. 8);
- Cross-cutting interventions on the interim design change arrangements for modifications and the management of Generic Design Assessment (GDA) Assessment Findings;
- Assessment of key documentation as outlined in Sections 3 and 4.2.

2.1 Standards and Criteria

9. The relevant standards and criteria adopted within this assessment are principally the Safety Assessment Principles (SAP), Ref. 26, internal ONR Technical Assessment Guides (TAG), Ref. 27, relevant national and international standards and relevant good practice informed from existing practices adopted on UK nuclear licensed sites. The specific SAPs and TAGs used together with any applicable national and international standards, guidance and relevant good practice, are cited within the individual progress reports (Refs 8 to 24).

2.2 Use of Technical Support Contractors

10. No technical support contractors were used in the production of this report.

2.3 Integration with Other Assessment Topics

11. This report summarises all the technical assessment workstreams (Refs 8 to 24) that constitute the Design and Safety Case cornerstone theme.

2.4 Out of Scope Items

12. There are no out-of-scope items. However, it should be recognised that the first convergence point does not permission or constrain any activities in respect of NNB GenCo and Hinkley Point C and so no formal regulatory decisions are being made. Hence the reason why only a summary progress report is being issued at this time rather than a major Assessment Report as defined in ONR's How2 BMS procedure AST/003 Issue 7.

2.5 Issues

13. In interventions with licensees ONR uses regulatory issues to track actions and matters requiring further work from a licensee. ONR issues are divided into 4 levels from 1 – 4 with 1 being an issue of the highest level of concern. ONR's business management system defines the meaning of each level. As a result of ONR's assessment of HPC project to date no level 1 and 2 issues have been raised. Level 3 is a shortfall in regulatory expectations which presents a risk (limited threat) to a positive judgement on a hold point. Level 4 is an action considered as routine regulatory business and in the context of this report mainly refers to updates required in documentation. This report does not describe all issues but those referred to in this report are examples taken from the level 3 issues given in the detailed topic reports.

3 DEVELOPMENTS IN THE LICENSEE'S SAFETY CASE

14. There are currently two versions of the PCSR addressing the safety of the twin UK EPR™ reactor unit facility proposed for construction by NNB GenCo Ltd adjacent to the existing nuclear facilities Hinkley Point A and Hinkley Point B near Bridgewater in Somerset.

15. The first is the final version of the UK EPR™ Generic Design Assessment (GDA) PCSR issued in November 2012 and which formed the basis for issue by ONR on 13 December 2012 of a Design Acceptance Confirmation (DAC) for the generic UK EPR™ design. The GDA PCSR addressed only the key elements of the design of a single UK EPR™ unit (the generic features on the nuclear island) and excluded ancillary installations that a potential purchaser of the design could choose after taking the site location into account. Other matters, for example the turbine hall and conventional island, were also deemed to be outside the scope of the GDA PCSR.

16. The second version is the HPC PCSR 2012 which addresses the whole Hinkley Point C licensed site comprising the proposed twin UK EPR™ units and all ancillary installations. HPC PCSR 2012 is an integration of an earlier 2011 GDA PCSR and new material addressing broader site specific matters not covered during GDA such as the fact that HPC is a twin EPR™ unit site and the selection of heat sink design. Parts of the generic documentation in HPC PCSR 2012 have now been superseded by those in the final GDA PCSR issued in November 2012 (note that the HPC PCSR 2012 and the final GDA PCSR were prepared concurrently).

17. The next issue of the HPC PCSR (current working title PCSR-3) will fully integrate the new generic material in the final GDA PCSR in addition to integrating design changes arising from the reference design for the UK EPR™ namely Flamanville-3. However, this will not be completed until construction of safety significant structures has commenced. In the interim period the safety case to justify the start of construction will consist of the above two PCSRs supplemented by a series of Construction Safety Justifications (CSJs), the first of which is defined as CSJ-01 and relates to the technical galleries (first nuclear safety related concrete pour). CSJ-01 is currently being developed. Consequently, since the issue of the two PCSRs only very limited new safety case material has been made available to ONR for assessment.

18. In the interim period, while it has been waiting for a Financial Investment Decision (FID) to commit funding for the construction of HPC, NNB GenCo has decided to develop an appropriate design reference configuration to de-risk the initial phase of detailed design work and to support the preparation of the CSJs and PCSR-3. NNB GenCo has presented its Management Expectation Document (MED) (Ref. 3) and supporting documentation (Refs 4 to 7) covering its acceptance strategy for the first project convergence point. The aim of these documents is to demonstrate that NNB GenCo understands the content, completeness and robustness of the design reference configuration at the start of the detailed design phase of the HPC project. These reports (Refs 3 to 7) form part of an evidence pack to support its claim to have completed these acceptance activities.

19. For the Design and Safety Case workstream, the MED (Ref. 3) identifies the following acceptance activities and criteria:

- Basic Design Reference (BDR) acceptance;
- Reference Configuration 1 (RC1) conditional acceptance;
- Design Change Process – Implementation of the Interim Process;
- Design Change Process – Readiness for LC20 Process;
- HPC PCSR 2012 ONR Assessment Issues;
- PCSR-3 Preparation and Progress;
- CSJ-01 Preparation and Progress;

- Design Process – demonstration of understanding;
- Design Process – demonstration of engagement and understanding;
- Oversight – Safety Directorate;
- Oversight – Nuclear Safety Committee.

20. The aim of the Basic Design Reference (BDR) (Refs 7 & 28) was to deliver a design reference called Reference Configuration 1 (RC1) that incorporated the modifications resulting from GDA on the UK EPR™ design. This was performed under the following five workstreams:

- C&I and Heating, Ventilation and Air Conditioning (HVAC);
- Classification and Diversification;
- GDA Assessment Findings;
- Flamanville-3 (FA-3) feedback, and;
- NNB GenCo's Design Authorities (DA) review of the GDA design.

21. RC1 (Refs 29 to 31) will be the reference design used as the starting point for detailed design and construction and its safety justification will be provided in PCSR-3. RC1 is intended to set out the requirements, the technical and methodological references, and the outcomes from the design process (Ref. 29) and includes the majority of modifications (Ref. 30) from FA-3 and also the Change Modification Forms (CMF) covering the modifications from GDA. It also identifies NNB GenCo's view of the outstanding risks to the design (Refs 7 & 31). Given the delay in FID the opportunity was taken to include additional modifications into a revised design reference called Reference Configuration 1.1 (RC1.1) although it should be emphasised that RC1.1 has not been assessed by ONR at this point in time. An updated Reference Configuration 2 (RC2) will be used during commissioning and its safety justification will be provided in the Pre-Commissioning Safety Report (PCmSR).

22. BDR acceptance and the Shadow Hold Point Review process have been the subject of Independent Technical Assessments (ITA) (Refs 32 to 35) performed by NNB GenCo's Safety Directorate and regular reports on these activities have also been made to NNB GenCo's Nuclear Safety Committee (NSC) (Refs 5 & 36 to 37).

4 ONR ASSESSMENT

4.1 Scope of Assessment Undertaken

23. The scope of the assessment covers the work performed in the Design and Safety Case cornerstone theme in support of the first convergence point. As well as summarising any significant developments with either the design or the safety case, an assessment is given of NNB GenCo's first Shadow Holdpoint Review Process. This includes a review of NNB GenCo's acceptance of RC1, an assessment of the acceptability of the NNB GenCo's GDA AF resolution plans, NNB GenCo's readiness for full LC20 arrangements, and an assessment of progress on its timely production of Construction Safety Justification (CSJ-01) and Pre-Construction Safety Report (PCSR-3). The assessment concludes with a summary of ONR's expectations with regard to Consent for first nuclear safety related concrete.

4.2 Assessment of Developments in the Design and Safety Case

4.2.1 Categorisation and Classification

24. During GDA the requesting parties developed a safety categorisation and classification methodology (Ref. 8) for the identification of categorised safety functions and associated classified Structures, Systems and Components (SSC) to meet UK and international standards and relevant good practice. NNB GenCo has put in place a significant programme of work to implement this methodology on the UK EPR™ design. The intention is to develop Classification Functional Safety Analysis (CFSA) documents to identify the safety features and their associated classification based upon the underpinning fault schedules. No CFSA documents have been shared with ONR at present. These documents will be used to substantiate the Safety Functional Requirement Notes (SFRN) which summarise the classification of the safety features for each plant system for the Nuclear Steam Supply System (NSSS), Balance of Nuclear Island (BNI), Balance of Plant (BOP) and Conventional Island (CI). The BNI SFRN was the only document available to ONR at the time of this assessment although the BOP/CI SFRN has now also been shared with ONR.

25. The inspector responsible for the assessment of categorisation and classification (Ref. 8) has concluded that there is good visibility of the classification work programme and planned deliverables and there is evidence of general consistency with the classification principles and methodology developed towards the end of GDA. In addition, no significant areas for concern have been identified based on a review of the guidance documents shared with ONR.

26. Although NNB GenCo is making reasonable progress in implementing the classification methodology and principles agreed during the GDA, and there are a number of positive elements to the work programme, there is currently a risk to ONR consenting to the start of construction (first nuclear safety related concrete). This is because at this point in time, the substantiation of the safety classification that is presented in the BNI SFRN and its completeness do not appear adequate. It is of concern that there does not appear to be adequate traceability of the substantiation for the classification presented in the document, which is an essential supporting document for PCSR-3. It is also of some concern that the complete scope of the Classification Functional Safety Analyses (CFSA), which will provide HPC specific substantiation for the classification of SSCs and a principal input into the SFRNs, will not be completed until after PCSR-3, which may result in there being inadequate account taken of the UK context in PCSR-3. For this reason, a level 3 Issue has been raised for NNB GenCo to provide such evidence. NNB GenCo claims there will be adequate substantiation on PCSR-3 timescales. The inspector will consider the evidence supporting this claim when NNB GenCo's response to the level 3 Issue becomes available.

4.2.2 Civil Engineering

27. The civil engineering assessment (Ref. 9) has considered key supporting references to the safety case which have been recently updated and found that progress is being made in addressing previously raised concerns. However, it is considered that there are areas of the design regarding technical galleries where progress is behind expectations. These aspects include categorisation and classification, drainage gallery design philosophy and seismic design methodology. Particular concerns are discussed below.

28. With regard to earthworks which are now in the initial starting phase on the site, the Quality Related Activities (QRA) requiring DA surveillance do not include criteria for storage and acceptance of re-used structural fill materials or for the specifications for testing to verify that formations comply with design requirements.

29. Construction of the technical galleries will be covered by CSJ-01. Since the HPC PCSR 2012 assessment a new Basis of Design Document for the technical galleries has been approved by NNB GenCo. The inspector considers that the Basis of Design is an improvement from the earlier version. The inspector's comments mainly concern the detailed use of the various proposed design codes. The Basis of Design Document has been written by the Responsible Designer (RD) such that a considerable amount of detail with respect to design and analysis methods is left for the detailed designer to describe in its Structural Design Method Statement (SDMS). While this approach does give flexibility to the detailed designer it also leads to the risk that the designer will propose methods that have insufficient rigour. NNB GenCo is currently addressing this risk by a requirement for the RD to approve all SDMS documents and for NNB GenCo to carry out surveillance on the documents. The inspector is currently assessing the detailed designer's SDMS.

30. Further developments have taken place with respect to the design studies for the drainage gallery. In order to address the inspector's concerns a Ground Water Strategy Report has been prepared. This identifies a programme of further design studies that are currently incomplete. Some of the inspector's comments relate to the clarity of the safety arguments advanced in the strategy report, and the inspector considers it to be very important that these are resolved prior to the detailed design being significantly advanced. In particular, the inspector is concerned that the overall claims made rely on structures, systems and components that are not intended to be safety classified (the key example being the piezometers and their associated monitoring system). Evidence needs to be provided that these further design studies fully address the inspector's comments. It is expected that this information will be required to enable detailed design to be completed. The inspector notes that detailed design for the galleries has commenced and there is therefore a risk that the design work may need to be repeated if it is based on inadequate assumptions.

31. Construction of the marine works structures will be covered by CSJ-03. Significant progress has been made in the development of the basic design with the production of a General Hypothesis Note for the marine works structures and a related Structures and Work Description document. The marine works structures are defined as all the offshore structures together with the onshore tunnels and access shafts. The concept design has been developed during an early contractor involvement phase and the designs will be further developed as part of a design and construct contract overseen by the RD. Based upon an assessment of the current progress with the marine works the inspector is broadly satisfied that the concept design is adequately defined to enable the detailed design to commence and that the design standards proposed are appropriate and represent relevant good practice.

32. Construction of the pump house and fore-bay will be covered by CSJ-04. Significant updates have taken place regarding the Heat Sink Structures Basis of Design

document and the pump house and fore-bay have been identified for early construction. Based on sampling of the pump house and fore-bay structures design documents the inspector is broadly satisfied that the basic design is adequately defined to enable the detailed design to commence and that the design standards proposed are appropriate and represent relevant good practice.

33. The Building and Structures Classification Summary Report has been updated since the version assessed as part of PCSR 2012, however it still shows that the technical galleries classification is incomplete, even though detailed design has commenced. A more robust justification is also needed as to why the Turbine Hall building is a seismic Class 2 structure rather than a seismic Class 1 structure.

34. Finally, the inspector recommends that ONR should commence a series of interventions focussed on NNB GenCo's arrangements for the control and oversight of nuclear safety related site activities.

4.2.3 Structural Integrity

35. The structural integrity assessment (Ref. 10) notes that the design of the primary pressure circuit components was defined during the GDA. These components have now been ordered and their manufacture is under way. Nevertheless, there remains areas of residual uncertainty related to the stress and fracture assessments:

- The identification of those locations with low margins has still to be performed;
- These assessments will be based on an AREVA hazard analysis document that has not yet been supplied to NNB GenCo;
- The assessment methodology is not finalised as AREVA is using a modified version of the appropriate design code which NNB GenCo intends to adapt for eventual application to HPC.

36. NNB GenCo's company processes for the ultrasonic inspection of forgings for high integrity components has taken account of ONR interventions and are progressing satisfactory. Similarly, NNB GenCo has demonstrated an understanding of the patterns of segregation in large ferritic forgings and has elicited a ruling by the design code owner to the effect that the forgings are code compliant. Given this, the inspector considers that NNB GenCo have made satisfactory progress in resolving the issues of macro segregation identified in the assessment of HPC PCSR 2012.

4.2.4 Mechanical Engineering

37. As noted in Section 1.2 above, the mechanical engineering assessment (Ref. 11) covers not only the first convergence point but also the mechanical engineering aspects of HPC PCSR 2012; specifically BNI, BOP and CI.

38. The inspector notes that the information provided in HPC PCSR 2012 on the water systems mainly reflects the adoption of the open circuit design for the heat sink; the material being consistent with that included in the site specific Heat Sink Summary Document (HSSD) produced by NNB GenCo in support of the HPC nuclear site license application. The inspector's assessment of the HSSD concluded that the open issues were unlikely to challenge the ability to provide an acceptable heat sink capability; some of these issues have subsequently been progressed giving further confidence on the proposed design.

39. NNB GenCo is progressing with cooling chain studies which will confirm the adequacy of the proposed heat exchangers and provide confidence in the sizing of the main cooling chain system pipework. The latter will support CSJ-01 required to inform ONR's decision as to whether to grant permission for the construction of the technical

galleries in advance of first nuclear island concrete. The inspector will be following this up as part of the on-going mechanical engineering intervention.

40. The information provided in HPC PCSR 2012 on Heating, Ventilation and Air Conditioning (HVAC) systems that provide confinement of radioactive material and maintain acceptable ambient conditions for structures, systems and components important to nuclear safety has had limited changes made to the section addressing the ventilation of the pumping station although the general intent and approach has not altered.

41. During GDA a number of design changes were introduced to the HVAC systems to address the concerns raised by ONR regarding failure of the essential support systems, the key changes being to the safeguard building HVAC. The RD has progressed a conceptual design to address the associated GDA AFs, however ONR has raised concerns with the evolving design and as a result a task force has been established to reach an acceptable position. At this time the inspector is satisfied that the project is taking appropriate measures to mitigate the risk and to be in a position to include sufficient material in PCSR-3.

42. The information provided in HPC PCSR 2012 on the turbo-generator set and the steam and power conversion systems is limited since the preferred bidder for the turbine hall turn-key contract had not been selected at the time the safety report was prepared. The inspector is satisfied that the approach for the turbo-generator and support systems is broadly consistent with established practices.

4.2.5 Equipment Qualification

43. The Equipment Qualification assessment (Ref. 12) notes that no new safety case material has been presented by the licensee. The inspector considers that the conclusions of the earlier assessment for HPC PCSR 2012 remain valid. This identified a number of items that NNB GenCo needed to address in this area, namely:

- confirmation as to the adequacy of the bounding environmental conditions for EQ;
- finalisation of the list of equipment to be qualified for HPC, including severe accident requirements, and;
- confirmation as to whether the Flamanville-3 (FA3) requirements for addressing stability and integrity qualification are adequate in the UK context.

44. Although further clarification has been provided through regulatory meetings a satisfactory position on each remains to be achieved. These items are viewed by NNB GenCo as potential risks to the project and as such are included on the project risk register.

4.2.6 Electrical Engineering

45. The Electrical Engineering assessment (Ref. 13) notes that no new safety case material has been presented by the licensee in the electrical engineering technical area since the GDA PCSR and the HPC PCSR 2012. In the interim, bi-monthly level 4 meetings are being held with the licensee, with additional monthly teleconferences. ONR has also attended a number of workshops and visited the offices of the RD to inspect progress with the electrical engineering aspects relating to emergency diesel generators and BDR deliverables. During these interactions ONR expressed concern with the lack of visibility of a clearly defined emergency generation electrical load schedule for all expected system configurations during normal and fault conditions. In particular, this has been highlighted as a potential concern for the ultimate diesel generation (UDG) systems. Currently from these interactions the following risks of significance have been identified:

- UDG electrical load rating;
- Emergency Diesel Generator (EDG) load margins;
- Common Cause Failure (CCF) and diversity;
- Switchgear and transformer physical sizing (compactness);
- Electrical cable wrapping;
- Cable tray – mechanical loading and heat dissipation.

46. Although, clarification on each of the above has been provided through the regular interface meetings, a satisfactory position remains to be achieved. From interactions it is apparent that these aspects are also viewed by NNB GenCo as potential risks to the project. NNB GenCo has presented its arguments to demonstrate the action it is taking to ensure the risk is mitigated. However, the inspector considers there is insufficient evidence at this stage to judge that the risks posed from each of these aspects are sufficiently controlled.

47. Given that contracts for EDGs and UDGs are likely to be placed before the issue of PCSR-3 and key supporting references, particularly those relating to AFs, the potential impact of these on the firm electrical design could be significant. The inspector has therefore placed an action on NNB GenCo to outline the process that details the philosophy and methodology used to establish EDG and UDG margins and power balance.

4.2.7 Control and Instrumentation

48. The Control and Instrumentation (C&I) assessment (Ref. 14) notes that no new safety case material has been submitted by the licensee in the C&I topic area and that the licensee has stated that no work will be carried out in the C&I topic area to support the CSJs as these predominately relate to civil construction activities.

49. A major outstanding issue from the GDA fault studies assessment concerned the C&I aspects of the HVAC system design. A number of meetings and workshops have been held with the licensee with the aim of discussing the issues of concern and agreeing a way forward.

50. The inspector has emphasised that the following areas should be resolved:

- A completely separate control system should be provided for the diverse HVAC system. This will require a commitment from the licensee to a design change and may require a new control panel in the main control room.

- A preliminary report should be prepared on the impact of a spurious failure of the safety Class 2 control system on the safety Class 1 HVAC system.

51. At a recent workshop the licensee agreed to fully consider these requirements. However, the design of the HVAC system has not yet been fully developed and so this still poses a significant licensing risk at this point in time.

52. The inspector has also attended the office in France of a supplier to inspect the progress being made with the Non-Computerised Safety System (NCSS). The inspector has expressed concern with the slow progress being made with the design and development of the NCSS and the increased sizing and complexity of the C&I architecture (e.g. protection system, safety automation system). In addition, there is uncertainty regarding allocation of functions between C&I systems, sharing of sensors between systems and difficulties in accommodating C&I cabinets within the nuclear island.

4.2.8 Fuel and Core Design (including Criticality Safety)

53. There has been little further development in the licensee's safety case within the fuel and core design (including Criticality safety) technical workstream (Ref. 15) since the GDA PCSR was completed in 2012. Accordingly, the inspector has not conducted any sampling assessments to date. The inspector is generally content with this position since nuclear fuel delivery to the HPC site will be towards the back end of the project.

54. Nevertheless, the licensee has indicated that good progress has been made on the actual fuel design requirements such that fuel contracts can be placed promptly post FID. This will allow the fuel designer to commence work in a timely manner to see which of its fuel products can meet the licensee's requirements. To this end specification of fuel requirements has allowed the fuel supplier to proceed with the design of eight possible loading patterns. This work has been cross checked by the RD giving the RD confidence that the neutronic data and core loading patterns will be bounding for a variety of potential loading patterns within the licensee's desired 18 month (plus or minus 2 months) fuel cycle range.

55. NNB GenCo has reviewed documents produced by the fuel supplier during a so called "adjusting phase" and is closely involved in overseeing developments in fuel management and the impact on the development of the fault studies and the re-load safety case. Work is well advanced on the future core re-load safety case strategy and recommendations have already been produced by the licensee in close consultation with the RD. The licensee's intention is to try to generate a Generic Safety Case which encompasses the majority of the fuel parameters so as to reduce the need for cycle specific analysis as core loading patterns are changed.

56. The RD has a forward work programme for production of under-pinning documentation relating to fuel design although the documentation is unlikely to be available to ONR before the end of 2014. A List of Deliverables (LoD) is also in preparation for 2015 which will aid ONR in the planning of its assessment of this workstream.

57. With regard to criticality safety the RD has now developed a technical specification for the forward work required by the licensee.

4.2.9 Interim Spent Fuel Store

58. The assessment (Ref. 16) of the Interim Spent Fuel Store (ISFS) notes that the licensee has a concept design for a wet ISFS on the HPC site but this concept design and progress on its supporting safety case has been "frozen" by the licensee, while the licensee re-evaluates potential dry storage options for the management of spent fuel. The inspector reports that no real progress has been made with the licensee's safety case since the issue of HPC PCSR 2012.

59. The inspector has received a detailed brief from the licensee on the scope of the re-evaluation work it is conducting for a potential dry store and the reasoning behind this work and is content that the licensee is undertaking a thorough study such that whatever technology is chosen it will be adequately underpinned. Nevertheless, given the potential impact of the dry store on the civil structures such as the fuel building, the inspector has raised an Level 3 Issue on the ONR database requiring adequate justification of the choice before the Consent for first nuclear island concrete.

4.2.10 Radioactive Waste and Decommissioning

60. The radioactive waste and decommissioning assessment (Ref. 17) notes the following:

- NNB GenCo is currently proposing to accumulate Intermediate Level Waste (ILW) ion exchange resins on site for a number of years as current processing

plans utilise machinery in France. The inspector expects this accumulation to be justified.

- Processing of other operational ILW consists of having one facility for both units. The issue of transferring radioactive material across site has been discussed. Appropriate OPEX and safety justification will have to be made for using one facility for both units.
- The current plot plan for HPC has only been reviewed using a limited selection of waste storage packages and yet NNB GenCo is only intending to submit the interim Letter of Comfort (LoC) in 2018 after first nuclear island concrete.
- At the point in time of this assessment decommissioning or radioactive waste arisings do not take into account High Level Waste (HLW).
- Current decommissioning plans are showing that NNB GenCo will not gain a concept LoC for decommissioning wastes until around 2019. NNB GenCo will then use samples of reactive materials subject to activation. It is unclear how NNB GenCo will demonstrate in PCSR-3 how the disposal of all decommissioning ILW and HLW wastes will be achieved.
- At the point in time of this assessment the disposal of control rods does not seem to have been fully considered.
- Spent fuel management and LoC timings will need to be considered when NNB GenCo has completed its review of the management options for spent fuel.
- A number of Level 4 Issues still need to be resolved.

4.2.11 Reactor Chemistry

61. The reactor chemistry assessment (Ref. 18) notes that the safety case for reactor chemistry at HPC has not developed significantly from that assessed as part of the HPC PCSR 2012 assessment. The inspector is content that this is a reasonable position for this stage in the project and remains content that NNB GenCo are progressing matters adequately.

4.2.12 Radiological Protection

62. The radiological protection assessment (Ref. 19) notes that the formal situation has not moved on since HPC PCSR 2012 was issued. However, the inspector has kept abreast of on-going work towards PCSR-3 and has been giving informal feedback. The inspector has no significant concerns as a result of the interaction with the Licensee.

4.2.13 Human Factors

63. The Human Factors (HF) assessment (Ref. 20) notes that in general satisfactory progress is being made in the development of the HF related parts of the safety case for PCSR-3. The inspector notes that the GDA HF safety case provides a sound basis for PCSR-3 and the consolidation at PCSR-3 is unlikely to require substantial changes to this case. However, there will need to be work to both address site specific issues and reconcile the GDA design reference with the reference configuration for PCSR-3. In particular, the HF inputs to building layout reviews provide an important foundation for ensuring adequate access, workspace and workplace ergonomics and these will be important for the HF safety case for CSJs and PCSR-3. The production of an overall HF programme and HF implementation plan is still outstanding. This is a significant omission though it is understood that this should be completed in the very near future.

4.2.14 Fault Studies

64. The fault studies assessment (Ref. 21) notes that a synthesis report has been received presenting the results of the “adjusting phase” fault analysis performed in support of the fuel and core design discussed earlier in Section 4.2.8. The report arrived too late to be assessed as part of this convergence point but will be a major input into the

assessment of PCSR-3. The “adjusting phase” is a set of sensitivity studies conducted to provide confidence in the input assumptions to be considered in the “realisation phase” analysis to support the HPC site specific safety case.

65. The inspector notes that the analysis does not appear to take account of ONR GDA AFs and proposes a core design with high radial power peaking factors. In some cases, analysis results from the adjusting phase had been compared against a criterion of 10% of fuel in Departure from Nucleate Boiling (DNB) conditions. As part of its intervention, ONR has re-iterated that it expects NNB GenCo to target no fuel in DNB for design basis faults. This concern will be the subject of on-going discussions with NNB GenCo.

66. While NNB GenCo is developing a better understanding of the implications of the GDA AFs in the fault studies area concerns remain regarding progress in developing a complete set of resolution plans for all the AFs. There are also significant concerns on specific AFs that are the subject of on-going discussions. These relate to failure of essential support systems and their impact on overall plant safety and include the HVAC system; C&I system; availability and sizing of Ultimate Heat Sink; and the sizing of the Ultimate Diesel Generators as well as issues associated with the removal of lower penetrations in the refuelling cavity and spent fuel pool. As noted by NNB GenCo’s own Independent Technical Assessment (ITA) team (Ref. 32) these outstanding AFs represent significant design risks to RC1 and so need to be resolved.

67. In relation to the GDA AF associated with the choice of thermal insulation used inside containment, NNB GenCo has given a commitment to carry out an ALARP study to consider the advantages of Reflective Metallic Insulation (RMI), and is planning to report the results of this study in the near future. This issue will need to be resolved on a timescale compatible with nuclear island safety related concrete.

68. In addition, NNB GenCo has presented its proposals for its Reload Safety Case. NNB GenCo intends to provide a generic safety case and to carry out simplified cycle-specific check calculations for each fuel cycle. Should more detailed cycle specific analysis be required NNB GenCo has identified a potential provider to carry out these analyses. The inspector has advised NNB GenCo that it is important to retain an in house capability to ensure that the necessary Suitably Qualified and Experienced Person (SQEP) status is maintained within NNB GenCo. The inspector will continue to monitor the Licensee’s developments relating to this aspect as part of normal regulatory activities.

4.2.15 Internal Hazards

69. Five internal hazards methodologies (Ref. 22) have been provided by the licensee to date and these will be crucial in the production of the internal hazards safety case for HPC. The methodologies cover the following hazards:

- Internal Missiles
- Dropped or Impacting Loads
- High Energy Line Break (HELB)
- Fire Studies
- Internal Flooding

70. The inspector has decided that an assessment of these internal hazards methodologies needs to be performed and has elected to use a technical support contractor (TSC) to perform this assessment. This review is currently in progress and any findings will be fed back to the licensee where necessary.

71. Based upon interventions and evidence provided by the licensee over the past 12 months, the inspector is content that the licensee is making acceptable progress in

the subject area of internal hazards. It is clear from the inspector's interventions in this area that the licensee is comfortable in challenging the RD and based on this, significant changes have been made in area of internal hazards.

72. Following changes to the plot layout of the site introduced after GDA but prior to HPC PCSR 2012 assessment there have been a number of discussions regarding turbine disintegration and the importance of both a deterministic and probabilistic argument to ensure the layout of the Hinkley C site is optimal with regards to ensuring risk is as low as reasonably practicable (ALARP). The licensee is taking this issue seriously and will be presenting its deterministic and probabilistic argument in the 2nd quarter of 2015. Nevertheless, the inspector has made a general recommendation that internal hazards safety cases should be supported by both probabilistic and deterministic arguments.

4.2.16 External Hazards

73. The external hazards assessment (Ref. 23) notes that most of the work over the assessment period has been to recruit a range of technical support contractors to enable a comprehensive assessment of the HPC PCSR 2012 and additional relevant documentation, sufficient to inform the inspector's advice with regards to the Consents for First Nuclear Safety Concrete and First Nuclear Island Concrete. There has been limited progress with the assessment work itself, except to formalise the technical findings made in the previous assessment report into formal ONR Issues and to define a sampling rationale for the large amount of documentation that needs to be assessed. Defining a sampling rationale was a significant item of work in itself and was undertaken by a technical support contractor. This same contractor has recently begun detailed assessment work and has developed an approach to presenting its assessment work for each external hazard. At this stage, therefore the previous preliminary assessment report produced for HPC PCSR 2012 still provides a valid statement on the progress of the assessment work itself. The technical issues raised during the preliminary assessment work that have been formalised into ONR Issues relate to frazil ice analysis, site specific beyond design basis criteria, and provision through the licensee's arrangements to monitor external hazards parameters with the aim of facilitating safe operation and the collection of data for the purposes of Periodic Safety Reviews under LC15.

4.2.17 Severe Accidents Analysis

74. In the Severe Accident Analysis (SAA) workstream (Ref. 21) the information is essentially unchanged from that presented in the GDA PCSR in November 2012 and HPC PCSR 2012. Consequently, the assessment of SAA aspects is unchanged from the position reported in the assessment of HPC PCSR 2012 for this topic.

75. While in general NNB GenCo has made good progress in developing credible resolution plans for GDA Assessment Findings, delivery of the close out of the GDA AF on containment overpressure protection system for beyond design basis accidents has yet to reach a satisfactory position and remains a significant concern. However, the inspector notes that NNB GenCo is making progress on its commitment to develop a concept design for a Filtered Containment Ventilation (FCV) System and associated assessment work as part of the resolution of this AF. This work is intended to inform a decision that is to be made by NNB GenCo's board in early 2015 regarding installing FCV in HPC. A supporting technical paper is to be produced which will provide further detail to ONR on similar timescales. This issue will need to have been resolved on a timescale compatible with nuclear island safety related concrete.

76. In terms of site specific severe accident analysis the inspector notes that the overall risk of a twin-reactor site will be addressed and that the existing GDA severe accident analysis will be reviewed to consider the site specific input parameters for HPC. Completion of this work is important in terms of developing the HPC safety case.

4.2.18 Probabilistic Safety Analysis

77. The Probabilistic Safety Analysis assessment (Ref. 24) notes that the safety case to support NNB GenCo's request to start construction of the nuclear island, known as PCSR-3, will be based on a PSA model (batch 4) with a reference design for the earlier Decided Design Reference (DDR). Although the PSA is planned to be updated (batch 5) to reflect RC1.1 prior to ONR granting Consent for start of nuclear island construction, this will only be a few months before the consent is required. There is therefore a risk to the second consent if the batch 5 PSA model identifies any significant issues.

78. Although NNB GenCo's adopted PSA strategy is clearly a compromise and there remain a number of uncertainties regarding PSA plans post start of nuclear island construction and the timing and scope of the (batch 5) PSA model, the inspector does not consider there are any significant issues regarding the PSA strategy that would affect ONR's decision whether to consent or not to the start of construction (either safety related concrete or nuclear island concrete).

79. Assessment (by sampling) of the PSA deliverables shared with ONR at this point in time has not led to any significant concerns being identified regarding the comprehensiveness of the documentation, capability of NNB GenCo or the RD or significant risks that may impact the first two formal ONR consents. Although a number of areas of uncertainty have been highlighted that will be followed-up under normal regulatory business, the inspector considers that NNB GenCo and the RD have made good progress in the area of risk informed design. The areas of uncertainty highlighted in the progress report (Ref. 24) are not significant risks to ONR's first two consents and will be discussed with NNB GenCo as normal regulatory business.

4.3 Assessment of the Design and Safety Case Shadow Hold Point Process

80. To assess the effectiveness of the Shadow Holdpoint Process in the Design and Safety Case workstream ONR decided to sample the following areas based upon the acceptance criteria presented in the MED (Ref. 3):

- BDR and RC1 acceptance including the adequacy of GDA AF resolution plans;
- Design Change Process including interim arrangements and readiness for LC20 arrangements;
- Preparation of CSJ-01 and PCSR-3
- Intelligent Customer capability (to understand and control the design process);
- ITA oversight;
- Decision making process.

81. In the following sections, inspectors were asked to provide feedback on the adequacy of NNB GenCo's acceptance RC1, GDA AFs resolution plans, the design change process and the preparation of CSJ-01 and PCSR-3. The assessment of NNB GenCo's intelligent customer capability, the oversight provided by the ITA team and the whole Safety Directorate and the effectiveness of the decision making process are reported in the summary progress report for the Organisational Capability cornerstone theme (Ref. 38).

4.3.1 NNB GenCo Acceptance of RC1

82. The inspector responsible for the assessment of Categorisation and Classification (Ref. 8) has no significant concerns regarding NNB GenCo's acceptance of RC1. Although the role of the RC1 description document (Ref. 29) was not clear to the NNB GenCo safety categorisation and classification work stream, the inspector considers NNB GenCo has carried out a reasonable assessment of the risk at RC1. However, the inspector considers that NNB GenCo has underestimated the risk associated with

the maturity of the SFRNs and CFSAs. Specifically, the SFRNs are not included in the RC1 description and only two out of the three SFRNs have so far been completed. It is unclear to the inspector how NNB GenCo was able to accept the design reference configuration RC1 without having issued all these documents. However, it is recognised that NNB GenCo has identified this limitation, which is captured in the RC1 risk assessment.

83. The civil engineering assessment (Ref. 9) has found that there are a number of key documents that do not appear to be included in Reference Configuration 1. Specifically, the list of RC1 documents does not contain a Basis of Design document for the following structures that are within the scope of the CSJs:

- Marine works (CSJ-03);
- Pre-stressing gallery (CSJ-05);
- Superstructure of the Turbine Hall (CSJ-06).

84. In addition, RC1 does not contain a hypothesis note for the design of the common raft which is a key design definition document for the nuclear island. There are also inconsistencies in RC1 as to which technical specifications for design have been included. Finally, the resolution plans for four GDA AFs have not been included within RC1.

85. The inspector responsible for the assessment of Equipment Qualification (Ref. 12) has looked at the content of RC1 and is satisfied that it identifies the key EQ related documents including the various Basic Design Reference (BDR) deliverables.

86. The electrical engineering assessment (Ref. 13) has identified no indications to suggest that risks are not currently being adequately managed and the evidence presented indicates that the licensee has exercised adequate surveillance over RC1 acceptance.

87. The C&I assessment (Ref. 14) notes that while RC1 and RC1.1 are being used to initiate detailed design work, there are a number of modifications which have yet to go through technical review and so there is the possibility that re-work will be required. The inspector believes that the risks are being adequately managed and the evidence suggests that the licensee has exercised adequate surveillance over RC1 acceptance. However, as noted in Section 4.2.7 above, the inspector has recently identified and brought to the attention of the licensee a major risk concerning the HVAC. The inspector has identified three risks during the assessment:

- The unavailability of RC1 System Design Manuals;
- At the time of the intervention in July 2014, the presence of a working document that was not recorded or tracked by the formal document management system although this has now been formalised, and;
- Only a limited number of primary surveillances of RD documentation, with potential for the RD to develop the design ahead of the safety case without fully considering the UK context.

88. The inspector responsible for the assessment of ISFS (Ref. 16) notes that the only ISFS design currently available is a concept design for a wet (pool) type for interim storage on the HPC site. No design exists for a dry storage concept although two candidate cask suppliers have been identified. Accordingly, there is no RC1 reference configuration for the ISFS.

89. From a reactor chemistry perspective (Ref. 18), the inspector is content with NNB GenCo's acceptance of RC1. The level of oversight and involvement appears appropriate for this stage of the project. The licensee has demonstrated an adequate degree of ownership of the design and the design process and this should form a basis on which to progress the project in this technical area. The inspector has not yet been able to sample their surveillance activities, but has seen nothing to suggest this would pose any concerns at this time.

90. The inspector responsible for the assessment of radiological protection (Ref. 19) notes that the licensee's risk assessment for RC1 does not identify any risks arising from this workstream. The inspector has no reason to challenge this.

91. The inspector responsible for the assessment of PSA (Ref. 24) considers that the PSA work stream does not have a significant role to play in the acceptance of RC1, and the consideration of the UK context from the perspective of PSA in the RC1 design description and definition documents appears reasonable. Nevertheless, the inspector makes the following observations:

- The role of the RC1 description document (Ref. 29) is not clear to the NNB GenCo PSA work stream.
- The basis for the PSA related documents included in the RC1 description document is not clear. It is therefore not clear whether this provides a comprehensive description of RC1 from a PSA perspective or indeed whether this list is appropriate.
- The batch 5 PSA model will give NNB GenCo opportunity to examine the PSA insights for the RC1.1 design. However, as these insights will come relatively late (just before requesting a consent to start construction of the nuclear island), this presents a level of risk to the second consent as the batch 5 PSA model could identify issues that would need to be addressed prior to starting construction of the nuclear island.
- An element of risk in the RC1 design that has not been considered in its acceptance by NNB GenCo is the status of the PSA model and the update to align it with RC1.1 have not been explicitly considered as part of the acceptance of RC1.

92. In summary, the feedback from inspectors is generally positive with regards to NNB's acceptance of RC1. Nevertheless, it must be recognised that NNB GenCo's acceptance is a conditional acceptance as there are still outstanding modifications to be included within the design reference and there remain design risks particularly associated with GDA AFs on the C&I aspects of the HVAC system and the sizing of the UDGs. A key design decision is still required over the choice of a wet or dry ISFS and the implementation of category and classification methodology is still to be completed with only one SFRN issued at the time of this assessment although a second has now been issued. It is highly desirable that these issues are resolved in order to give full confidence in the RC1.1 design reference as a suitable starting point for detailed design work.

4.3.2 Acceptability of NNB Assessment Finding (AF) Resolution Plans

93. Although no resolution plans have been formally issued by NNB GenCo in the safety categorisation and classification area, the inspector (Ref. 8) is generally satisfied with the content of the draft resolution plans.

94. In the area of civil engineering (Ref.9), the inspector considers that the resolution plans for addressing Generic Design Assessment findings lack appropriate information with

respect to the planned deliverables and do not adequately assess the effects on the safety case. The inspector has been informed that these gaps are being addressed in other ways without modifying the plans. This approach will require further assessment however the inspector's main concern is with the lack of progress in producing technical responses and closure packs, a considerable number of which are required prior to first nuclear safety related concrete. The inspector also notes that while there has been some progress with closing regulatory issues arising from ONR's assessment of PCSR 2012, in general the agreed dates for closure have not been met and a significant number of issues still require resolution. All of these PCSR 2012 issues are required to be closed out prior to first nuclear safety related concrete. For this reason, the inspector has recommended (Ref. 9) that ONR should maintain regular interventions focussed on the progress with closure of Generic Design Assessment findings, and in particular should seek agreement with NNB GenCo regarding the type and level of evidence required to demonstrate closure.

95. In the area of structural integrity (Ref. 10), NNB GenCo has issued resolution plans for 43 of the 63 AFs related to structural integrity, 11 of the 35 AFs for the nuclear steam supply system (NSSS), and 2 of the 4 AFs related to both structural integrity and the NSSS. These plans have been shared with ONR. The inspector considers that this corresponds to a level that is to be expected at this stage in the project.

96. The inspector responsible for the assessment of Mechanical Engineering (Ref. 11) is satisfied with the current status of the resolution plans associated with the mechanical engineering GDA AFs required to be completed prior to first nuclear island concrete and will be reviewing progress against the implementation of the plans during routine regulatory interactions.

97. The inspector responsible for the assessment of Equipment Qualification (Ref. 12) considers two AFs as being of particular significance at this stage of the project. The first relates to the adequate specification of EQ for which a resolution plan has been issued which is considered to be adequate. The second relates to the development of a set of arrangements for the qualification of plant against hazards with a timescale of post first nuclear island concrete; the inspector has challenged this timescale and is awaiting a response.

98. The resolution plans for all electrical engineering GDA AFs are complete (Ref. 13). The inspector has provided comments on these plans and these are currently being addressed. The inspector also notes that four fault studies GDA AFs are included in the PCSR-3 specifications relevant to electrical engineering. However, one fault study AF relating to the analysis of the station blackout fault sequence (AF-UKEPR-FS-112) does not appear to be included in these documents. Given the potential impact of this AF on the electrical systems, the inspector would have expected it to be referenced in these specifications. The inspector has therefore placed an action on the licensee to convene a level 4 cross-cutting meeting to review specifically the potential impact of the work activities from those GDA fault studies AFs with electrical implications.

99. The inspector responsible for the assessment of C&I (Ref. 14) is content that the licensee is adequately following its due process for the management of GDA AFs in the area of C&I. However, the inspector has only been provided with 48 draft resolution plans and four resolution plans are still completely outstanding. In addition, the inspector has only been provided with a draft delivery programme. The inspector has concluded that the licensee does not have sufficient C&I SQEP resources to review and verify the draft resolution plans produced by the RD and to prepare the final versions.

100. There has been little progress made with the production of resolution plans in fuel / core / criticality workstream area (Ref. 15). However, with one exception for which a resolution plan has already been provided, the milestone associated with the findings

is delivery of fuel to site which occurs very late in the project. The inspector accepts the licensee's current lack of progress but will be pressing for a declared programme for completion of resolution plans in early 2015 against which to monitor the licensee's progress.

101. Similarly, very few GDA AF resolution plans have been issued with regard to the ISFS (Ref. 16). The inspector is generally content with this position as many are specific to an assumption of the use of wet storage technology (which may change to a dry storage technology in due course) and/or the AFs generally require closure well beyond ONR's first two Consents.

102. The inspector responsible for the assessment of Radioactive Waste and Decommissioning (Ref. 17) is planning future meetings to discuss progress with resolution plans in this topic area.

103. The inspector responsible for the assessment of reactor chemistry (Ref. 18) is content with NNB GenCo progress with reactor chemistry AF resolution plans for this stage of the project. NNB GenCo has prioritised, developed resolution plans and appear to understand both the intent and type of evidence needed for resolution. The inspector notes some AFs which may be more difficult to resolve, but considers this to be part of normal business. Some of the weaknesses in the presented resolution plans, regarding scope of closure packs and timings should become clearer as the processes develop and evolve.

104. A number of GDA AFs resolution plans have been issued for radiological protection (Ref.19). The inspector is intending to perform an assessment of a selection of them but is waiting until more are available. However, the inspector judges that this is not problematical as there is only minimal scope for these to impact on the design at this stage given the nature of the workstream.

105. The inspector responsible for the assessment of Human Factors (Ref.20) considers that progress with the GDA HF AFs linked to first structural concrete is satisfactory at this point.

106. The GDA Fault Studies assessment (Ref. 21) resulted in 120 AFs being raised. During this phase of activity, ONR has received Resolution Plans for 72 of these, although the majority of these plans have been produced by the RD and are yet to complete NNB GenCo's due process. Of the 120 AFs, 55 have been re-allocated to other topic streams considered to be more appropriate disciplines to lead on these findings while six AFs require Fault Studies input have been identified from Cross Cutting topic areas. There are therefore 71 AFs covered by the Fault Studies topic area. As the majority of Assessment Findings Resolution Plans are yet to complete the final stages of NNB GenCo's due process at this time, a view as to the credibility of these plans has yet to be formulated. As noted in Section 4.2.14 above the GDA AF to consider the installation of RMI will need to be resolved on a timescale compatible with nuclear island safety related concrete. Given the number of outstanding GDA AFs in the fault study area, the inspector has recommended that ONR should maintain its engagement to monitor progress with resolution plans in this area.

107. The inspector responsible for the assessment of Internal Hazards (Ref. 22) is content that the licensee is addressing the AFs for which resolution plans are required before first nuclear concrete pour. The inspector will continue with the assessment of the plans in due course and is looking forward to seeing a close out plan for the AFs.

108. NNB GenCo has issued closure forms for four of the seven GDA AFs relevant to External Hazards topic area (Ref. 23) and these will be assessed by ONR during the next phase of work.

109. As noted in the SAA (Ref. 21) assessment presented in Section 4.2.17 above, although NNB GenCo has made good progress in developing credible resolution plans for GDA AFs in the SAA topic area, the resolution plan for the GDA AF on containment overpressure protection system for beyond design basis accidents has yet to reach a satisfactory position and remains a significant concern. NNB GenCo is developing a concept design for a FCV to inform a decision on whether to install one by early 2015. This issue will need to be resolved on a timescale compatible with nuclear island safety related concrete.

110. The inspector responsible for the assessment of PSA (Ref. 24) is reasonably satisfied with the GDA AF resolution plans that have been issued and shared with ONR in the area of PSA and is also content with the NNB GenCo arrangements for managing these GDA AFs. Out of the 12 PSA assessment findings prioritised by NNB GenCo as requiring resolution before nuclear island concrete, nine have completed due process within NNB GenCo and have been shared with ONR. The key area of uncertainty regarding the resolution plans reviewed relates to the adequacy of the hazards PSA and supporting studies to inform the early safety cases. An adequate hazards PSA and/or comprehensive risk informed design studies are important to inform the design and construction of early structures, and therefore inform the milestones of first safety related concrete and nuclear island concrete. A key requirement of an adequate risk informed design approach is that the PSA is representative, sufficiently comprehensive and is used iteratively in the design process. Without this, NNB GenCo may not be able to demonstrate that the design reduces risk as low as reasonably practicable (ALARP).

111. In summary, there are a number of assessment areas where in the judgement of the inspectors progress with the closure of GDA AFs should have been more advanced than it is at this stage. In my judgement this represents one of the biggest regulatory risks to the project. It is urgent that progress is made on the resolution of a number of assessment findings in the areas civil engineering, electrical engineering, C&I, EQ for hazards, fault studies, severe accident analysis, and the treatment of hazards within the PSA.

4.3.3 Design change process including interim process and readiness for LC20

112. The inspectors responsible for the assessment of the Categorisation and Classification (Ref. 8), Electrical Engineering (Ref. 13) and PSA (Ref. 24) are satisfied that the interim modifications arrangements are adequate, which provides some confidence in NNB GenCo's readiness for moving to its Licence Condition (LC) 20 arrangements. However, the PSA assessment inspector (Ref. 24) notes the following:

- PSA was not a key part of the interim modifications arrangements. However, it is the inspector's expectation that PSA should play an increased role in the LC20 arrangements, in particular in terms of highlighting the need for modifications, risk informing the proposed modifications and informing the ALARP process.

- The current PSA model has a number of limitations, and even the future (batch 5) model will be limited, particularly in the area of hazards PSA. This may limit its application or could introduce biases in the insights used to inform modifications to the design under the LC20 arrangements.

113. The inspector responsible for the assessment of civil engineering (Ref. 9) is satisfied that design changes are being adequately assessed prior to incorporation into the reference configuration.

114. Based on sampling of Category 1 and Category 2 modifications that have gone through different stages of the licensee's modification process, the inspector

responsible for the assessment of C&I (Ref. 14) is content that there is an adequate process for the control of modifications and this has been followed. In addition, the inspector is content that adequate progress has been made towards implementation of LC20 arrangements. The inspector has identified three risks during the assessment:

- Earlier screening forms may have been modified without revising the forms or changing the dates;
- The Design Authority in NNB GenCo and the Safety Directorate do not have sufficient SQEP resources to progress the C&I modifications;
- The modification process does not adequately cover the process for closing out the C&I technical review actions.

115. While there has only been limited Reactor Chemistry involvement in modifications and the modification process (Ref. 18), the inspector has made no observations that would dispute the licensee's readiness for moving to full LC20 arrangements following the first convergence point.

116. A recent Fault Studies led intervention (Ref. 21) which focused on examining the readiness of NNB GenCo to implement its proposed arrangements to comply with LC20 concluded that the interim modifications arrangements are adequate which provides some confidence in Licensee's readiness for moving to its LC20 arrangements. However, the intervention noted that some residual concerns relating to the Licensee's overall technical screening of the documents and the demonstration of ALARP within the design modification process remain.

117. The inspector responsible for the assessment of Internal Hazards (Ref. 22) is satisfied that based upon a sample of the output from the process that the process has been followed correctly to date.

118. In summary, feedback from those inspectors involved in interventions on the modification process was very positive both with regard to NNB GenCo's interim modification process and its suitability as a basis for future LC20 arrangements. Nevertheless, it must be remembered that the modification process only identifies the preferred design solution and associated future work activities together with a categorisation for nuclear safety. Detailed implementation and substantiation of modifications through the production of a safety case is left to the design process and so there is an inherent design risk that ill-conceived modifications could be adopted into the reference design that need to be reversed at a later stage. As noted in the fault studies intervention, one way to mitigate this design risk would be for NNB GenCo to improve the quality of the information provided to the technical screening process with the RD being encouraged to identify potential safety dis-benefits with any modification as well as the benefits.

4.3.4 Progress in development of the Safety Case (CSJ-01 and PCSR-3)

119. There is reasonable visibility of the RD's categorisation and classification (Ref. 8) work programme for PCSR-3 with the exception of the substantiation issue already discussed in Section 4.2.1 above. The inspector considers that NNB GenCo is making reasonable progress in developing CSJ-01 and PCSR3. However, the inspector requires increased visibility of planned delivery of the key safety categorisation and classification references to CSJ-01 and PCSR3 to enable the planning of assessment work to ensure there is sufficient time to perform an adequate assessment and ensure there are no risks to timely consent.

120. Based on sight of early draft material the Civil Engineering inspector (Ref. 9) is broadly content with the outline structure of CSJ-01, although in its present form the civil

engineering content is comparatively weak and further engagement with NNB GenCo will be required to ensure that the final content meets ONR's expectations.

121. The inspector responsible for the assessment of Structural Integrity (Ref. 10) notes that NNB GenCo has shared its plans for the NSSS elements of the HPC PCSR-3 with ONR. For the NSSS, the structure of PCSR-3 will be similar to that of GDA PCSR with few minor changes. PCSR-3 key deliverables from the RD to NNB GenCo are scheduled for mid-2015.

122. Mechanical Engineering Assessment (Ref. 11) concludes that the on-going work with the mechanical engineering areas (BNI, BOP, CI) demonstrates suitable progress towards meeting ONR's requirements for an adequate PCSR-3 to be available to support nuclear island construction.

123. The inspector responsible for the assessment of Equipment Qualification (Ref. 12) does not consider there to be any EQ related activities that specifically need to be addressed as part of CSJ-01 nor any subsequent CSJs. Overall, from an EQ perspective the inspector considers that NNB GenCo is making adequate progress in developing PCSR-3. Although the inspector notes a number of areas of uncertainty, at this point in time the inspector is generally confident that they present programme risks rather than safety case related risk.

124. Overall, from an electrical engineering perspective (Ref. 13), the inspector considers that NNB GenCo is making adequate progress in developing CSJ-01 and PCSR-3. Although there are a number of areas of uncertainty, at this point in time the inspector is generally confident that they are not a significant risk to the first two Consents.

125. Based on sampling of the evidence presented the C&I assessment (Ref. 14) concludes that the licensee is adequately progressing with the development of CSJ-01 and PCSR-3 with delivery of three of the C&I related sub-chapters expected in 2014 and four in 2015. The inspector has identified the following three risks:

- A programme for the production of PCSR-3 sub-chapters relating to C&I together with a list of the main references may not be available in good time to allow the inspector to adequately plan and assess the documentation.

- A formal list of design documentation (LoD) and delivery schedule may not be available in good time to allow the inspector to adequately plan and assess the documentation.

- PCSR-3 sub-chapters may be produced prior to the functional requirements being fully specified, design finalised and incorporated into the C&I section of the system design manuals (SDM). This may result in the design being developed without considering the safety case requirements such that the ALARP position is not adequately justified.

126. With respect to fuel and core design technical area (Ref. 15), the licensee has produced a Chapter specification for PCSR-3 although the licensee has noted that this may be subject to change with the development of the list of deliverables for 2015. The licensee has still to decide how the fuel design requirements will be presented in PCSR-3 and indicated that these may be referenced out to a synthesis report, which it is hoped could be produced on similar timescales to PCSR-3 recognising that this document is a key feed to the fuel contract. The inspector is content with this position.

127. The inspector responsible for the assessment of the Interim Spent Fuel Storage (ISFS) facility (Ref. 16) notes that since a choice of technology for the ISFS is not due to be made by the licensee until the end of 2014, the ISFS facility will not form an input into CSJ-01 which will provide a safety justification for the technical galleries. However, the

inspector reports that the licensee is aware that the re-evaluation exercise must consider any potential impacts on the technical galleries of the use of dry storage casks, which may be hauled over the ground beneath which the technical galleries will sit. Similarly, the timing of PCSR-3 and the decision on the spent fuel management technology to be adopted means that the licensee is actively considering how it might incorporate a dry store into PCSR-3, if that is the chosen technology. The licensee has recognised that any impacts of the dry store on civil structures of (for instance) the fuel building has the potential to delay the issue of Consent for the pouring of nuclear island concrete and that this must be addressed as a matter of urgency. For this reason, the inspector has raised a Level 3 Issue on the ONR database which will be monitored towards resolution.

128. With regard to radioactive waste and decommissioning (Ref. 17), it was noted that NNB GenCo's process does not engage with ONR with respect to the scope for PCSR-3. Within the decommissioning area there appears to be a perception that addressing GDA AFs and PCSR 2012 Issues would be sufficient for the purposes of PCSR-3. The inspector has emphasised that GDA and the assessment of PCSR 2012 were based only on a sample and ONR might chose a different sample for PCSR-3 and that a coherent, integrated safety case is expected. Is also needs to be recognised that a key reference for the decommissioning safety case is the Decommissioning Waste Management Plan (DWMP). NNB GenCo are currently not intending to revise the document until three years before active commissioning even if the spent fuel strategy changes from wet storage to dry storage.

129. The reactor chemistry assessment (Ref. 18) notes that the licensee has a reasonable understanding at this stage of the project of what is required for PCSR-3 and has developed plans and strategies to achieve this. However, the underlying technical planning required to achieve this is somewhat behind what the inspector would expect. Although the NNB GenCo chemistry team have found methods to manage this effectively, and are taking actions to address this going forward, this is an area where further ONR intervention is needed.

130. The inspector responsible for the assessment of radiological protection (Ref. 19) has been kept abreast of on-going work towards PCSR-3 and believes this provides evidence that the UK context is well understood.

131. As noted in Section 4.2.13 above, the Human Factors assessment (Ref. 20) notes that the GDA HF safety case provides a sound basis for PCSR-3 such that the consolidation at PCSR-3 is unlikely to require substantial changes to the case. However, there will need to be work to both address site specific issues and to reconcile the GDA reference design with the reference configuration for PCSR-3.

132. The inspector responsible for the assessment of Fault Studies (Ref. 21) considers that NNB GenCo is making reasonable progress in developing the safety cases to support CSJ-01 and PCSR3. The inspector notes a number of areas of uncertainty, at this point in time that require further developments prior to the first Consents.

133. The Internal Hazards assessment (Ref. 22) notes some concerns regarding the visibility of documentation being produced in the area of internal hazards for first and second consent. This issue is being pursued with the licensee and a route map is being produced. The inspector has made a recommendation that the licensee should ensure that a full list of deliverables pertinent to internal hazards is provided to the regulator as soon as practicable. In addition, the licensee should ensure that a resource plan is produced that is linked to the LoD for 2014 and 2015. A similar recommendation is made for the internal regulator.

134. The inspector responsible for the assessment of External Hazards (Ref. 23) notes that the submission of CSJ-01 suite of documents is expected in 2015. The inspector does

not expect that these documents will present any new information relevant to external hazards design basis and will instead focus on the detailed civil design of the technical galleries.

135. From a PSA perspective (Ref. 24), the inspector considers that NNB GenCo is making adequate progress in developing the safety cases CSJ-01 and PCSR-3. Although there are a number of areas of uncertainty, at this point in time the inspector is generally confident that they are not a significant risk to the first two consents. With the exception of hazards PSA, discussed above, the inspector has not identified any other items that need to be included in CSJ-01 or PCSR-3 to those already identified by NNB GenCo.

136. In summary, feedback from the inspectors was generally positive. There are risks associated with the choice of ISFS technology. Nevertheless, the inspectors generally considered that preparation of CSJ-01 and PCSR-3 appeared to be going well.

4.4 Judgement on the current position compared with expectations for First Consent

137. In principal, ONR's preference would have been for the final version of the PCSR (PCSR-3) to have been issued ahead of the first Consent for the start of construction. The potential risk of starting construction based upon the CSJ approach is that a fully integrated technical safety justification may not be developed. This may result in the foreclosure of potential ALARP modifications to the design that might otherwise have been feasible due to the constraints of the site layout plan and the sizing of civil structure designs becoming largely fixed before the safety case is complete. The first challenge for NNB GenCo is therefore to demonstrate in CSJ-01 and the other CSJs that will follow not only the substantiation of the specific structures they are looking to justify, but also that this potential risk has been successfully managed by decoupling the site plan and the design of the technical galleries and other civil structures from any outstanding design risks associated with the design of the nuclear island.

138. Currently there are a number of design risks with the nuclear island and diesel buildings that have been identified as part of this assessment for the first convergence point. Some are associated with unresolved GDA AFs. These are the introduction of diversity into the safeguard building HVAC system, concerns with the complexity and sizing of the C&I system design in general, the electrical loading demand on the UDGs, consideration of implementation of a FCV, completion and substantiation of the categorisation and classification process, demonstration of adequate safety margins in design basis faults and adequate progress with the closure of AFs associated with the civil design. This assessment of the first convergence point has also identified site specific design risks associated with the site plot plan due to the emerging issues with the adequacy of the turbine disintegration safety case and the choice of ISFS technology. The second challenge for NNB GenCo is therefore to progress and hopefully accelerate close out work on these AFs and issues. The aim is to provide evidence of sufficient progress to have mitigated these risks by the time ONR needs to make its regulatory decisions on first Consent.

139. It is recognised that the design development of a large engineering project is a continuous process, with detailed design and substantiation information developing all the time up until the virtual completion of the project. The design reference (RC1.1) represents the design at an arbitrary fixed point in time for the purposes of freezing the scope of PCSR-3 prior to commencing with civil construction and detailed design work on the mechanical and electrical systems for the nuclear island. It is also recognised that there is a reference plant at FA-3 that has largely completed the detailed design process and that ONR has performed a detailed four year assessment of the GDA design as well as the more recent site specific assessment of HPC PCSR 2012 as part of site licensing process. These factors provide some confidence in the design

reference such that in my judgement that the preparation of PCSR-3 will largely be a consolidation process of the two existing PCSRs with relatively little new information being contained within the PCSR-3 itself. Instead, the important new information that will be presented will come in the form of the supporting references giving the detailed design and the design substantiation information. It is essential that this information is provided in a timely manner to allow ONR to perform its assessment and come to a well informed and evidence based decision on the first Consent. The third challenge for NNB GenCo is therefore to commit to a credible LoD programme that allows sufficient time for ONR assessment and feedback.

140. A related matter is the quality of the information produced through the design process by the RD. This is an area where NNB GenCo through its understanding of the UK licensing regime can potentially add very significant value as its relationship with the RD develops and matures. It needs to take an active approach in its surveillance of the activities of the RD to ensure that adequate safety cases are provided to substantiate the design and manage the design risk. The RD needs to recognise that the safety case is a strategic document that has to be used to inform and control the design process including adequate justification of modifications. The final challenge for NNB GenCo is therefore to provide sufficient confidence in the design through the quality of its safety case documentation that ONR can readily share in NNB GenCo's judgement of the design's adequacy.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

141. This progress report summarises the assessment and intervention findings for the first project convergence point of the construction phase of the Hinkley Point C project for the Design and Safety Case cornerstone theme. It is a high level summary of 16 individual progress reports and one assessment report, the publication of the latter having been delayed from the time of assessment of HPC PCSR 2012 earlier this year. These conclusions cover the following three main areas:

- Assessment of developments in the Design and Safety Case;
- Assessment of the Design and Safety Case Shadow Hold Point Process;
- Judgement of the current position compared with expectations for First Consent.

142. The main purposes of this report are to share ONR's overall judgement of the development of Design and Safety Case since the assessment of HPC PCSR 2012 and to provide a clear view on the areas where NNB GenCo needs to focus in the approach to first Consent.

5.1.1 Assessment of progress with the Design and Safety Case

143. There is a common theme in many of the progress reports that are summarised in this report in that little new safety case material has been submitted by the licensee since the submission of HPC PCSR 2012. This reflects the delay in the HPC project while NNB GenCo has been waiting for the FID to commit funding for the construction of HPC. While this is understandable, it does mean that ONR has had only limited visibility of the design work carried out in the Design and Safety Case areas. Exceptions to this include some progress with the safety categorisation and classification of safety functions and associated SSCs, the civil design of structures, the manufacture of primary pressure circuit components and the performance of the "adjusting phase" studies in the fault studies topic area.

144. The assessment has also highlighted a number of outstanding design risks that still need to be resolved. These are the introduction of diversity into the safeguard building HVAC system, concerns with the complexity and sizing of the C&I system design in general, the electrical loading demand on the UDGs, consideration of implementation of a FCV, completion and substantiation of the categorisation and classification process, demonstration of adequate safety margins in design basis faults, adequate progress with the closure of AFs associated with the civil design, the adequacy of the turbine disintegration safety case and the choice of ISFS technology.

5.1.2 Assessment of the Design and Safety Case Shadow Hold Point Process

Adequacy of NNB GenCo's acceptance of RC1

145. With regard to NNB GenCo's acceptance of RC1, the feedback from inspectors is generally positive. Nevertheless, it must be recognised that NNB GenCo's acceptance is a conditional acceptance as there are still outstanding modifications to be included within the design reference and there remain design risks particularly associated with GDA AFs on the C&I aspects of the HVAC system and the sizing of the UDGs. A key design decision is still required over the choice of a wet or dry ISFS and the implementation of the safety categorisation and classification methodology is still to be completed with only one SFRN issued at the time of this assessment although a second has now been issued. It is highly desirable that these issues are resolved in order to give full confidence in the RC1.1 design reference as suitable starting point for detailed design work.

Progress with the closeout of GDA assessment findings

146. With regard to progress in the close-out of GDA AFs, there are a number of assessment areas where in the judgement of the inspectors progress should have been more advanced than it is at this stage. In my judgement this represents one of the biggest regulatory risks to the project. It is urgent that progress is made on the resolution of assessment findings in the areas of civil engineering, electrical engineering, C&I, EQ for hazards, fault studies, severe accident analysis, and the treatment of hazards within the PSA.

Implementation of interim modification process and readiness for LC20

147. Feedback from those inspectors involved in interventions on the modification process was very positive both with regard to NNB GenCo's interim modification process and its suitability as a basis for future LC20 arrangements. Nevertheless, it must be remembered that the modification process only identifies the preferred design solution and associated future work activities together with a categorisation for nuclear safety. Detailed implementation and substantiation of modifications through the production of a safety case is left to the design process and so there is an inherent design risk that ill-conceived modifications could be adopted into the reference design that need to be reversed at a later stage. As noted in the fault studies intervention, one way to mitigate this design risk would be for NNB GenCo to improve the quality of the information provided to the technical screening process with the RD being encouraged to identify the potential safety dis-benefits of any modification as well as the safety benefits.

Progress with CSJ-01 and PCSR-3

148. With regard to the preparation of CSJ-01 and PCSR-3, feedback from the inspectors was generally positive. There are risks associated with the choice of ISFS technology. Nevertheless, the inspectors generally considered that preparation of CSJ-01 and PCSR-3 appears to be going well.

5.1.3 Judgement of the current position compared with expectations for First Consent

149. The report identifies four areas where NNB GenCo needs to focus to manage its regulatory risk:

- To demonstrate through CSJ-01 and the other CSJs that it has decoupled the outstanding design risks associated with the on-going development of the design sufficiently to allow the start of civil construction in advance of PCSR-3 delivery;
- To adequately progress and hopefully accelerate the closure of significant outstanding GDA AFs and issues to mitigate the associated design risk;
- To develop though its LoDs adequate work programmes to ensure detailed design reports and design substantiation reports are delivered in a timely manner to enable ONR assessment and feedback, and;
- Through active surveillance of the RD's design activities to ensure that adequate safety cases are provided to substantiate the design and manage the design risk. The RD needs to recognise that the safety case is a strategic document that has to be used to inform and control the design process including the adequate justification of modifications.

5.2 Recommendations

150. My recommendations are as follows:

- Recommendation 1: Based on the advice given in the civil engineering assessment, ONR should commence a series of interventions focussed on NNB GenCo's arrangements for the control and oversight of nuclear related site activities.
- Recommendation 2: ONR should consider raising a Level 3 Issue with regard to the turbine disintegration safety case to ensure adequate consideration of the site layout plan is taken into account to ensure risks are reduced to ALARP.
- Recommendation 3: ONR should continue to focus on the close out of GDA AFs and HPC PCSR 2012 issues.
- Recommendation 4: ONR should work with NNB GenCo to develop an agreed LoD for each topic area to ensure timescales provide adequate time for ONR assessment and feedback. ONR will need to work with NNB GenCo to ensure it has adequate resourcing plans to meet these commitments.
- Recommendation 5: ONR should commence a series of interventions looking at the interface between NNB GenCo and the RD (and AREVA) to ensure adequate control and understanding of the design process is in place.

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