Office for Nuclear Regulation
An agency of HSE

PROJECT ASSESSMENT REPORT

Report Identifier:	ONR-SZB-PAR-13-020
Revision:	Revision 1
Project:	DFS
Site:	Sizewell B
Title:	ONR's assessment of Category 1 paper, NP/SC 7575, SZB EC 338898, Dry Fuel Store (DFS) safety case, known as stage submission 1 revision 0, furnished to ONR for information purposes only.
Licence Instrument No.: (if applicable)	n/a
Nuclear Site Licence No.:	63
Licence Condition:	19(4)
TRIM Ref:	2013/238321

Document Acceptance and Approval for Issue / Publication

Role	Name	Position	Signature	Date
[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]	[redacted]		[redacted]
Approval for publication:	n/a	Not for publication		

Revision History

Revision	Date	Author(s)	Reviewed By	Accepted By	Description Of Change
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Circulation (latest issue)

Organisation	Name	Date
[redacted]	[redacted] [redacted]	
[redacted]	[redacted]	
[redacted]	[redacted]	

Office for Nuclear Regulation

An agency of HSE

Sizewell B – DFS Project

ONR's assessment of Category 1 paper, NP/SC 7575, SZB EC 338898, Dry Fuel Store (DFS) safety case, known as stage submission 1 revision 0, furnished to ONR for information purposes only

Project Assessment Report: ONR-SZB-PAR-13-020
Revision 1
29 July 2013

EXECUTIVE SUMMARY

Title

ONR's assessment of the first issue of the Sizewell B dry fuel store safety case, furnished to ONR for information purposes only.

Permission Requested

The first issue of the Sizewell B dry fuel store safety case is not the subject of formal Office for Nuclear Regulation (ONR) permissioning.

The purpose of this project assessment report is to record the work ONR has undertaken, which can then be used by ONR inspectors as a reference document as the safety case develops to support the regulatory permissioning strategy and to share comments with the licensee EDF Energy Nuclear Generation Limited (EDF NGL).

Background

The spent nuclear fuel assemblies arising from operating Sizewell B nuclear power station are currently being stored on site under water, within steel racks located in the Sizewell B fuel storage pond. Further spent fuel storage capacity will be required prior to the end of cycle 15.

EDF NGL has developed a proposal to construct and commission a dry fuel storage facility at Sizewell B to provide the necessary additional spent fuel storage capacity. The proposals are presented in a paper of principle that sets out the strategy by which the safety case for the new facility will be made in a series of stage submission papers and identifies a number of hold points to provide for adequate control and regulation of the project.

Sizewell B's arrangements for construction and commissioning of the new facility make provision for the identification and release of regulatory hold points by ONR. A hold point is a stage in a project beyond which work may not proceed until cleared by an appropriate authority. Sizewell B has developed arrangements which require a number of the safety case stage submission papers to be submitted for the agreement of ONR by issue of a licence instrument. In addition, the nuclear site licence provides for more direct regulatory control of progression from one stage of construction or commissioning to the next by specification of a licence instrument known as a consent.

ONR's permissioning strategy was set out in project assessment report "Schedule of construction and commissioning hold points including specification of consent to commence active commissioning" dated 14 December 2012. ONR specified one hold point under site licence condition 21(4) plus six hold points under arrangements developed by EDF NGL to comply with licence conditions 19(1) and 21(1). The seven hold points identified within that report were agreed with Sizewell B who confirmed each hold point had been included within their project programme; and acknowledged receipt of specification licence instrument LI531 under licence condition 21(4) concerning active system commissioning which requires EDF NGL to obtain a consent licence instrument from ONR prior to commencement.

Matters arising from ONR's work

During ONR's review of: the first issue of the Sizewell B dry fuel store safety case; and level 4 technical meetings, ONR inspectors have discussed their review findings with EDF NGL and raised further questions. Since ONR has not undertaken a formal assessment of the first issue of the

Sizewell B dry fuel store safety case; ONR will seek to confirm that EDF NGL addresses ONR inspector's review comments and questions when subsequent stage submissions are submitted for formal assessment.

Since the first issue of the Sizewell B dry fuel store safety case, the detailed design of the cask lifting transporter has developed to accommodate additional safety features. This work has resulted in the height of the dry fuel store building being increased to accommodate a larger cask lifting transporter.

Conclusions

ONR notes that the Sizewell B dry fuel store safety case remains to deliver much of the evidence required to support the claims and arguments made. The status of this first issue of the Sizewell B dry fuel store safety case was communicated to ONR by EDF NGL and is an expected feature of the staged submission strategy being followed by EDF NGL. This is reflected in the level of ONR engagement with EDF NGL, who continue to develop the safety case as the programme of work continues against a challenging timescale. ONR expects to see the required supporting evidence prior to release of agreed regulatory hold points, when planned revisions of this first issue are submitted for assessment to support ONR permissioning of defined dry fuel store project activities.

Recommendations

I recommend ONR maintain its current level of engagement with EDF NGL.

LIST OF ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
ASME	American Society of Mechanical Engineers
BSL	Basic Safety level (in SAPs)
BSO	Basic Safety Objective (in SAPs)
CBSIS	Computer Based Systems Important to Safety
CE	Civil Engineering
C&I	Control and Instrumentation
CNS	Civil Nuclear Security (ONR)
CTF	Cask Transfer Facility
DECC	Department of Energy and Climate Change
DFS	DFS
DSR	Design Substantiation Report
EC	Engineering Change
EDF NGL	EDF NGL Energy Nuclear Generation Limited
EDF NNB	EDF Nuclear New Build
EE	Electrical Engineering
EH	External Hazards
EIMT	Examination, Inspection, Maintenance and Testing
FAT	Factory Acceptance Testing
FBC	Fuel Building Crane
FI	Fuel Integrity
FME	Foreign Material Exclusion
FMEA	Failure Mode Effect Analysis
FMECA	Failure Modes, Effects and Criticality Assessment
FPB	Flask Preparation Bay
FS	Fault Schedule
FSB	Fuel Storage Building
FSP	Fuel Storage Pond
GDF	Geological Disposal Facility
HAW	Higher Activity Wastes
HAZOP	Hazard and Operability
HEART	Human Error Assessment and Reduction Technique

LIST OF ABBREVIATIONS

HEP	Human Error Probability
HF	Human Factors
HFIP	Human Factors Integration Plan
HLW	High Level Waste
HMI	Human Machine Interface
HOW2	Office for Nuclear Regulation) Business Management System
HRA	Human reliability Analysis
HSE	The Health and Safety Executive
IAEA	The International Atomic Energy Agency
ILW	Intermediate Level Waste
INSA	Independent Nuclear Safety Assessment
IPR	Intervention Project Record
KSR	Key Supporting Reference
LAN	Local Area Network
LC	Licence Condition
LI	Licence Instrument
LLW	Low Level Waste
LoC	Letter of Compliance (GDF)
LPSA	Living Probabilistic Safety Assessment
ME	Mechanical Engineering
MPC	Multi Purpose Canister
MPCCS	MPC Cooling System
NARA	Nuclear Action Reliability Assessment
NDA	Nuclear Decommissioning Authority
NIO	Nuclear Inspection and Oversight
NSAP	Nuclear Safety Assessment Principles
NSRS	Nuclear Safety Requirements Specification
ONR	Office for Nuclear Regulation
OPEX	Operational Experience
PAR	Project Assessment Report
PCER	Pre-construction Environment Report
PCSR	Pre-construction Safety Report
PSF	Performance Shaping Factors

LIST OF ABBREVIATIONS

PFHM	Pond Fuel Handling Machine
PSA	Probabilistic Safety Assessment
PSR	Periodic Safety Review
PWR	Pressurised Water Reactor
QA/QC	Quality Assurance / Quality Control
RGP	Relevant Good Practice
RMTT	Radioactive Materials Transport Team
RP	Radiological Protection
RW	Radioactive Waste
RWMC	Radioactive Waste Management Cases
RWMD	Radioactive Waste Management Directorate
SAP	Safety Assessment Principle(s) (HSE)
SAT	Systematic Approach to Training
SCC	Stress Corrosion Cracking
SFAIRP	So far as is reasonably practicable
SFR	Safety Functional Requirement
SI	Structural Integrity
SQEP	Suitably Qualified and Experienced Personnel
SRD	Safety and Regulatory Division
SS	Stage Submission
SSC	System, Structure and Component
SZA	Sizewell A
SZB	Sizewell B
SZC	Sizewell C
TAG	(ONR) Technical Assessment Guide
TDMS	Temperature Difference Monitoring System

This page intentionally left blank.

TABLE OF CONTENTS

This page intentionally left blank.

1 PERMISSION REQUESTED

1. Category 1 paper, NP/SC 7575, SZB EC 338898, Dry Fuel Store (DFS) safety case (Reference 1), known as stage submission 1 revision 0 (SS1 Rev.0), is not the subject of formal Office for Nuclear Regulation (ONR) permissioning.

2. The purpose of this project assessment report is to:

   2.1. Record the work ONR has undertaken on this initial submission of the DFS safety case which can then be used as a reference document by ONR inspectors when the subsequent stage submissions are received and which will be formally assessed to support the agreed permissioning strategy; and

   2.2. Share with EDF NGL the comments and questions raised by ONR inspectors during their assessment work and technical meetings with the EDF NGL dry fuel store project team.

2 BACKGROUND

2.1 Requirement for a Dry Fuel Store

3. The pressurised water reactor at Sizewell B is powered by nuclear fuel that is made up of uranium oxide pellets stacked together within a metal zircaloy tube, called a fuel rod. 264 of these fuel rods are braced together to form a fuel assembly. The reactor core is made up of 193 fuel assemblies, where the process of nuclear fission generates heat that is ultimately used to produce electricity.

4. The reactor must be refuelled periodically, to replace those fuel assemblies that can no longer produce sufficient power. This used fuel is transferred to the fuel pond where it is placed in storage under water. The water provides a highly effective barrier between the used fuel, which is highly radioactive and still producing heat, and the outside environment. The fuel storage pond is divided into two regions (regions 1 and 2) where the fuel assemblies are stored vertically in storage racks. A key nuclear safety issue is the avoidance of criticality. This is the point when the number of fission reactions rapidly increases due to the presence of a significant quantity (known as a critical mass) of fissile material.

5. Region 1 has 308 storage locations and was designed to store a batch of new fuel and a complete core offload. Criticality is avoided in region 1 of the fuel storage pond by the design of the storage racks, which ensure that the fuel assemblies remain physically separated by an adequate distance.

6. In region 2 the fuel storage positions are packed closer together and criticality is avoided in a different manner. Region 2 has 1593 potential storage locations that are more closely packed than region 1 and were designed to take credit for fuel burn-up. A safety case for burn-up credit has never been made; consequently the safety case for operation of region 2 has been made on a phased basis.

7. Phase 1 operation permitted only one out of four (1oo4) rack locations to be used for fuel storage by placing physical blocks in the other rack positions. This phase of operation is exhausted.

8. Phase 2 operation allowed for two out of four (2oo4) storage locations to be used in a checkerboard pattern. Region 2 rack locations that are not permitted to be used are fitted with single cell inserts (SCIs). These SCIs physically block placement of fuel assemblies and ensure that criticality is prevented by enforced separation of available fuel storage locations (no credit is taken for neutron absorption). Fuel storage pond operational restrictions are specified in Nuclear Safety Requirement (NSR) 9.3, which was previously approved by ONR in accordance with LC23(4).

9. Region 2 fuel storage locations under phase 2 are also exhausted and safety case documentation for phase 3 operation to permit 3oo4 rack locations to be utilised was submitted in December 2009 (Reference 2) to ONR (NP/SC 7507 Stage Submission 4 Consolidated safety case for phase 3 fuel storage). Phase 3 storage conditions make use of fewer single cell inserts, new solid absorber assemblies (SAAs) containing Boron Carbide and a limited claim on soluble Boron in the pond water to avoid criticality. Phase 3 operation required an amendment to NSR 9.3, in accordance with LC23(5), which specifies the location of a reduced number of single cell inserts and permitted locations for fuel assemblies fitted with Boron containing SAAs.

10. In November 2010, licence instrument LI524 (Reference 3), supported by project assessment report PAR 78/2010 (Reference 4), was issued by ONR to approve the changes to the Sizewell B operating rules to permit phase 3 operation.

11. However, the current rate of accumulation and current safety case restrictions mean that further spent fuel storage capacity will be required by the end of cycle 15 (late 2017). Although cycle 15 is planned to end in late 2017, space in the fuel pond is required before this date to receive new fuel prior to the end of cycle 15 and commencement of refuel outage RF015 (refer to Reference 5). EDF NGL has therefore developed a proposal to construct and commission a dry fuel storage facility at Sizewell B to provide the necessary additional spent fuel storage capacity to support future station operation beyond cycle 15.

12. The proposals are presented in a Paper of Principle (Reference 5) titled Sizewell B DFS (Addendum 1). Reference 5 sets out the strategy by which the safety case for the new facility will be made in a series of stage submission papers.

2.2 Department of Energy and Climate Change (DECC) and the planning application process

13. British Energy (now EDF NGL) submitted in 2010 an application for the construction and operation of a building for the dry storage of spent fuel assemblies from Sizewell B nuclear power station. The application was submitted under section 36 of the Electricity Act 1989 and required the consent of the Secretary of State for the Department of Energy and Climate Change (DECC). HSE was a statutory consultee in that process and project assessment report (PAR) 2010/29 (Reference 6) was written to record HSE ND's (now ONR) assessment of the proposed application; and concluded that at that stage "there was not a substantive reason for HSE ND to advise the Secretary of State for DECC not to give consent to the application".

14. Four areas of the assessment in PAR 2012/29 were recommended to be specifically brought to the attention of the Secretary of State for DECC:

    14.1. Radiological protection – dose levels at the adjacent Sizewell A site;

    14.2. Fuel and Fuel route – National strategy for a Geological Disposal Facility & Disposability Case;

    14.3. External Hazards – Accidental and Malicious aircraft crash; and

    14.4. Security – Security Classification of the DFS.

15. HSE ND's internal consultation process identified (at annex A of PAR 2012/29) several areas that the Licensee needed to be cognisant of during the development of their proposal and which HSE ND intended to address with the Licensee through normal business arrangements.

16. HSE ND's letter to DECC was sent on 13 May 2010 (Reference 7). DECC announced the grant of planning consent on 22 July 2011 (Reference 8).

2.3 The ONR permissioning Strategy

17. The Paper of Principle (Reference 5) identifies a number of hold points to provide for adequate control and regulation of the project.

18. The licensee's arrangements (Reference 9) for construction and commissioning of the new facility make provision for the identification and release of hold points by ONR. A hold point is a stage in a project beyond which work may not proceed until cleared by an appropriate authority. Sizewell B has developed arrangements which require a number of the safety case stage submission papers to be submitted for the agreement of ONR by issue of a Licence Instrument (LI). In addition, the nuclear site licence provides for more direct regulatory control of progression from one stage of construction or commissioning to the next by specification of a LI known as a Consent.

19. ONR's permissioning strategy was set out in ONR project assessment report "Schedule of construction and commissioning hold points including specification of consent to commence active commissioning", ONR-CNRP-SZB-PAR-12-047 Revision 0E (Reference 10) dated 14 December 2012. ONR specified one hold point under site licence condition 21(4) plus six hold points under arrangements developed by EDF NGL to comply with licence conditions 19(1) and 21(1). The seven hold points identified within that report were agreed with Sizewell B who confirmed each hold point had been included within their project programme in letter SZB50754N dated 27 February 2013 (Reference 11). Letter SZB50754N also acknowledged receipt of specification licence instrument LI531 under licence condition 21(4) concerning active system commissioning which requires EDF NGL to obtain a consent licence instrument from ONR prior to commencement.

3 PROJECT CONTROL ARRANGEMENTS

20. ONR's management of the Sizewell B Dry Fuel Store permissioning strategy is described in intervention project record (IPR) NGL018 (Reference 12).

21. Communications between ONR and EDF NGL concerning the Dry Fuel Store project are described in EDF NGL's "ONR communications plan" (Reference 13).

22. EDF NGL's local arrangements for compliance with licence condition 19 (Construction or installation of new plant) is described in EDF NGL document "Control arrangements for construction or installation of new plant" (Reference 9).

23. Key supporting references furnished to ONR to support stage submissions are recorded at Reference 14.

24. ONR's hold point strategy is described in project assessment report ONR-CNRP-SZB-PAR-12-047 Revision 0E dated 14 December 2012 (Reference 10); and illustrated in matrix form at Reference 15.

25. ONR Specification LI531 (Reference 16) requires ONR Consent to commence active commissioning.

26. Sizewell B confirmed each hold point had been included within their DFS project programme in letter SZB50754N dated 27 February 2013 (Reference 11).

27. ONR Inspector's log of questions resulting from assessment work and technical level 4 meetings with the EDF NGL dry fuel store project team is recorded at Reference 22, with EDF NGL responses at References 23, 24, 25 and 26.

4 REGULATORY ENGAGEMENT

28. ONR has regularly engaged with EDF NGL prior to the furnishing of Reference 1 and continues this engagement as the Dry Fuel Store programme of work continues. This has included:

28.1. Nuclear Safety Requirement Specifications (NSRS) meetings:

28.1.1. SS1 Rev 0 NSRS (June 12);

28.1.2. SS2 NSRS (September 12)

28.1.3. SS3 NSRS (October 12)

28.2. Technical level 4 meetings:

28.2.1. Criticality (June 12)

28.2.2. Fuel and Core components (June 12)

28.2.3. Structural Integrity (July 12)

28.2.4. Hazards (September 12)

28.2.5. PSA (February 13)

28.2.6. Human Factors (April 13)

28.2.7. Fuel and Core components (May 13)

28.2.8. Criticality (May 13)

28.2.9. Radiological Protection (May 13)

28.2.10. Control and Instrumentation (May 13)

28.3. Programme level 4 meetings take place at six weekly intervals; the most recent was on 30 May 2013.

5 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF CATEGORY 1 PAPER, NP/SC 7575, SZB EC 338898, DFS SAFETY CASE, REVISION 0

29. EDF NGL furnished ONR with Reference 1 through the minutes of the December 2012 nuclear safety committee (Reference 17) held at Barnwood. Although Reference 1 is not the subject of formal ONR permissioning, it helps inform the ONR assessment of category 2 stage submissions 2 and category 1 stage submission 3 and is a prerequisite to support ONR's release of regulatory hold points 1 and 2 which allow commencement of construction of the DFS building and commencement of the category 1 modifications in the fuel storage and handling facilities respectively.

30. The aim of Reference 1 is to inform the NSC and ONR of progress with the DFS project and to continue with the detail design, procurement and build of the DFS system. It aims to demonstrate that the ALARP principle remains satisfied with the addition of the DFS to the Sizewell B site.

31. The EDF NGL covering note for Reference 1 to the NSC explains that since the NSC meeting held in November 2011 a number of key design developments have been agreed by the EDF NGL dry fuel store design decision panel (DDP):

31.1. The use of stainless steel grade 316L for both walls of the multi purpose canister (MPC);

31.2. The use of a dual walled MPC. This is to protect the inner wall (which is also the load path for handling) from Stress Corrosion Cracking;

31.3. Develop an ultrasonic testing capability for the lid to shell weld on the MPC;

31.4. The need to develop the system design to monitor the temperatures of the MPC at the top and bottom for the purpose of detecting depressurisation;

31.5. Develop a specific corrosion test facility based on a full size MPC within the DFS building;

31.6. Inclusion of an energy absorber within the Hi-Storm overpack to prevent an MPC breach in the event of a 5.2m drop; and

31.7. Provision of a low profile transporter to move the Hi-Trac with an MPC inside from the fuel storage building to the DFS. Previously this was to be performed with a "Vertical Cask Transporter";

32. Challenges, at the point of furnishing Reference 1, still to be resolved include:

32.1. Fuel Sentencing – when to check for failed fuel in the loading process;

32.2. Fuel handling – flask preparation bay position when welding the MPC; and

32.3. Radiation doses to members of the public for normal operation - Impact on SZA given proximity to the site boundary and some SZA offices.

5.1 ONR Nuclear Safety Assessment

33. Following receipt of Reference 1, ONR nuclear safety inspectors sampled the report and engaged in a series of technical level 4 meetings with the EDF NGL DFS project team aimed at providing initial feedback on the report's content. Each ONR inspector provided a brief (Reference 18) on what they had sampled and their view on what subsequent stage submissions should address. These comments are summarised in the following sub sections of this report.

5.1.1 Hazards

34. An ONR external hazards (EH) specialist inspector reviewed Reference 1 and the key supporting reference for hazards, hazard requirements and beyond design basis assessment requirements (Reference 19). This review took cognisance of work undertaken by ONR's Civils specialist inspector (Reference 20) and a level 4 meeting held with EDF NGL in September 2012 (Reference 21). The ONR safety assessment principles (SAPs) are referred to in [ ] brackets; and reference was made to ONR's technical assessment guide TAG 13.

35. Seven questions were raised with the EDF NGL DFS project team which are recorded at Reference 22. Each question has been given to EDF NGL. EDF NGL has provided responses to each of the questions raised by ONR (References 23, 24, 25 and 26) but further engagement is required since final resolution depends on future work to develop the complete safety case.

36. The external hazards analysis presented in Reference 1 and key supporting reference (Reference 19) is acknowledged by EDF NGL to be incomplete, but much work has been done to characterise the significant hazards. It is likely that when Reference 1 is updated it will provide sufficient external hazards information to support ONR's permissioning strategy. However several issues are identified below and EDF NGL should consider these prior to submission of revised documentation and subsequent full assessment by ONR external hazards specialists.

37. General comments:

    37.1. Weather related hazards – It is not clear that up to date information has been sourced to define design and beyond design basis definitions. If historical information is used, then its use should be justified in terms of the life of the DFS operations. The key supporting reference (Reference 19) states that hazard combinations have not yet been reported [EHA.6, para. 217(a)]. One combination in particular seems significant and that is extreme wind and extreme precipitation because there is a known correlation between these hazards and a significant claim in Reference 1 is that the DFS will not be inundated from external flooding.

    37.2. Climate change – It is not clear that climate change estimates have been matched to the 100+ year station life. If quality data to do this is not available then a robust beyond design basis case should be made in lieu [EHA.11, FA.19, paras. 226, 558, 559].

    37.3. Qualitatively defined design basis and beyond design basis events – There are several examples of these, e.g. biological hazards, solar activity. Assumptions have been made as to what constitutes a frequent and infrequent design basis etc, yet in these cases, this is obviously not supported by a frequency analysis [EHA.4], and no explanation is provided. It should be made clear in Table 3.8 of Reference 1 that these hazards are not probabilistically derived, why there needs to be “frequent” and “infrequent” design bases in these cases, and an underpinning logic to make clear why the chosen definitions are relevant to developing an ALARP design.

    37.4. Faults – Not all hazards are referenced back to the fault schedule, e.g. aircraft crash, seismic. Hazards should be treated as potential initiating events [EHA.1, EHA.4, FA.5]. This point was also identified by the ONR Civils specialist inspector at paragraphs 102.3 and 102.8.

    37.5. Interaction with Sizewell A (SZA) and Sizewell C (SZC) adjacent sites - There needs to be evidence that the external hazard effects arising from SZA and SZC have been fully captured and that the effects of the DFS operations have similarly been reflected onto those adjacent sites [ST.5, EHA.14]. This is not clear except for SZC turbine failure, although it may have been captured elsewhere.

    37.6. There needs to be evidence of a management interface with the adjacent site operators [para. 127]. Also, any claims made on behalf of those duty holders (Magnox and EDF NNB) should clearly be accepted by them. Evidence should be provided in the safety case of this. Particular issues are: decommissioning related hazards arising from SZA; and construction/operation hazards arising from SZC. ONR would expect Magnox to seek to raise a modification under their LC22 arrangements to recognise the DFS and related operations as a new external hazard to the SZA site. This will, for example, provide the vehicle for demonstrating an ALARP position with respect to any increased worker dose arising from the DFS. EDF NGL is not able to do this since it is not the licensee for the SZA site.

38. Hazard identification and screening:

    38.1. Hazards information is largely drawn from the Sizewell B station safety case, with some examples of additional more recently identified hazards from PSR2. For others, e.g. precipitation, there is evidence of more recent references supporting the design basis selection. Whilst the selection of external hazards appears to be comprehensive and without obvious gaps; evidence is needed to justify this claim. This point was made at the level 4 meeting in September 2012 (Reference 27). It should be clear that:

38.1.1. Vendor advice and existing site safety cases have been interrogated;

38.1.2. Advice from adjacent sites has been obtained;

38.1.3. Advice from elsewhere, especially the UK, for similar facilities has been obtained, where there has been relevant OPEX say; and

38.1.4. That the hazard identification and screening process is up to date and relevant to the DFS plant and operations, and not based on historical documentation as a convenience.

38.2. Section 3.8.1 of Reference 1 states that Reference 19 provides screening criteria, but ONR cannot find evidence of this within the document, nor is there a description of the process undertaken to screen hazards. There should be evidence that a screening process took place, e.g. notes of screening workshop and report summarising its conclusions, process used etc. [para. 212].

38.3. Generally, there should be a positive statement that for all hazards where historical data has been used (e.g. station safety case, PSR), then this has been brought up to date or remains fit for purpose for the predicted life of the facility and operations.

38.4. Table 3.8 refers to appendix C of Reference 19. Reference 19 does not contain an appendix C and the HR reference numbers in it do not match those in Reference 1. Table 3.8 of Reference 1 defines design basis AND beyond design basis conditions which is good practice.

39. Hazard Levels and Requirements

39.1. This section quotes 10^{-4}/yr as an external hazard design basis, but Table 3.8 identifies “Frequent Hazards” as >10^{-3}/yr and “Infrequent Hazards” as <10^{-3}/yr. The ONR SAPs call for a conservative 10^{-4}/yr definition for a design basis and the document should clearly establish this for all hazards defined probabilistically [EHA4, FA.4, para. 514(c)]. For hazards not defined probabilistically, the basis for the definition should be identified.

40. Comments on specific external hazards:

40.1. Malicious aircraft crash

40.1.1. This topic area will be taken forward by ONR’s Civils inspector through inspection of the licensee’s assessment. This ONR inspection work will be coordinated with ONR’s CNS inspector and recorded separately due to the security classification.

40.2. Aircraft impact

40.2.1. An aircraft crash frequency analysis should be provided and this should underpin the need for the chosen design and beyond design basis definitions [EHA.4, EHA.7].

40.2.2. The safety case should comment as far as practicable on the likelihood that the chosen design and beyond design basis definitions will remain applicable throughout the life of the site.

40.3. Biological hazards

40.3.1. A qualitative definition of design and beyond design bases is used and this seems reasonable, subject to the general comments made above. The hazard requirements (HR) imply a number of operating procedural controls; and examination, inspection, maintenance and testing (LC28) tasks. The safety case should confirm that the dose implications of this are accounted for in the operator dose analysis and the operator dose ALARP assessment.

40.4. EMI and solar activity

40.4.1. These are relatively new hazards to be recognised in nuclear safety cases and Reference 19 recognises this implicitly in terms of EDF NGL work currently ongoing. However, Reference 19 does not provide justification for why the design and beyond design basis definitions adopted in Table 3.8 have been selected. See general comment above.

40.5. Humidity

40.5.1. It is unclear whether the effects of humidity have been considered in the thermal modeling of cooling of the casks.

40.6. Salt spray

40.6.1. This section of Reference 19 seems rather qualitative, as are the corresponding entries in Table 3.8. The data provided in Reference 19 would appear to provide a basis for selecting a design basis value for corrosion loss per year, but this is not stated. Maintenance arrangements are recommended and this is sensible, but it is not clear what corrosion protection will be designed in from the outset to the DFS or other equipment items. How corrosion data is to be used to inform the design process to ensure an adequate level of safety over the extended lifespan of the DFS is unclear.

40.6.2. The LC28 maintenance arrangements are unlikely to be as rigorous once the site ceases to operate as they will be during operation. The safety case should consider the type of maintenance arrangements that would be appropriate during the different lifecycle phases of the site and consider whether rules should be established under LC23 to ensure these take place.

40.7. Lightening

40.7.1. There is significant work ongoing for the EDF NNB new build sites on this subject and advantage could be taken of this, at least to estimate the severity of lightening strikes and whether they are a credible hazard to nuclear safety or not for the DFS operations.

40.7.2. The statements in Table 3.8 appear to be arbitrary. It is unclear why 200kA is selected as a frequent design basis hazard and why 50% more is selected as an infrequent design basis hazard.

40.8. Precipitation

40.8.1. The logic for protection measures presented in Reference 19 seems reasonable, but the climate change assumption is to 2039 only. See climate change general comment above.

40.9. Seismic

40.9.1. Seismic hazard levels are drawn from the existing station safety case, which seems reasonable. Revised definitions for SZC are not considered in Reference 1, but if early work on the SZC definitions gives cause to undermine the Sizewell B values, this should be taken into account when setting a design basis for the DFS.

40.9.2. A beyond design basis level of 0.2g is quoted. A general rule of thumb is that, one gets a doubling of pga for an order of magnitude reduction in exceedence probability. On this basis 0.2g would not reach 10^{-5}/yr. So if 0.2g is selected, then a case for why this is a reasonable beyond design basis value should be stated. Note that the 40% rule has lost favour as relevant good practice. Instead the safety case should actively seek to demonstrate that there are no cliff edges to identified seismic fault conditions given the uncertainties in the design and hazard analysis processes involved [EHA.7].

40.9.3. Seismic aspects to consider are:

40.9.3.1. The longevity of the store – this might encourage higher values because of the elevated time at risk.

40.9.3.2. Whether long period ground motion (very low frequency) is significant given that heavy lifts are envisaged with the casks. Is a low natural frequency seismic response implied?

40.10. Snow

40.10.1. The need to prevent drifting snow impeding cask cooling is recognised in Table 3.8 but not in Reference 19. The comments in Reference 19 seem reasonable but should be supported by evidence.

41. The ONR EH specialist inspector engaged with EDF NGL at Reference 27 to discuss the areas identified above and development of Reference 1 and Reference 19. The external hazards analysis presented in Reference 1 and Reference 19 is acknowledged by EDF to be incomplete, however, should the comments listed above be addressed in a subsequent stage submission then the ONR EH specialist inspector is satisfied that this will provide sufficient external hazards information to support ONR's permissioning strategy.

5.1.2 Probabilistic Safety Assessment

42. An ONR probabilistic safety assessment (PSA) specialist inspector reviewed the PSA key supporting reference (KSR) associated with the DFS (Reference 28), and also reviewed parts of Reference 1 before attending a level 4 meeting on 4 February 2013 (References 29 and 30) to gain a shared understanding of EDF NGL's intentions regarding the role of PSA in the Sizewell B DFS project.

43. An objective of the level 4 meeting was to address the adequacy of the initial PSA submission against relevant safety assessment principles (SAPs), Reference 31, and guidance in the PSA technical assessment guide (TAG) 030 document Issue 03; and to receive an update on progress from the Sizewell B DFS project team. The level 4 meeting examined the following areas:

43.1. The contents of the PSA KSR (Reference 28) and the assessment process used in the submission. Particularly how the project team is planning to use the PSA to risk inform the Sizewell B DFS design.

43.2. PSA assessment details. Including the key assumptions used in the PSA assessment, their impact on the results and the sensitivity of the results.

43.3. Future development plans. Such as how the PSA will be developed to continually support the project as the DFS programme progresses.

44. EDF NGL confirmed they intend to use PSA findings to risk inform the design of the DFS as it evolves from the concept design to the final design stage. Therefore, EDF NGL is expected to develop adequate PSA to support the stage submissions of the Sizewell B DFS safety case.

45. At the time of issue of Reference 1 a single PSA KSR (Reference 28) was produced that represented the concept design for the DFS. In accordance with the expectations of ONR TAG 030, ONR consider the scope and findings of this first PSA submission to be suitable and sufficient for this initial stage of the project but recognising that further work is required as the project develops. This is essential to enable PSA findings to continue to risk inform the DFS design and contribute toward the developing safety case.

46. The PSA process described at the level 4 meeting was consistent with that described within (Reference 28) and included: the process for identifying initiating faults; compatibility to enable integration of the DFS initiating faults into the existing Sizewell B fault schedule (FS), production of function event trees (in RiskSpectrum) for each sub fault of the initiating faults; and selection of appropriate risk targets.

47. An improvement area identified was the recording and sharing across the project of key assumptions that had been adopted by the DFS project PSA; and the effect of this growing list of key assumptions. It is ONR's expectation that an auditable method of managing and sharing key assumptions will be put in place as the DFS project moves forward. In addition, improvements aimed at identifying assumptions and data items that contribute most significantly to the risk, undertaking sensitivity studies, and undertaking additional analyses (as required) to address any potential vulnerabilities uncovered in the design or operation of the DFS would be beneficial.

48. Concerning the proposed scope for future PSA work, the approach to: the review of the existing list of identified faults; continued identification of faults/hazards by failure mode effect analysis (FMEA); operability assessments by component and system design reviews; review of operational experience (OPEX) from similar facilities; and the anticipated updates that can be incorporated into the developing DFS PSA were discussed. In addition to the improvements to the FS described above, updates to the accident sequence analysis are also anticipated that will reflect inputs from the following assessments: thermal analysis; structural analysis; radiological analysis; human reliability analysis (HRA) (including post fault mitigation human error probabilities (HEPs)); and fuel analysis.

49. The EDF NGL plan is for the new DFS initiating faults to be integrated into the current Sizewell B FS numbering structure. However, it was identified that currently the fuel handling faults are not represented in the living PSA (LPSA) as they do not result in an uncontrolled radiological release. The difficulties associated with integrating the DFS PSA into the LPSA were identified as:

49.1. The LPSA is used to derive the frequencies of all sequences resulting in core damage and uncontrolled releases, whereas the DFS PSA will be used to quantify sequences resulting in design basis releases and uncontrolled releases. Therefore, due to inconsistencies, it would be difficult to incorporate quantification of DFS design basis sequences into the LPSA.

49.2. The DFS will remain in operation after Sizewell B has ceased generating and therefore it may be beneficial to change the LPSA into the DFS PSA (in due course). An approach could be to retain all the DFS sequences that presently contribute to risk within the LPSA, as it will ease future transition and aid transparency. EDF NGL plan to incorporate all of the DFS PSA into the LPSA.

50. Following engagement with EDF NGL at References 32 and 33, the ONR PSA specialist inspector is satisfied that adequate progress has been made from a PSA perspective but that continued effort is required to ensure the potential benefits from using PSA throughout the design stage are realised.

5.1.3 Fuel Integrity

51. An ONR fuel integrity (FI) specialist inspector has sampled Reference 1 primarily from a perspective of spent fuel storage and maintenance of spent fuel integrity during storage and future retrieval operations; and has also looked for any criticality safety issues associated with the DFS concept, its intended mode of operation and for spent fuel retrieval operations.

52. Twenty nine questions were raised with the EDF NGL DFS project team which are recorded at Reference 22. Each question has been given to EDF NGL's lead on fuel performance matters for the DFS (Reference 34) and was discussed at a level 4 meeting with the EDF NGL held on 1 May 2013. EDF NGL has provided responses to each of the questions raised by ONR (References 23, 24, 25 and 26) but further engagement is required since final resolution depends on future work to develop the complete safety case.

53. In terms of fuel Integrity, Reference 1 provides insufficient detail in a number of key areas. This includes those areas relating to maintenance of fuel integrity during storage and future retrieval. Accordingly, it is ONR's view that a subsequent revision of Reference 1 should address the following:

53.1. Define and substantiate the system to be used for temperature measurements across the stored cask, which is intended to give early indication of cask leakage. Additional detail is also required to explain how the temperature measurement system will be interrogated, calibrated, maintained etc.

53.2. Demonstrate that the proposed vacuum drying system, for the loaded casks, will be capable of achieving the required level of drying of the fuel and that the equipment will be capable of being accurately calibrated to demonstrate that the required level of fuel dryness has been achieved.

53.3. EDF NGL should define how fuel temperatures will be measured and controlled during the drying process.

53.4. Additional detail is required to explain how EDF NGL will ensure that only intact fuel is loaded into the storage casks before each cask is transferred to the DFS.

53.5. Provide sufficient detail of the proposed repackaging facility to demonstrate that it can adequately deliver all of its required functions and can be accommodated at an appropriate location on the Sizewell Site. In addition it must be shown in EDF NGL's planning that a repackaging facility can be funded and constructed within the required timescales.

53.6. The methodology for the lid to shell welding process needs to be decided and the concept needs to be proven.

53.7. Additional operational experience (OPEX)/research information is required to demonstrate that there are no long term material compatibility issues throughout the proposed storage system.

53.8. Further develop proposals for measuring cask thermal output.

54. In terms of Criticality, no specific criticality safety issues were identified in Reference 1 or the detailed level 4 meeting held with the EDF NGL criticality safety lead for this safety case. Little challenge to criticality safety during actual storage was identified provided there is no degradation of the fuel geometry during storage and/or loss of cladding integrity; and there is no bulk water ingress into the storage cask. However, more information will be required over the course of this project on the long term performance of the chosen neutron absorber material within the cask for this storage phase.

55. Fuel retrieval from the dry fuel store and provision of contingency options remain to be detailed. Criticality safety will need due consideration for these operations when this level of detail becomes available.

56. Although Reference 1 was not intended to provide the complete safety case with all issues resolved and justified; the ONR FI inspector has noted several areas that a subsequent revision of Reference 1 should address and which ONR will consider further during the permissioning process.

5.1.4 Radiological Protection

57. An ONR radiological protection (RP) specialist inspector has sampled Reference 1. Reference 1 provides limited detail and resulted in 63 technical questions being raised with the EDF NGL DFS project team which are recorded at Reference 22. Each question has been discussed with EDF NGL's lead on radiological protection matters for the DFS and was discussed at a level 4 meeting with the EDF NGL held on 22 May 2013. EDF NGL has provided responses to each of the questions raised by ONR (References 23, 24, 25 and 26) but further engagement is required since final resolution depends on future work to develop the complete safety case.

58. ONR's RP specialist inspector identified no deficiencies or omissions within the licensee's approach that would lead to the conclusion that EDF NGL will not be able to make an adequate safety case with regard to matters of radiological protection.

5.1.5 Radioactive Waste Management

59. An ONR radioactive waste (RW) specialist inspector has reviewed Reference 1 from a radwaste perspective. This radwaste assessment was based solely on a review of Reference 1, no supporting references were reviewed or assessed. The sample considered focused on the radwaste and decommissioning aspects. The results of this assessment are presented against LC25 (Operational Records), LC32 (Accumulation of Radioactive Waste), LC34 (Leakage and Escape of Radioactive Materials and Radioactive Waste), LC35 (Decommissioning) and the Joint Regulatory Guidance on Radioactive Waste Management.

60. LC25 – operational records

60.1. Table 1.1 (page 25) states that the DFS project will use existing LC25 (Operational Records) compliance arrangements to ensure appropriate records are made of any operation, inspection and maintenance of any DFS plant that will affect safety. LC25(2) requires records to be maintained of the amount and location of all radioactive material, including nuclear fuel and radioactive waste, used, processed, stored or accumulated upon the site at any time. EDF NGL should confirm that their existing LC25 arrangements fully reflect this requirement.

61. LC32 – accumulation of radioactive waste

61.1. Arg. 6.4 (page 56) states radioactive waste will be minimised to ALARP levels and appropriately processed. EDF NGL do not intend to dispose of Sizewell B spent fuel elements to the geological disposal facility (GDF) in Holtec casks, rather a repackaging facility is proposed. This will mean that the Holtec casks would be radwaste. EDF NGL should explain why the selection of a cask for the DFS that is not intended to be used in GDF and which the Nuclear Decommissioning Authority's (NDA) Radioactive Waste Management Directorate (RWMD) has confirmed is not compatible with the GDF is consistent with LC32 and the waste management principles generally.

61.2. Section 11.3.1.1 (page 246) states the current assumption for the DFS system is that core components will be sentenced to the DFS with the fuel and are not classified as waste because they could be reused. EDF NGL should clearly identify the applicable core components at this section using the national inventory waste stream code and confirm that they have not already been declared as operational waste when sent to the DFS. The claim these components would be potentially reused seems tenuous and ONR would want to see some evidence this was feasible and explanation of what re-justification might be required.

61.3. Section 11.3.1.2 (page 246) notes the provision of dry fuel storage introduces a significant volume of Systems Structures and Components (SSCs) to the Sizewell B site. A number of these SSCs have the potential to be subjected to low levels of contamination and activation and may therefore be classified as low level waste (e.g. MPCs). EDF NGL should explain the basis for the prediction that the MPCs may be classified as Low Level Waste (LLW). If the prediction of LLW for the MPCs is based on averaging activity over the weight of the empty MPC this may be vulnerable to a future LLW disposal site not being willing to accept what is essentially diluted ILW. EDF NGL should confirm the number of MPCs that will be disposed and their weight and volume; and explain why disposing of them to a LLW disposal site is a good use of scarce LLW disposal space.

61.4. Section 11.4.1 states activation of the MPC / Hi-Storm casks is expected to be extremely small which suggests the Hi-Storm casks may be LLW (if not free release) as well. EDF NGL should confirm whether this is the case, and what the predicted weight and volume is, assuming they are not reused. It is also stated that contamination ought not to be a problem with the Hi-Storm; and again EDF NGL should confirm whether this is a prediction for LLW or free-release based on averaging over the weight of the Hi-Storm.

61.5. Section 11.4.1 (page 247) details measures to reduce the generation of radioactive waste. This section does not attempt to provide a justification for the current strategy (use of Holtec MPCs), from a radioactive waste management perspective. This is a fundamental weakness that does need to be addressed. The DFS proposals, based on what is in Reference 1, do not appear to minimise generation of radioactive waste. Reference 1 needs to recognise this and present the case for why this is acceptable; and identify the benefits. It does not, and an assessment of what is currently presented against the ONR radwaste SAPs (Reference 31) would not lead to a positive conclusion, as it seems to deal with the operational radwaste and exclude the MPCs themselves which are the most significant radwaste arising. RWMD has said that the MPCs are not compatible with the GDF but that repackaging the fuel into KBS-III canisters would be acceptable. Packaging the spent fuel in a container that is known to be incompatible with the UK's GDF is counterintuitive, and needs more to justify the position in Reference 1, on ALARP and waste management grounds, as it does not look like generation of radwaste is being minimised.

61.6. Table 11.1 (page 250) includes principle P1 'The arising on site of radioactive waste has been minimised'. Based on a review of Reference 1, ONR would not conclude this principle has been complied with.

61.7. Section 19.3 (page 343) notes the MPC is not compatible with the GDF, so the spent fuel will have to be repackaged into KBS-III canisters, and a pre-conceptual letter of compliance (LoC) has been obtained from RWMD. This is positive, but Reference 1 does not really justify, from a waste management perspective, why the project is pressing ahead with the Holtec MPCs. The reasons need to be spelt out clearly.

62. LC34 – leakage and escape of radioactive material and radioactive waste

62.1. It is noted (section 1.1) that spent fuel stored in the DFS will not be classified as radioactive waste and there is potential for spent fuel to be an energy reserve in the future. Therefore the DFS will not be designed to store / process radioactive waste. LC34 (Leakage and Escape of Radioactive Material and Radioactive Waste) is relevant as the spent fuel is a radioactive material. It is noted (section 1.3) that LCs 19, 20. 21 and 22 listed as particularly relevant to the DFS safety case, LC34 is also particularly relevant given the long timescales over which spent fuel will be stored in the DFS.

62.2. Table 1.1 (page 26) states the DFS will use the existing LC34 compliance arrangements to ensure, so far as is reasonably practicable, that radioactive material associated with the DFS is at all times adequately controlled or contained so it can not leak or otherwise escape from such control or containment. In addition, existing LC34 compliance arrangements will also be used to ensure, so far as is reasonably practicable, that no such leak or escape of radioactive material associated with the DFS can occur without being detected, and that any such leak or escape is then notified, recorded, investigated and reported. ONR understand that EDF NGL's existing LC34 compliance arrangements do not include radioactive material, but acknowledges that work is ongoing in this area.

62.3. Section 17.3.2 highlights that the ability to retrieve an MPC back to the fuel pond (or to the repackaging plant once the fuel pond is decommissioned) will be demonstrated by the project, so that if a containment barrier is suspected of being challenged the fuel can be re-packaged (intact) or returned to the fuel pond. Can whether the MPCs have leaked only be established by putting them back into the fuel pond or the repackaging plant? This seems very onerous, and not in line with LC34. Is some sort of monitoring of individual casks not practicable? Stage submission 1 revision 1 should explain how failed fuel is detected when in the DFS and what happens, following decommissioning of the fuel pond, to ex-DFS fuel that is found to be failed.

63. LC35 – decommissioning

63.1. It is noted that section 19 is on decommissioning and sets out the future intention to set out the strategy for safely decommissioning the DFS, this has not been assessed by ONR's RW specialist inspector at this stage.

64. Joint regulatory guidance on radioactive waste management

64.1. Section 2.1 (page 32) notes that "to minimise foreclosure of options with respect to classification of fuel as a waste/energy resource, inspecting the fuel/MPC internals and repackaging the fuel for final disposal (if fuel is classified as a waste at some point in the future), the nuclear safety strategy for the project requires that the fuel can be retrieved at any point in the storage period". Part 2 of the Joint Regulatory Guidance (Radioactive Waste Management Cases [RWMCs]), Reference 35, defines (para 2) Higher Activity Wastes (HAW) as 'HLW, ILW and such LLW as can not be disposed of at present. Para 5 states 'Licensees are reminded that the same safety and environmental standards apply to all activities involving radioactive materials whether or not the material is declared as radioactive waste.'. ONR's interpretation of paras 2 and 5 of the joint regulatory guidance is that this would apply to the Sizewell B spent fuel and therefore ONR would expect to see something akin to a RWMC. Whilst this does not have to be called a RWMC (it could be, for example a Spent Fuel Management Case), or be presented as one document, ONR would expect the sort of information described in part 2 of the joint regulatory guidance on radioactive waste management (Reference 35) to be available.

64.2. Table 2.1 (page 57) contains no link to Chapter 11 on radwaste apart from Arg. 6.4. This is disappointing. Arg 1.3 is 'Suitable strategies will be in place to satisfy safety assessment principles and latest international and UK regulatory guidance. The joint regulatory guidance on radioactive waste management (Reference 35) is UK regulatory guidance.

64.3. In section 15.5 (page 302) UK regulatory interface is taken to be dialogue with ONR. The title of section 15 is 'PWR NSAPs, UK Regulatory & International Guidance Compliance'. ONR considers Reference 35) to be relevant to this section; currently two IAEA radwaste management documents are cited.

65. Based on a relatively high level sampling assessment of EDF NGL's proposals as presented in Reference 1, it is not clear to the ONR RW specialist inspector that the proposals are consistent with LC32 and radwaste management principles generally. If it is only possible to establish whether an MPC has leaked by returning it to the fuel pond ONR would be concerned about compliance with LC34. A storage solution has been selected for the Sizewell B DFS that to ONR's knowledge is not compatible with the acceptance criteria of the proposed UK GDF. If this solution has been selected because the benefits in other areas outweigh the dis-benefits in the radwaste area then this should be presented in stage submission 1 revision 1. It is not evident that the expectations detailed in part 2 of Reference 35 in terms of production of a radioactive waste management case (or the spent fuel equivalent) will be met.

66. Although Reference 1 was not intended to provide the complete safety case with all issues resolved and justified; the ONR RW inspector has noted several areas that a subsequent revision of Reference 1 should address and which ONR will consider further during the permissioning process. The topics to be addressed by a future planned revision of Reference 1 were discussed with the EDF NGL dry fuel store project team at Reference 36.

5.1.6 Mechanical Engineering

67. ONR specialist mechanical engineering (ME) inspectors having sampled the following topic areas did not identify any specific concerns:

67.1. Equipment classification;

67.2. Categorisation and qualification arrangements;

67.3. Examination, inspection, maintenance and testing (EIMT) arrangements; and

67.4. Level 3 safety functional requirements (SFR).

68. Although Reference 1 presented limited detail, the approach described for equipment categorisation, classification and qualification was appropriate. The approach taken to derive the level 3 safety functional requirements is appropriate but further refinement is required. Several issues remain outstanding such as the MPC shock absorber; this as well as the other 'further work actions' will require rapid resolution to ensure adequate justification can be made within the design and safety case.

69. The proposed operating life for the DFS is 100 years. It is ONR's expectation that the next revision of Reference 1 explains how existing or modified EIMT arrangements are to be managed and/or developed to integrate the DFS process. Currently Reference 1 does not adequately identify the risks associated with the proposed 100 year lifetime of the DFS in terms of equipment selection and maintenance regimes; nor how these considerations are to be managed over the 100 year time period to meet the so far as is reasonably practicable (SFAIRP) legal requirement. Equipment selection and maintenance regime arrangements should consider how regulatory requirements will be fulfilled across the operational life of the DFS.

70. Reference 1 gives limited information concerning the engineered and operational protective measures in the existing fuel storage pond (FSP) and the proposed DFS. Although these elements of the safety case are at an early stage, ONR's expectation was to see an outline of the key interlocks and assumptions. The engineered and operational protective measures important to nuclear safety will be examined in ONR's assessment of subsequent stage submissions to ensure engineered and operational interlocks are suitable and sufficient.

71. Future ONR mechanical engineering assessment of subsequent DFS stage submissions will examine the following areas of the safety case which Reference 1 recognises need to be further developed:

71.1. Adequacy of the DFS building passive ventilation to meet all cooling requirements during normal operation and fault conditions;

71.2. Design of the MPC Cooling System (MPCCS) for the flask prep bay (FPB);

71.3. Review of existing cranes against modern codes and standards;

71.4. Testing of existing fuel storage building (FSB) plant following modification; and demonstration of safe resumption of existing fuel route operations with modified plant.

72. On the basis that: Reference 1 was not intended to provide the complete safety case with all issues resolved and justified; and the additional documents sampled, the ONR ME inspector is satisfied that the content and level of detail given in Reference 1 is broadly in line with ONR's expectations.

5.1.7 Control & Instrumentation and Electrical Systems

73. An ONR specialist control & instrumentation (C&I) inspector has sampled the C&I aspects of Reference 1. The DFS is considered by EDF NGL to be largely passive, including the casks, therefore there is no associated control system. There are however monitoring systems that are safety related. The key area of C&I is modification to existing plant and processes primarily associated with cask handling functions. In addition the plant and equipment associated with transportation from the fuel storage building to the DFS is likely to have some C&I equipment.

74. In section 3 it is stated that the DFS structure, systems and components (SSCs) have been categorised following the Sizewell B categorisation process. Further clarification is required to confirm that this categorisation and classification process is compliant with modern standards such as BS EN 61226.

75. Single failure tolerance/diversity is confirmed within section 3 to meet the criterion laid down in the pressurised water reactor (PWR) nuclear safety assessment principles (NSAPs). EDF NGL should confirm that the design has been reviewed against and meets the requirements of the ONR SAPs and relevant IAEA guidance.

76. The temperature difference between the MPC lid and bottom is sensitive to the strength of the circulating fill gas convection current within the MPC, which in turn is dependant upon the MPC fill gas pressure. The provision of a MPC temperature difference monitoring system (TDMS) is identified in section 21 as safety case challenge B2. In section 5.5.11.1 the development of the TDMS is noted but it is uncertain that it will be successfully implemented. Whilst ONR recognise that development of a functional TDMS might be a challenge; ONR considers a system to detect the loss of fill gas pressure in the MPC to be an important parameter for continued through life safety. ONR would expect appropriate substantiation for a decision not to implement a system to detect the loss of fill gas pressure in the MPC.

77. The provision of appropriate instrumentation such as the MPC TDMS and other equipment proposed to confirm the long term storage conditions, although not control functions, are safety related instrumentation that require development and present some risk to the project should their development prove unsuccessful. EDF NGL should explain what contingencies have been considered should the development of planned equipment prove unsuccessful.

78. There are a significant number of hazards and associated safeguards relating to the handling activities in the existing fuel building. Throughout section 6 there are a number of key issues that EDF NGL needs to address. The most significant of these issues are listed below:

    78.1. The design of the MPC Cooling System (MPCCS) remains to be confirmed (Sub-section 6.6.6). ONR expect that a future stage submission will explain the specific requirements of the design and how these are met, including the system safety functional requirements; and categorisation and classification.

    78.2. A significant number of assumptions are made within sub-section 6.7.5 concerning the handling operations. It is ONR's expectation that a future stage submission confirms what has actually been designed into the process and how such design meets the specific safety requirements. In addition, where administrative controls are identified, EDF NGL should demonstrate that such controls reduce risk to as low as reasonably practicable (ALARP).

    78.3. The pond fuel handling machine (PFHM) and the fuel building crane (FBC) are identified as category 2 manual control systems in section 6.8.3, which discusses manual control, automatic control, instrumentation, alarms and interlocks. Implementation of changes to the fuel building crane control and protection system is to be justified in stage submission 3 revision 0. Section 6.8.3 also notes that the pond fuel handling machine control and protection system is to be upgraded as part of a separate project. This upgrade will include a re-validation of the existing hazard and interlock schedule including dry fuel storage operations. In addition to the reporting arrangements established for those separate projects, ONR expect to be informed of the progress of modifications to existing plant that has the potential to affect the DFS project through the established DFS project ONR communications plan arrangements.

78.4. ONR consider the statements made in sub-sections 6.8.3.1 and 6.8.3.2 regarding the categorisation of the automatic control and protection systems to be contradictory. Sub section 6.8.3.1 says automatic control and protection systems are category 1, whereas sub section 6.8.3.2 lists category 2 automatic control systems. A future revision of Reference 1 should clarify the categorisation of automatic control and protection systems.

78.5. In sub-section 6.9.2 the fuel inspection equipment and MPC welding equipment are described as “safety category 3 (not important to nuclear safety)”. An established definition for safety category 3 within EDF NGL is “A proposal affecting nuclear safety which, even if inadequately conceived or executed, could not lead to a significant increase in the risk of radiological hazard” (Reference 37). The comment in brackets is inconsistent with this definition, is misleading, and should be removed.

78.6. The MPCCS and the Blowdown and Drying system are Category 1 safety systems with associated C&I, however, no mention is made of the appropriate C&I standards and codes in sub-section 6.9.2.2 where other codes have been identified.

78.7. Sub-section 6.9.3, final paragraph states that the automated welder will be provided with safety category 3 interlocks to prevent “exposing operators to a high radiation hazard”. Category 3 interlocks do not seem appropriate for protecting the operator from a high radiation hazard, albeit the level is not identified.

78.8. Similar to ONR’s earlier comment regarding assumptions, within sub-section 6.9.4.1. the detection of abnormal MPC temperatures is claimed “should be” revealed by monitoring equipment during welding. It is ONR’s expectation that a future stage submission confirms what has actually been designed into the process and how such design meets the specific safety requirements.

79. ONR welcomes the recognition of aging and obsolescence within sub-section 8.1. and expects to consider this aspect further when the C&I aging and obsolescence strategy becomes available.

80. Modifications to the control arrangements for existing station fuel and cask handling equipment and operations, to accommodate dry fuel storage, is to be justified through stage submission 3 revision 0 or specific implementation engineering changes (ECs). Noting that stage submission 1 revision 1 is intended to substantiate claims made on this equipment with respect to DFS operations, ONR expect to be informed of the progress of such modifications to existing plant that has the potential to affect the DFS project through the established DFS project ONR communications plan arrangements.

81. Control is discussed in sub-section 8.4.2 which describes “Dependencies between protection and control will be identified and adequately addressed”. Clearly any dependencies between protection and control systems should be avoided. Any dependencies between such systems will require substantiation to confirm that risk has been reduced to ALARP.

82. Sub-section 8.4.3 identifies certain temperature measurements within the DFS that potentially would be made available on the engineering local area network (LAN). The computer based systems important to safety (CBSIS) security aspects of providing such information on a LAN should be considered. In addition, the provision of measured parameters to the off site emergency response centre provided as part of EDF NGL’s response to the Fukushima accident ought to be considered also.

83. The discussion in sub-section 8.8 concerning hazards should confirm whether recommendations made following the Fukushima accident have been considered with regards to maintaining power supplies and qualification of any essential instrumentation.

84. The statements made in sub-section 8.14 concerning software are high level. It is ONR’s expectation that more detail of the processes, codes and standards will be provided in a future stage submission. Typically such references will include BS EN 61508 part 3, ONR SAPs and TAG 46. EDF NGL should also consider the requirements of CBSIS security and the creation of an appropriate security case(s).

85. The ONR specialist C&I inspector considers Reference 1 to provide an appropriate outline programme of work to support the future development of the design and safety case for the Sizewell B DFS. Although Reference 1 is recognised to provide a high level description with further submissions to follow, ONR’s expectation was for it to be much more precise in a number of key areas which have been identified in the above text. In addition to not presenting evidence, Reference 1 frequently does not adequately specify the requirement; rather it alludes to what may be provided. Without the specific requirements being identified in certain areas, there is the potential for non compliance with the safety case requirements.

5.1.8 Structural Integrity

86. An ONR specialist structural integrity (SI) inspector undertook a high-level review of the evidence presented in those sections of Reference 1 most pertinent to structural integrity.

87. Section 3 of the report covers general design aspects of the DFS and refers to the optioneering process that has been used to demonstrate that the Holtec double walled MPC is the most appropriate design for the dry storage option. The methodology by which the ALARP case for the choice of DFS made could be better explained and/or referenced in the stage submission.

88. ONR note that detailed design and procurement will involve a further ALARP analysis to determine whether the DFS design could be optimised further. It is ONR’s expectation that the design should be shown to be ALARP against the original design options available during this further ALARP analysis.

89. Section 3.2.4.1.1 gives the outstanding issues in the design of the DFS. The possibility of sipping the gas within the MPC to examine for failed fuel is considered by EDF NGL to be a commercial issue that is not safety related. The proposal is to fill the MPC with helium gas which is often used as a leak detection gas due to its small size and ability to diffuse though otherwise immeasurably small orifices. Introducing engineered escape paths for this gas will increase the likelihood of its escape; this might effect the cooling of the fuel inside the MPC. The possibility of depressurisation of the MPC, including via any sipping device, should be considered.

90. Section 3.2.5.3 discusses the basis of the structural integrity substantiation. This section is a very high-level review of the current situation and does not provide any in-depth information on the probabilistic and deterministic analysis performed or proposed. This falls short of what ONR would expect from a safety case; ONR will look to future stage submissions to provide more substantial information.

91. Section 5.3 of Reference 1 gives an overview of the proposed plant including subsections addressing each of the components individually within the Holtec DFS system. No discussion concerning the function of the double walled MPC is presented. A significant amount of work remains before the justification of the proposed solution can be presented. This is a risk to the timeline of the programme. ONR note, again, that the MPC will be filled with helium; this will be performed via a vent in the MPC lid. It is not clear to ONR how escape of the helium is to be prevented, and how efficiency of filling of the MPC, from the top with the light gas, is to be guaranteed. Although ONR is not permissioning an activity solely on the basis of Reference 1, ONR will look to a future stage submission to addressed this topic.

92. The deterministic structural integrity requirements on the MPC are based around ASME code compliance. Designing these components against a recognised nuclear design code is, clearly, to be supported. It is not, however, apparent immediately why this might be sufficient to demonstrate that the design is suitable for use in the UK and at Sizewell B. The stage submission contains a large quantity of discussion on how demonstration of ASME compliance is to be made. Before any permissioning activity, ONR would expect to have documentation presented which demonstrates why building to ASME is sufficient and, where gaps are identified, what EDF NGL intends to do to fill gaps against UK expectations.

93. ONR note that there have been a number of initial scoping assessments done which identify areas considered, at this stage, to be limiting. ONR note that these are at a very preliminary stage and are based upon a single-wall MPC, which is not the proposed design. Furthermore the Failure Modes, Effects and Criticality Assessment (FMECA) has not yet been completed, neither have the manufacturing principles been worked up. ONR judge that the design is too immature to assess where the limiting regions might be with any accuracy.

94. Section 5.5.4 of the stage submission gives detail on the defect tolerance calculations. This states that defect tolerance studies will be undertaken: that is, they have not yet been performed. This too presents a risk: the output from these analyses may be needed to inform the inspection programme.

95. The inspections planned for the MPC are at an early-stage of planning. No details of the inspections are given for planned in-service, pre-service and manufacturing inspections. EDF NGL state that “Where appropriate, inspections will contain redundant and diverse elements and have their capability demonstrated.” The approach of robust and qualified inspections is one that ONR support. Details of these inspections will be required in the near term. Qualification of in-service inspection processes takes a significant amount of time. ONR judge that this represents a risk to the production timeline of the Dry Fuel store. ONR will look to future stage submissions to gain confidence that inspections will be appropriate and that safety is not compromised to meet programme timescales.

96. The issue of in-service degradation has been the subject of a significant amount of work and was key in the ALARP analyses performed to date. EDF NGL acknowledges that chloride stress corrosion cracking (SCC) is a possible degradation mechanism for these components and is considering this in their analyses. ONR judge that the most likely

long-term degradation mechanism is chloride SCC and consider the analysis performed thus far to be satisfactory.

97. The structural integrity analyses of the Hi-Storm and Hi-Trac units are at a very high-level and do not contain any substantial detail. ONR note, again, that these are to be designed against the ASME code. When the analyses for these components are presented in future stage submissions, ONR will expect to see justification of not only ASME code compliance, but also why the work done is sufficient for the UK environment at Sizewell B specifically.

98. On the basis that: Reference 1 was not intended to provide the complete safety case with all issues resolved and justified; and the additional documents sampled, the ONR specialist SI inspector considers that the chloride SCC analyses performed so far is satisfactory but has identified several areas for improvement which should be addressed in subsequent stage submissions, including justification of: the use of helium given its ability to escape; the double walled MPC; the use of ASME codes; and construction and in service inspection.

5.1.9 Civil Engineering

99. An ONR specialist civil engineering (CE) inspector sampled those parts of Reference 1 relevant to the DFS building, including: any civil modifications to the existing fuel storage building; and proposed haul path. The civil engineering aspects of the proposed DFS safety case were also considered. The structural capacity of the Hi-Storm ‘overpacks’ is considered by ONR’s structural integrity specialists since the concrete is provided primarily for shielding rather than strength.

100. Fifteen questions were raised with the EDF NGL DFS project team which are recorded at Reference 22. Each question has been given to EDF NGL. EDF NGL has provided responses to each of the questions raised by ONR (References 23, 24, 25 and 26) but further engagement is required since final resolution depends on future work to develop the complete safety case.

101. Malicious Aircraft crash assessment will be taken forward by ONR’s Civil inspector through inspection of the licensee’s assessment. This ONR inspection work will be coordinated with ONR’s CNS inspector and recorded separately due to the security classification (Reference 38).

102. Reference 1 is not the final safety case and sections of the document require to be developed during subsequent revision. The opportunity now exists to acknowledge, within a future revision, the role of the DFS superstructure in preserving the condition of the stored casks, providing a good environment for temperature monitoring, and reducing the effects of certain hazards. Accordingly, it is ONR’s view that a subsequent revision of Reference 1 should address the following:

102.1. The last paragraph of section 3.8.2 states that the role of the DFS building is solely to provide a visual screen. Whilst noting that the nuclear safety functions of the foundations and floor slab are mentioned later in the document (section 7.4.1) ONR believe that the superstructure also has a safety role for the following reasons:

102.1.1. Weather protection: Given the proposed 100 year storage duration, the longevity of the containers would be adversely affected if they were exposed to the elements and wildlife (for example from: corrosion due to rain, airborne chlorides, animal fouling, high temperatures, and freeze/thaw actions).

102.1.2. The superstructure helps protect the casks from hazards such as snow or flooding that might block the lower cooling vent holes in the casks.

102.1.3. The enclosing superstructure provides a better environment for monitoring and inspecting the containers during storage.

102.1.4. The superstructure facilitates the provision of adequate long-term security arrangements for the store.

102.2. Reference 1 does explain that following the detailed design review, the design will be subject to final optimisation, and the safety functional requirements (SFRs) will then be finalised. This phase will complete with issue of a detailed design package and a set of design substantiation reports which explain how the safety functional requirements have been satisfied through the detailed design. This phase of the work will support the production and issue of: stage submission 1 revision 1 of the DFS safety case; stage submission 2 revision 0 (DFS Building); and stage submission 3 revision 0 (Fuel and Container Handling and Transfer). ONR intend to sample the nuclear safety requirements specification for stage submission 2 and the design substantiation report (DSR) for the DFS building.

102.3. Table 3.8 presents a list of hazards considered in the DFS design and development process. Hazard requirement HR Ref 14 covers precipitation, but does not mention surface water run-off and the potential for flooding of the cask transfer facility (CTF) pit, or increased degradation of the building contents. (See OPEX from Calvert Cliffs, July 2011; Reference 39).

102.4. Section 5.5.9.1 addresses in-service degradation of the external surfaces of the casks, but does not specifically mention the requirement to maintain the integrity of the lifting points on the MPC. These are required to be serviceable if the MPC is to be removed from the Hi-Storm for ‘reverse’ processing or final removal from the site. This point is recognised in sections 5.6.4 and 5.6.7 for the Hi-Storms, although the contributing role of the DFS building as a protective weather envelope is not recognised.

102.5. Sections 5.5.9.1 (External Degradation), 5.5.10 (Careful control of operating conditions) and 5.5.11.2 (Vent, Salt and Environmental Monitoring) should acknowledge the function of the superstructure in providing a more stable and benign environment to reduce the extent of cask degradation and the effects of certain faults and hazards.

102.6. Section 5.6.6.1 discusses the concrete used for the manufacture of the Hi-Storm ‘overpacks’, and states that it might not be possible to store samples under conditions representative of the actual Hi-Storm operation. However, ONR would not expect it to be too difficult to store samples within the DFS building where conditions would be reasonably similar.

102.7. Section 5.8.2.1.3 presents the results from the preliminary thermal modelling and states that the fuel temperatures with an MPC within a Hi-Storm are not particularly sensitive to blockage of the cooling air vents, and even with 90% blockage of the vents, the predicted peak temperatures are within the normal operating limits. Section 5.11.4 on hazards mentions collapse of the building but does not give details for security reasons. Whilst it may be considered unlikely that a full or partial collapse of the building would fully block the vents of a cask, would this also be the case if the collapse was due to snow and ice? What would be the mission times for unblocking the vents? This scenario is included in Table 3.8 as hazard requirement HR Ref 16.

102.8. Section 5.11 addresses hazards but does not mention internal flooding either from rain water ingress or surface water run-off. This has the potential to block the lower vents of the Hi-Storms (and to flood the CTF pit). See comment above concerning table 3.8. Nesting animals might also have a similar effect on cask ventilation. ONR note that section 5.11.7 mentions vent blockage as a hazard in itself, but it would be useful to include a list of the possible causes; and inspection criterion/prevention measures.

102.9. Section 7.4 addresses the structural integrity of the DFS building and it would be useful to mention here that the safety case for the DFS building will be presented in Stage Submission 2, rather than stating this in the very last section, section 7.15.

102.10. Section 7.4.1 quotes an acceptance limit for the floor slab of 5 degrees from the horizontal at any point under any fault loading. In order to monitor the floor slab for settlement and tilt after construction, during initial placement of the casks, and throughout the operational life of the DFS, a system of monitoring of the floor slab is likely to be required. It is therefore expected that leveling surveys would be part of the on-going inspection/surveillance requirements for the operational safety case, and a commitment to do his should be captured in the documentation. It should also be mentioned in section 7.12 on structural monitoring, inspection, testing and maintenance.

102.11. Section 7.4.2 states that the results from the geotechnical assessment will be used to appropriately assess and substantiate: the foundation/floor slab bearing capacity; potential settlement; and liquefaction risk for the DFS building. Where and how these assessment results are recorded should be identified. ONR intend to see the geotechnical report identified at reference 7.6 of Reference 1, which should consider the settlement and tilt of the foundations and floor slab.

102.12. Section 7.4.4 mentions the CTF. Depending upon the depth of the foundation and floor slab, and the height of the ground water table, this element of the structure could experience upward buoyancy forces, and these would need considering in the design of this part of the base slab. The extent to which the CTF is ‘water proved’ (either by tanking, water-stops in construction joints, and/or metal liner) should be dictated by the consequences of the CTF filling with water and the requirement to meet relevant good practice. Some discussion or comment on this is required.

102.13. Stage submission 1 should clarify whether the CTF is to have a load bearing cover or will it be barriered when not in use (noting that barriers may obstruct the movement of the cask transporter)?

102.14. Section 7.6 addresses the durability of the DFS building, and mentions the likelihood of the need to replace doors, louvers etc. Has the worker dose implications of building inspection and maintenance been calculated, and what would be the effect on dose estimates if the roof was to require recladding? This may be significant as section 14.8.2 states that the assessed worker risk already exceeds the required target.

102.15. Section 7.11.1 on water drainage does not explicitly differentiate between internal drainage, external drainage of rainwater hitting the building, or rainwater run-off from adjacent external ground. All these have the potential to cause internal flooding of the DFS. Some clarity here would improve comprehension. For example, is the perimeter floor slab drainage that is mentioned an internal or an external drain?

102.16. The role of future PSRs in maintaining the safety case throughout the 100 year operating period of the facility should be mentioned.

103. ONR is content with the selection of civil design codes specified, and it is noteworthy that for the first time, EDF NGL has committed to design a new building to the modern Eurocode standards. This decision follows a level 4 meeting ONR had with EDF NGL on this topic on 11th June 2012 (Reference 40).

104. The ONR CE Inspector was satisfied that Reference 1 presents a useful statement on the current status of the safety case, and is a suitable vehicle for ONR to engage with EDF NGL during their development of the DFS project.

5.1.10 Human Factors

105. An ONR human factors (HF) specialist inspector has sampled Reference 1 focusing primarily on sections: 13 - Human Factors (Human Machine Interface); and 16 - Operational Safety Management and Training, of the safety case and a number of supporting documents. Reference 1 outlines the safety case claims and arguments but does not provide the evidence required to substantiate these. Rather, Reference 1 identifies the activities and analyses that will be undertaken during development of the detail design to ensure that the claims and arguments can be substantiated.

106. In addition to review of documents ONR's Human Factors (HF) specialist inspector has also met with EDF NGL's human factors and safety case specialists via a number of level 4 Meetings, the most recent on 25 April 2013 (Reference 41), to discuss human factors integration and human factors in the probabilistic safety analysis.

107. ONR's review of documentation and interactions with EDF NGL staff sought to establish how the developing safety case and DFS design will address ONR regulatory principles as expressed in HF related SAPs (Reference 31) and TAGs; in particular SAPs EHF 1 -10 and ONR TAGs T/AST/058 Human Factors Integration and T/AST/063 Human Reliability Analysis.

108. Human factors (human machine interface):

108.1. Section 13 of the safety case presents EDF NGL's approach for specialist HF input to the Sizewell B DFS project both to support the developing design and safety case. It provides a high level description of the Dry Fuel Storage process and identifies the principal operator tasks at each stage of the process. The section briefly describes some preliminary HF assessment work that has been undertaken and outlines the remaining HF assessment work that will be completed in support of the project. In form, therefore, this section of the safety case is more akin to a human factors integration plan (HFIP) rather than an HF report which presents and assesses the claims and arguments made in relation to HF in the safety case. Reference 1 suggests that the HFIP will be periodically reviewed and updated as required to reflect any changes relating to the HF approach. Section 13 should make clear what HF assessments will be undertaken in support of each stage submission.

108.2. ONR recognises that the preliminary HF analysis identified in section 13 will need to be updated as the detail design of the Sizewell B DFS develops and UK specific information becomes available. Some elements of this preliminary analysis are useful, particularly the task analysis and error identification aspects where these are used to derive recommendations to be addressed via the detail design. It is less clear to ONR what value is provided by human error quantification at this stage or how the screening values are to be used since there is no requirement for human error probabilities (HEPs) in relation to initiating events to support the PSA; and the approach to PSA taken at Reference 1 is to use risk targets to identify target initiating event frequencies for the design of individual systems structures and components (SSCs).

108.3. The derivation of the HEPs reveals that the human error assessment and reduction technique (HEART) was used; a technique that is normally considered to provide best estimate HEPs and is not recognised as a method for deriving screening values. Further, it is clear that the design is not sufficiently progressed to allow for proper assessment of the performance shaping factors (PSFs) that are used within HEART to derive human reliability estimates. As a result, there is a real chance the HEPs derived are likely to be optimistic rather than conservative and not meet the requirements of screening values. ONR recognise that the values derived are considered to be preliminary and that a commitment is provided to revise these when sufficient detail design information becomes available. ONR considers it will be necessary to undertake a complete revision of the HEPs supporting stage submission 1 of the safety case. ONR also expect EDF NGL to utilise their updated human error quantification technique, the nuclear action reliability assessment technique, which had been developed as an improved version of the HEART method when revising the preliminary HEPs.

108.4. A human engineering programme is outlined in section 13 that will be undertaken to support the detail design of the DFS System, and includes: a programme of task and error analysis work; an OPEX review; an allocation of function review; a human machine interface (HMI) review; a review of inspection and maintenance tasks and a workplace and environment review. ONR consider the planned work to be appropriate, however more detail is required on the methodology and standards that will be applied in those reviews. ONR considers it to be good practice and supports the inclusion of HF representation in design reviews and design development activities.

108.5. Section 13 indicates that human reliability assessment will be undertaken to support the claims made in the safety case for: operator initiated fault sequences; claims on operators as a line of protection; and claims on operator post-fault recovery actions. Although the preliminary task and error analysis has been cross referenced against an initial fault schedule produced by the PSA team, and it is reported that “mostly similar” humans errors were identified; the report does not identify which errors were common to both analyses and which, if any, additional human errors were added to the fault schedule as a result of the initial task and error analysis. ONR consider that section 13 should provide a table of the known claims that will be made on the operator in each of the three categories of claim listed above; and provide any preliminary argument that can be made in relation to each claim (In accordance with section 1.4.2 of Reference 1). ONR does not consider it necessary at this stage to derive HEPs in relation to these claims, but would expect the submission to show evidence that a human factors schedule was being developed which mapped the claims, arguments and evidence in relation to HF that would be required in order to produce an adequate stage submission 1 revision 1.

108.6. A programme of HF verification and validation activities is identified in the conclusions of section 13 that will be undertaken at three stages in the project:

Factory Acceptance Testing (FAT); Inactive Commissioning; and Active Commissioning. It is explained that the requirements for verification and validation will be identified as the detail design progresses and this is appropriate at this stage. ONR consider it an example of good practice that HF practitioners are involved in conducting verification and validation of the design in relation to HF issues at these phases of the project.

109. Operational Safety Management and Training:

109.1. Section 16 provides an outline of the assessment work that will be undertaken to substantiate the operational safety management and training aspects of the safety case. A significant amount of HF assessment is identified as being required to underpin this substantiation. ONR is content that the approach to procedure development based on task analysis and implementation of EDF NGL's procedure development guidance is appropriate. ONR will review a sample of the DFS operating procedures as part of an ONR readiness inspection planned prior to permissioning inactive commissioning of the DFS System.

109.2. Management of the DFS will come under the fuel route according to section 16.4. ONR is content with the approach to workload analysis described in section 16 of the submission aimed at planning of staffing levels for the intended 100 year life of the facility.

109.3. The systematic approach to training (SAT) described in section16.7 and intended to define the training process required for the DFS system explains that outputs from the HF assessment will be fed into the training programme development; and also that a formal HF review of the training programme will be undertaken as part of the design review process. ONR considers the application of SAT to meet the requirements of relevant good practice (RGP) in relation to training and will review the outputs from the HF review of training when assessing stage submission 1 revision 1.

110. Reference 1 is unclear on what HF assessment is to be undertaken in support of the remaining stage submissions. However, ONR considers that Reference 1 outlines an appropriate programme of work in support of the development of the design and safety case for the Sizewell B DFS System, but do not consider that the material constitutes a presentation of the HF related claims and arguments that will be made in the safety case - the stated purpose of Reference 1. ONR would have expected an outline presentation of the expected claims to be made on the human operator in relation to operator-initiated fault sequences; operators acting as or supporting equipment acting as a line of protection within fault sequences; and operator post fault recovery actions. HF references to Reference 1 confirm that preliminary work has been undertaken to identify operator initiated fault sequences and as a minimum ONR would have expected some indication of the likely claims and arguments arising from such work to have been presented.

111. ONR has made comment about the approach taken to human error quantification in the human reliability analysis. These comments centre on the approach to screening used in the DFS project and the use of the HEART human error quantification method.

112. The ONR HF inspector does not consider that Reference 1 has clearly identified the claims that would be made on the human operator in relation to initiating events, fault protection or fault recovery. It is ONR's expectation that in a subsequent revision of Reference 1 each claim on operator action should be clearly stated and that evidence should be provided to substantiate that the tasks in which these actions are found are feasible and properly supported by the task design and operational environment including

the human machine interface (HMI), procedures and training. In addition, HEPs derived in the final PSA should be fully assessed taking into account information generated during detailed design. Much of the work outlined in Reference 1 is appropriate and once complete could provide the evidence to support the claims and arguments that might be made in relation to operator action. The ONR HF inspector is content that an appropriate work programme is in place.

5.2 ONR Nuclear Security Assessment

113. An ONR civil nuclear security inspector (CNS) continues to engage with EDF NGL concerning the security arrangements for the: DFS, haul path, and modifications to the existing fences and site access arrangements. EDF NGL has provided a security statement for assessment by ONR CNS; and ONR CNS are seeking clarifications to this statement before completing their verification process that is required to support approval of the security arrangements for the DFS facility.

5.3 ONR Radiological Material Transport

114. An ONR radiological materials transport team (RMTT) inspector has provided clarification to EDF NGL concerning the application of transport regulations to the DFS project. These clarifications are noted below and are recorded in Reference 42:

114.1. Confirmed that the package employed to transport spent fuel from SZB to geological disposal must be approved against the regulations in force at the time. It is the package that is approved rather than the route (Reference 43); and

114.2. Confirmed that the carriage of dangerous goods regulations do not apply whilst the MPC remains on the licensed site (including outside of the inner security fence). The DFS safety case is to substantiate the MPC/Hi-Storm transport solution for the on licensed site move (References 43, 44 and 45).

115. A point to note concerning the future transport of a package off the licensed site (Paragraph 114.1) is the point raised in ONR's assessment of the original planning application (Reference 46) in which it was noted that the Department for Transport position on this was that the design for long term storage of waste or fuel should from the outset be geared to ensuring that the material is transportable at the point it leaves that storage facility (i.e the storage regime has to make sure that the material always meets transport regulations, from the point of emplacement to 100 years hence and thus adequate records need to be kept, behaviour noting etc). This requirement was also captured in the radioactive waste management section of this PAR (section 5.1.5). ONR notes that it is currently EDF NGL's intent to repackage the nuclear matter stored in the DFS before transport off the licensed site.

5.4 ONR Safeguards

116. An ONR safeguards inspector has been informed of the ONR permissioning strategy for the DFS project and is invited to the DFS programme level 4 meetings (Reference 47). The ONR safeguards inspector has engaged separately with Sizewell B through normal business and intends to participate in dry fuel store level 4 meetings commencing October 2013.

6 REGULATORY CONSIDERATIONS

6.1 Licence Condition 19 (Construction or installation of new plant) arrangements

117. EDF NGL is in the process of developing fleet wide LC19 arrangements which ONR is monitoring as part of a separate intervention project. Whilst that work is ongoing, Sizewell B has implemented local LC19 arrangements, specifically aimed at the

construction of the DFS, described in EDF NGL document "Control arrangements for construction or installation of new plant" reference SZB/LI/001/019 (Reference 9).

6.2 The Environment Agency

118. The Sizewell B Environment Agency (EA) inspector has been informed of the ONR permissioning strategy for the DFS project and is invited to the DFS programme level 4 meetings (Reference 48).

119. EA has raised actions on EDF NGL at the level 4 programme meetings concerning:

119.1. Potential hazards on the haul path (i.e. bulk chemicals, fuel oil, buried pipework etc);

119.2. What sustainability considerations are being given to construction; and

119.3. Production of an assessment of the process design to demonstrate compliance with Environmental Regulations 2010.

120. Each of these actions has been recorded in the DFS level 4 programme meeting actions tracker (Reference 49) and will be managed through normal business.

6.3 Fuel Storage at Sizewell B

121. The spent nuclear fuel assemblies arising from operating Sizewell B nuclear power station are currently being stored on site under water, within steel racks located in the Sizewell B fuel storage pond (FSP). However, the current rate of accumulation and current safety case restrictions mean that further spent fuel storage capacity will be required by the end of cycle 15 (late 2017). Although cycle 15 is planned to end in late 2017, space in the fuel pond is required before this date to receive new fuel prior to the end of cycle 15 and commencement of refuel outage RF015 (refer to Reference 5).

122. The licensee has developed a proposal to construct and commission a dry fuel storage facility at Sizewell B to provide the necessary additional spent fuel storage capacity. The proposals are presented in a Paper of Principle (Reference 5) titled Sizewell B DFS (Addendum 1). Reference 5 sets out the strategy by which the safety case for the new facility will be made in a series of stage submission papers.

6.4 Fuel Retrieval and Contingency Planning

123. Paper of principle (Reference 5) noted that the safety case approach adopted will follow the "strategy that a credible contingency is available for any untoward operational experience or technical developments at all stages of store operation". Contingency arrangements such as the use of a HI-STAR package or repackaging facility are highlighted in Reference 5. Reference 1 makes further "outline" statements on the provision of such contingencies but does not, at this point, confirm what contingencies will be in place and available to use from the start of operation of the dry fuel store process. When set against the possible background of fuel assemblies being required to be put into the dry fuel storage system to free up storage locations within the existing fuel storage pond to support cycle 15 refueling, a future submission will need to clarify how a credible retrieval route is made continuously available from the point at which the dry fuel storage process commences; and has the capacity, should there be a common degradation mechanism, to cater for the dry stored inventory.

6.5 Emergency Management

124. The potential consequences of incidents or accidents at Sizewell B have implications for the physical and radiological safety of operational staff and members of the public (including Sizewell A staff/contractors/visitors). The station approach to emergency response must minimise the impact on the public and environment. A future submission

of Reference 1 will need to specify the requirements for emergency management concerning the dry fuel storage process and ensure that such requirements are fully integrated into the existing station arrangements; including training in and exercising of those arrangements.

7 MATTERS ARISING FROM ONR'S WORK

125. Concerning the submission of SS2 and SS3, ONR notes (Reference 50) that both documents will not now have completed full INSA before submission to the July NSC and ONR. This is due to key supporting references being delivered later than required to maintain what is a challenging programme of work that has little float within it. Availability of key supporting references has the potential to affect ONR's assessment of SS2 and SS3 and consequently permissioning of hold points. The pre-requisites given in ONR's process for assessment of category 1 safety cases (Reference 51) requires:

125.1. The Safety Submission

125.2. All references providing necessary supporting evidence.

125.3. The Nuclear Safety Committee minutes.

125.4. A letter from the licensee requesting approval of a change to arrangements under a particular licence condition.

125.5. The INSA report

126. During ONR's review of Reference 1 and level 4 technical meetings, ONR inspectors have discussed their review findings with their discipline counterparts in EDF NGL and raised further questions that are recorded at Reference 22 and which has also bee shared with the EDF NGL dry fuel store team. Since ONR has not undertaken a formal assessment of Reference 1; ONR will seek to confirm that EDF NGL addresses these review comments and questions when subsequent stage submissions are submitted for formal assessment.

127. Since issue of Reference 1, the height of the DFS building has been increased to accommodate the proposed cask lifting transporter. An adverse condition investigation (ACIN 793946) was undertaken by EDF NGL to understand why this change had been necessary as it affected the planning permission for the DFS. EDF NGL provided a copy of their stakeholder letter (Reference 52) and ACIN 793946 (Reference 49 attachment) to ONR.

128. ONR was provided with a draft of EDF NGL's proposed quality plan to support the release of hold point 1 (Reference 53). This hold point 1 quality plan included confirmatory check for EDF NGL Safety and Regulation Division (SRD) hold point release and ONR hold point release.

8 CONCLUSIONS

129. The reviews of Reference 1 provided by ONR specialists and recorded in this PAR note that the document remains to deliver much of the evidence required to support the claims and arguments made. The status of this first issue of the Sizewell B dry fuel store safety case was communicated to ONR by EDF NGL and is an expected feature of the staged submission strategy being followed by EDF NGL. This is reflected in the level of engagement with EDF NGL who continue to develop the safety case as the programme of work continues against a challenging timescale.

130. The EDF NGL project programme is planning for success and ONR's regulatory hold points are set within that plan. ONR has seen some slippages in the EDF NGL programme of work against their plan, including: enabling modifications (west car park, security turnstiles, 11kV transformer); transporters' contract placement; MPC/Hi Storm/Hi-

Trac release for manufacture etc. Similarly the completion timescales for key supporting references associated with SS2 and SS3 has meant that EDF NGLs INSA will not have been fully completed before submission to the NSC and ONR. Should SS2 and SS3 fail to deliver the required safety case standard to support the issue of ONR agreement licence instruments for these category 1 (SS3) and category 2 (SS2) submissions; then this may affect the timescales on which ONR is able to release regulatory hold points 1 (commence construction of the DFS) and 2 (commence category 1 modifications on fuel storage and fuel handling facilities); and consequential impact on the overall EDF NGL DFS programme.

9 RECOMMENDATIONS

131. I recommend ONR maintain its current level of engagement, described in IPR NGL18 (Reference 12), with EDF NGL.

132. Given the importance to safe storage of nuclear matter over an extended period of time (100 years+), I recommend that an ONR inspector visits Holtec's manufacturing facility for the purpose of gaining confidence in the quality assurance and standard of manufacture of key components such as the MPC, Hi-Storm and Hi-Trac.

10 REFERENCES

1 Category 1 paper, NP/SC 7575, SZB EC 338898, Dry Fuel Store (DFS) safety case. Stage Submission 1 Revision 0. (2012/496728)

2 British Energy - Sizewell B Power Station - Technical Specifications Safety Limits and Nuclear Safety Requirements Section 2.3.9 - SZB50572R - 04 December 2009 Part 1. (2009/494121)

3 Sizewell B - LI524 - Approval of amendments to NSR 9.3. (2010/568911)

4 PAR 78/2010 Sizewell B- Phase 3 operation of the Region 2 fuel storage racks - Approval of changes to NSR Section 2.3.9 - NP SC 7507 SS4 EC 329325 V03. (2010/572507)

5 Sizewell B DFS Paper of Principle (Addendum 1). (2011/589703)

6 Sizewell B Dry Fuel Store Planning Application PAR 2010/29. (2010/197487)

7 Sizewell B - Dry fuel store - Planning application - Letter to DECC - Version 2. (2012/202537)

8 SZB Dry Fuel Store project, DECC grant consent for planning application on 22 07 2011. (2013/230828)

9 SZB Dry Fuel Store Project, SZB/LI/001/019 dated March 2013 - Control Arrangements for Construction or Installation of New Plant (LC19 local arrangements for DFS). (2013/161220)

10 SZB Dry Fuel Store Project, Hold Point PAR ONR-CNRP-SZB-12-047, Schedule of construction and commissioning hold points with Specification (LC21[4]) of Consent (LC21[4]) to commence active commissioning. (2012/363755)

11 NGL - Sizewell B - Unique no SZB 50754N - Request for ONR Regulatory Hold Points within the Sizewell B Dry Fuel Store Project - 27th February 2013 Jim Crawford. (2013/108375)

12 EDF NGL - Sizewell B - Intervention Project - NGL 018 - SZB Dry Fuel Store Project see 2011/569559 -2011/344484 & 2009/347627 - 12 July 2012. (2012/278208)

13 SZB Dry Fuel Store Project, PD_REP_SZB_KA0020_037 (2) - EDFs SZB DFS - ONR Communication Plan Rev 001 at May 2013. (2013/193678)

14 SZB Dry Fuel Store Project - Live schedule of documents received by ONR with TRIM reference. (2013/12635)

15 SZB Dry Fuel Store Project, EdF/ONR Level 4 Progress Meeting - 28 November 2012 @ Barnwood. (2012/461686)

16 SZB Dry Fuel Store Project, Specification LI531 (2012 436585) and Letter. (2012/490917)

17 EDF NGL - Unique Nos GEN 32422 N – NSC Minutes for 05 & 06 December 2012. (2012/496714)

18 SZB Dry Fuel Store Project, Stage Submission 1 Revision 0, ONR Inspectors' assessment notes. (2013/229745)

19 Sizewell B Dry Fuel Store, Key Supporting Reference for Hazards, Hazard Requirements and Beyond Design Basis Assessment Requirements, DAO/REP/JIDB/010/SZB/12 Rev. 000, 31/5/12. (2012/442218)

20 D Garnett, e-mail to P Ford, 11/3/13, SXB Dry Fuel Store - SS1, Revision 0 - Comments on civil aspects. (2013/179874)

21 Contact Report ONR-SZB-CR-12-156 Rev 0, SZB Dry Fuel Storage Project - External Hazards Level 4 meeting on 12/9/12. (2012/376008)

22 SZB Dry Fuel Store Project, Schedule of ONR inspector's questions sent to NGL. (2013/15486)

23 SZB Dry Fuel Store Project, EDF Responses to ONR Questions, dated 19-04-2013. (2013/147883)

24 SZB Dry Fuel Store Project, EDF Responses to ONR Questions, dated 05-05-2013. (2013/168092)

25 SZB Dry Fuel Store Project, EDF Responses to ONR Questions, dated 17-05-2013. (2013/186730)

26 SZB Dry Fuel Store Project, EDF Responses to ONR Questions, dated 21-05-2013. (2013/190922)

27 Contact Report ONR-SZB-CR-12-156 Rev 0, SZB Dry Fuel Storage Project - External Hazards Level 4 meeting on 12/9/12 (2012/376008).

28 DAO/REP/JIDB/012/SZB/12 Revision 000; Sizewell B Dry Store Key Supporting Reference for Fault Schedule, PSA and Public Risk. (2012/397876)

29 DFS PSA L4 Meeting Slides 04.02.13. (2013/68701)

30 SZB DFS PSA- ONR-SZB-IR-12-040 - Level 4 Meeting Intervention Report (Revision 0). (2013/85127)

31 Safety Assessment Principles for Nuclear Facilities 2006 Edition, Revision 1. (HOW2)

32 SZB DFS PSA Level 4 Meeting Intervention Report (Revision 0A) (2013/68731).

33 SZB DFS PSA- ONR-SZB-IR-12-040 - Level 4 Meeting Intervention Report (Revision 0) (2013/85127).

34 SZB DFS - Questions on SS1 Rev 000. (2013/52318)

35 The management of higher activity radioactive waste on nuclear licensed sites, Part 2 Radioactive waste management cases. Joint guidance from the Health and Safety Executive, the Environment Agency and the Scottish Environment Protection Agency to nuclear licensees. February 2010. (http://www.hse.gov.uk/nuclear/wastemanage.htm)

36 SZB Dry Fuel Store Project, ONR Consideration of SZB Dry Store Submissions with respect to radioactive materials and waste aspects (SS1 Rev 1) (2013/277965).

37 Aspects of Categorisation of proposals submitted under the Modification Process (BEG/ICP/SHE/EC/001), E/REP/BADB/0019/GEN/05 Rev 000

38 SZB Dry Fuel Store Project - Malicious Aircraft crash assessment (2013/277771).

39 SZB Dry Store Project - Calvert Cliffs Inspection - Report No 1. (2012/324372)

40 Sizewell B - Contact Report 2012 - 072 Dry Fuel Store civil design code choice - 8/6/12. (2012/231880)

41 ONR-CNRP-CR-13-016 Revision 0 SZB DFS HF Level4 April 2013 (2013/159981).

42 SZB Dry Fuel Store Project, Contact Report ONR-CNRP-CR-13-068, Level 4 Programme meeting held at Barnwood on 30 May 2013. (2013/205394)

43 SZB Dry Fuel Store Project, ONR transport inspector, comments on Transport Feasibility Study (2013/87195) and transport regulations applicability for movements on site. (2013/185035)

44 SZB Dry Fuel Store Project, ONR RMT inspector's opinion on application of regulations during cask movements on the licensed site (but outside the security fence). (2013/191726)

45 SZB Dry Fuel Store Project, ONR RMT response concerning regulation of on licensed site cask movements. (2013/191696)

46 Sizewell B Dry Fuel Store Planning Application - High Level Comments. (2010/197610)

47 SZB Dry Fuel Store Project, safeguards interface with/visibility in the CNR programme - SZB Dry Fuel Store. (2013/231120)

48 SZB Dry Fuel Store, EA, RE: Introduction of hold points into EdF's SZB Dry Fuel Store project programme. (2013/231130)

49 SZB Dry Fuel Store Project, ONR Level 4 Project Progress Meeting briefing pack (Part 1) for 26/04/2013 meeting. (2013/150457)

50 SZB Dry Fuel Store Project, Contact Report ONR-CNRP-CR-13-068, Level 4 Programme meeting held at Barnwood on 30 May 2013. (2013/205394)

51 SZB Dry Fuel Store Project, CNRP Process Changes to Address the Requirement for Assessment of Category 1 Safety Submissions. (2013/205326)

52 Sizewell B Dry Fuel Store Project - 2013 April - EDF Letter to DFS Stakeholders regarding building height increase and working hours. (2013/145919)

53 SZB Dry Fuel Store Project, Draft Quality Plan for Dry Fuel Store (ONR Hold Point 1 Release). (2013/123725)