



PROJECT ASSESSMENT REPORT			
<b>Unique Document ID and Revision No:</b>	ONR-HYB-PAR-14-034 Revision 0	<b>TRIM Ref:</b>	2015/120486
<b>Project:</b>	Heysham 2 Reactor 7 Periodic Shutdown 2015		
<b>Site:</b>	Heysham		
<b>Title:</b>	EDF Energy Nuclear Generation Limited (NGL) – Heysham – consent under Licence Condition 30(3) to start-up Heysham 2 Reactor 7 following the 2015 Periodic Shutdown		
<b>Licence Instrument No:</b> (if applicable)	588 (Consent)		
<b>Nuclear Site Licence No:</b>	60		
<b>Licence Condition:</b>	30(3)		

#### Document Acceptance and Approval for Issue / Publication

Role	Name	Position	Signature	Date
Author	[Redacted]	Inspector		28 Apr 2015
Reviewer	[Redacted]	Principal Inspector		28 Apr 2015
Accepted by <sup>1</sup>	[Redacted]	Superintending Inspector		29 Apr 2015
Approval for publication <sup>2</sup>	[Redacted]	Superintending Inspector		29 Apr 2015

#### Revision History

Revision	Date	Author(s)	Reviewed By	Accepted By	Description of Change
A	24 Apr 2015	[Redacted]	[Redacted]	n/a	1 <sup>st</sup> draft for review
B	27 Apr 2015	[Redacted]	[Redacted]	n/a	2 <sup>nd</sup> draft incorporating review comments
0	29 Apr 2015	[Redacted]	[Redacted]	[Redacted]	First accepted issue

<sup>1</sup> Acceptance of the PAR to allow release of LI

<sup>2</sup> Approval is for publication on ONR web-site, after redaction where relevant

**Circulation (latest issue)**

Organisation	Name	Date
Office for Nuclear Regulation	[Redacted Name List]	
Environment Agency	[Redacted Name List]	
Licensee	[Redacted Name List]	

## Heysham 2 Reactor 7 Periodic Shutdown 2015

**EDF Energy Nuclear Generation Limited (NGL) – Heysham – Consent under Licence  
Condition 30(3) to start-up Heysham 2 Reactor 7 following the 2015 Periodic Shutdown**

Project Assessment Report ONR-HYB-PAR-14-034  
Revision 0  
29 April 2015

© Office for Nuclear Regulation, 2015

If you wish to reuse this information visit [www.onr.org.uk/copyright](http://www.onr.org.uk/copyright) for details.

Published 05/15

*For published documents, the electronic copy on the ONR website remains the most current publicly available version and copying or printing renders this document uncontrolled.*

## EXECUTIVE SUMMARY

### Title

EDF Energy Nuclear Generation Limited (NGL) – Heysham – Consent under Licence Condition 30(3) to start-up Heysham 2 Reactor 7 following the 2015 Periodic Shutdown.

### Permission Requested

NGL, the Licensee of Heysham 2 power station (HYB), has requested that the Office for Nuclear Regulation (ONR), grants consent to start-up Reactor 7 following completion of the 2015 periodic shutdown (also known as a statutory outage) carried out in accordance with the requirements of the Plant Maintenance Schedule (MS) made under Licence Condition (LC) 28(4).

### Background

HYB is a nuclear licensed site operating two Advanced Gas-cooled Reactors, known as Reactor 7 and Reactor 8. To continue to operate safely and reliably the reactor plant requires examination, inspection, maintenance and testing. Continuous improvement also requires plant safety improvements to be implemented where these are deemed to be reasonably practicable. Whilst some of these activities can take place when the reactor is at power, many of them require it to be shut down. The Licensee's arrangements require that periodic shutdowns are carried out every three years at each reactor at HYB, providing the opportunity to undertake such activities. On completion of a periodic shutdown the reactor concerned cannot be started up without consent from ONR under LC 30(3).

In November 2014, ONR agreed to the extension of the operating period of HYB Reactor 7 from 10 November 2014 to 15 March 2015.

During the Reactor 7 periodic shutdown 2015, which commenced on 27 February 2015, the Licensee has conducted:

- Examinations, inspections, maintenance and testing activities in accordance with the MS.
- Inspections to support the station safety case.
- Work to comply with statutory requirements.
- Remedial work to rectify plant adverse conditions and emergent work.
- Plant safety improvements where these are deemed to be reasonably practicable.

Where inspection work revealed the potential for an adverse plant condition, the Licensee has assessed the inspection results in accordance with their arrangements and taken appropriate remedial action as necessary prior to ONR granting consent to reactor start-up.

Towards the end of the periodic shutdown, the HYB Station Director wrote to ONR requesting consent to start-up Reactor 7. In that letter, the Station Director confirmed that all remaining outstanding maintenance required for start-up would be completed and there were no actions raised during the start-up meeting requiring closure before start-up.

The Licensee's internal regulator, Independent Nuclear Assurance, has provided a Concurrence Statement that supports start-up.

The Pressure Systems Safety Regulations 2000 (PSSR) competent persons (for the Pre-stressed Concrete Pressure Vessel (PCPV), the reactor penetrations and the balance of plant) have each confirmed that they are content for Reactor 7 to start up.

## **Assessment and inspection work carried out by ONR in consideration of this request**

The ONR Site Inspector, the ONR Periodic Shutdown Project Inspector and ONR Specialist Inspectors have sampled the Licensee's arrangements for controlling and completing the examination, inspection, maintenance and testing requirements of the MS, and other plant modifications of nuclear safety significance, as identified within the outage intentions document. This has included visiting site to inspect samples of the Licensee's implementation of arrangements. These visits included attending the outage intentions meeting where the outage scope was agreed, the mid-outage meeting where work progress to date was presented and the start-up meeting where the readiness of Reactor 7 to return to service was discussed.

The specialist inspectors have undertaken assessments and produced reports for each specialism. I have made use of these reports in the production of this Project Assessment Report (PAR).

The regulatory interventions carried out by ONR have not identified any issues of safety significance, which remain unresolved in relation to the Licensee's safety case for the start-up of Reactor 7, and its operation for a further period of three years, allowing ONR consent to start-up Reactor 7 under Licence Condition 30(3) to be recommended as described within this report.

## **Matters arising from ONR's work**

Station has confirmed to ONR that the requisite outage related work has been successfully completed and that all actions identified by ONR for resolution prior to consent have been addressed. The actions agreed for the longer term, have been included in the relevant station processes, and will be tracked to completion within their arrangements to ensure risks continue to be reduced as low as reasonably practicable.

No matters preventing issue of HYB Licence Instrument 588 arose from the work undertaken by ONR inspectors in relation to the HYB Reactor 7 periodic shutdown 2015.

## **Conclusions**

Following assessment and inspection of matters arising in relation to the Heysham 2 Reactor 7 periodic shutdown 2015, I am satisfied that the Licensee's justification to start-up the reactor and operate for a further period of three years is adequate; consequently, consent to start-up the reactor can be granted.

## **Recommendation**

I recommend that in accordance with the request from the Licensee, ONR should grant consent under Licence Condition 30(3) attached to Nuclear Site Licence No:60 for Reactor 7 at Heysham 2 nuclear power station to start-up following the 2015 periodic shutdown, and Licence Instrument 588 be issued and released to the Licensee to permit this outcome.

## LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
APEX	Appointed Examiner
C&I	Control and Instrumentation
CNRP	Civil Nuclear Reactor Programme
CNS	Civil Nuclear Security (ONR)
EA	Environment Agency
EC	Engineering Change
EMI	Electromagnetic Interference
EMM	Electronic Method of Measurement
HOW2	(Office for Nuclear Regulation) Business Management System
HYB	Heysham 2 Power Station
GC	Gas Circulator
INA	Independent Nuclear Assurance
INSA	Independent Nuclear Safety Assessment
IR	Intervention Record
IRR99	Ionising Radiations Regulations 1999
LI	Licence Instrument
LC	Licence Condition
MOM	Mid-Outage Meeting
MS	Maintenance Schedule
NGL	EDF Energy Nuclear Generation Limited
OAP	Outage Assessment Panel
OID	Outage Intentions Document
OIM	Outage Intentions Meeting
ONR	Office for Nuclear Regulation
OSRC	Operational Safety Review Committee
PAR	Project Assessment Report
PCPV	Pre-stressed Concrete Pressure Vessel
PSA	Probabilistic Safety Assessment
PSSR	Pressure Systems Safety Regulations 2000
PTSE	Post-Trip Sequencing Equipment
RFI	Radio Frequency Interference
RTS	Return To Service
SAP	Safety Assessment Principle(s)
SQEP	Suitably Qualified and Experienced Person
SSC	Structure, System and Component
SUM	Start-Up Meeting

T&F	Trap & Free measurement method
TS	Task Sheet
VFC	Variable Frequency Convertor
VSD	Variable Speed Drive



## TABLE OF CONTENTS

1	PERMISSION REQUESTED .....	10
2	BACKGROUND .....	10
2.1	GENERAL .....	10
2.2	OUTAGE PLANNING AND MANAGEMENT .....	10
2.2.1	Licensee's management.....	10
2.2.2	ONR's intervention management process .....	12
3	ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST .....	12
3.1	SAFETY MANAGEMENT .....	13
3.1.1	Management systems .....	13
3.1.2	Modifications .....	13
3.1.3	Radiological protection .....	14
3.1.4	Fire safety .....	15
3.1.5	Conventional health and safety.....	15
3.2	ENGINEERING ASSESSMENTS .....	16
3.2.1	Civil engineering.....	16
3.2.2	Structural integrity.....	17
3.2.3	Electrical engineering .....	20
3.2.4	Control and instrumentation systems.....	21
3.2.5	Graphite core integrity .....	22
3.3	MEETINGS.....	24
3.3.1	Outage intentions meeting.....	24
3.3.2	Mid-outage meeting.....	24
3.3.3	Start-up meeting.....	24
3.4	EMERGENT ISSUES .....	25
3.4.1	Irregular behaviour of gas circulator variable speed drives .....	25
4	MATTERS ARISING FROM ONR'S WORK.....	26
5	CONCLUSIONS .....	27
6	RECOMMENDATIONS.....	28
7	REFERENCES .....	29

## **1 PERMISSION REQUESTED**

1. EDF Energy Nuclear Generation Limited (NGL), the operator and Licensee of Heysham 2 power station (HYB), has written (Reference 1) to the Office for Nuclear Regulation (ONR) requesting consent under Licence Condition (LC) 30(3) to start-up Reactor 7 on completion of its periodic shutdown (also known as its statutory outage). This Project Assessment Report (PAR) presents my consideration of this request and recommends that ONR grants consent to start-up Reactor 7 through the issuing Licence Instrument (LI) 588.

## **2 BACKGROUND**

### **2.1 GENERAL**

2. The nuclear site licence issued to NGL for HYB requires the Licensee to periodically shut down plant under LC30. This is to enable examination, inspection, maintenance and testing to take place in accordance with the requirements of HYB's Plant Maintenance Schedule (MS) under LC28. At HYB, reactor periodic shutdowns are undertaken triennially as specified in the MS preface, which is an approved document under LC28(4). The Licensee also undertook work during the shutdown associated with the requirements of Pressure Systems Safety Regulations 2000 (PSSR), previous commitments, and plant safety improvements/modifications under LC22.
3. The Licensee requires consent from ONR under LC30(3) to start-up Reactor 7 on completion of its periodic shutdown. The previous consent to start-up Reactor 7, HYB LI 568 (Reference 2), is dated 10 November 2011. On 22 September 2014, NGL wrote to ONR (Reference 3) requesting agreement to an extension of the operating period of Reactor 7 to 15 March 2015 as the scheduled shutdown would coincide with poor availability of staff and resources during the Christmas to New Year period which would contravene NGL corporate procedure, that advises avoiding these periods when planning shutdowns. ONR inspectors undertook assessments of the Licensee's safety case for the extension. The culmination of the assessment process was the PAR (Reference 4), which recommended issuing the agreement. On 3 November 2014, ONR issued HYB LI 583 (Reference 5), agreement to an extension of the operating period of Reactor 7 to the requested date. The Reactor 7 periodic shutdown 2015 commenced on 27 February 2015.

### **2.2 OUTAGE PLANNING AND MANAGEMENT**

#### **2.2.1 Licensee's management**

4. NGL began planning the Reactor 7 periodic shutdown approximately two years prior to its start. Progress was monitored by NGL with the aid of their Pre-Outage Milestone Plan. Appropriate milestones were complete prior to the start of the periodic shutdown.
5. NGL produced the Outage Intentions Document (OID) (Reference 6) for Reactor 7 periodic shutdown 2015. This outlines the periodic shutdown organisation, infrastructure and management arrangements to deliver the planned safety related activities. The OID, together with the referenced scope related supporting documents comprised the periodic shutdown intentions for Reactor 7.
6. The outage activities were managed using an Outage Control Centre, which provided overall control and monitoring of outage work based on use of an area and plant island approach as described in the OID:
  - Boiler Island;

- In Service Inspection Island;
  - Protection, Electrical and Data Processing Systems Island;
  - Reactor Island;
  - Sea Water Island;
  - Turbine and Feed Island;
7. Each island had Suitably Qualified and Experienced Persons to control outage work planning, execution and completion, including any response required to emergent issues.
  8. The Licensee's outage process has planned into it a series of meetings with ONR, these being the Outage Intentions Meeting (OIM), the Mid-Outage Meeting (MOM) and the Start-Up Meeting (SUM).
  9. NGL provided ONR with a copy of the OID prior to holding the OIM on 9 October 2014 which was distributed to ONR specialist inspectors assigned to HYB Reactor 7 periodic shutdown 2015. The organisational arrangements and programme of work for the shutdown were discussed at the meeting.
  10. NGL held the MOM and SUM on 27 March and 23 April respectively. ONR inspectors attended both meetings. The purpose of the MOM was to allow station and ONR to review the progress and developments with the periodic shutdown. The purpose of the SUM was for the Licensee to demonstrate it had adequately met the requirements of the MS, dealt with emergent issues and demonstrated the safety of Reactor 7 for the next operational period.
  11. On 27 April 2015, the HYB Station Director wrote to ONR requesting consent to start-up Reactor 7 on completion of the periodic shutdown (Reference 1). The request letter was sent prior to completion of the shutdown. In his request letter, the Station Director confirmed that all remaining outstanding maintenance required for start-up would be completed and there were no actions raised during the SUM requiring closure before start-up
  12. The request letter was accompanied by a series of appendices detailing the outcome of inspections to date.
  13. The Licensee's internal regulatory process requires that the internal regulator, Independent Nuclear Assurance (INA), independently support the application for reactor start-up. INA seeks assurance by undertaking a series of activities both before and during the periodic shutdown. The scope of these activities for the current HYB periodic shutdown is defined in a INA Concurrence Part A (Reference 7). On completion of these activities, INA issues a report, Concurrence Part B, which presents the findings of their work and includes a statement supporting the start-up.
  14. On 24 April 2015, INA issued a Concurrence Statement (Reference 8) for the HYB Reactor 7 periodic shutdown 2015 return to service. The report stated that INA considered that there were no issues remaining with respect to the requirements of Concurrence Part A, and Concurrence Part B would therefore be provided for start-up and subsequent operation of Reactor 7 within the constraints of the current safety case.
  15. The Licensee produced a Return To Service (RTS) Engineering Change (EC) (Reference 9) that approves the results of inspections completed in the Reactor 7 periodic shutdown inspection programme. INA has issued an Independent Nuclear

Safety Assessment (INSA) approval statement (Reference 10) for the RTS EC with no caveats.

16. The PSSR competent persons (for the Pre-stressed Concrete Pressure Vessel (PCPV), the reactor penetrations and the balance of plant) have each confirmed that they are content for Reactor 7 to start up (Reference 11 , Reference 12 and Reference 13 ).

### **2.2.2 ONR's intervention management process**

17. ONR business management process within the Civil Nuclear Reactor Programme (CNRP) requires that an Intervention Task Sheet (TS) is produced for activities exceeding five days work. The TS provides the background to the proposed intervention, the anticipated outcomes, duration, prioritisation, lists specialisms assigned to the project and the intervention strategy.
18. The HYB Site Inspector produced a TS (Reference 14) which was endorsed by the CNRP management team.
19. The CNRP strategic themes relevant to the project were; high quality safety cases, adequacy of arrangements and compliance, robust procurement and supply chain processes, lifetime management, and plant reliability. The anticipated outcomes of the project included:
  - The Licensee delivering a shutdown that is safely managed.
  - Closeout of significant issues raised by ONR interventions to the satisfaction of the inspector raising the issue, prior to the conclusion of the shutdown (or an acceptable plan to address the issue beyond the shutdown).
  - The Licensee delivering the required safety related work activities, enabling ONR to produce a PAR that considers NGL's request to start up Reactor 7 on completion of the shutdown.
20. The following specialisms were assigned to the project:
  - Civil engineering systems
  - Control and instrumentation systems, including reactor protection systems
  - Electrical systems
  - Fire safety
  - Graphite core integrity
  - Human factors
  - Radiological protection
  - Site inspection
  - Structural integrity
21. The ONR process for delivering a permissioning project requires preparation of a PAR for the permissioning decision by the Deputy Chief Inspector (DCI). The PAR is informed by the intervention findings of the inspectors assigned to the project. If the DCI decides to grant permission then a Licence Instrument is prepared and issued.

## **3 ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST**

22. I have considered NGL's request for ONR to consent to start-up HYB Reactor 7 on completion of its periodic shutdown as part of my role as ONR project inspector assigned to the shutdown. I have followed ONR procedures for delivering a

permissioning project, as detailed in ONR's Business Management System (HOW2) (Reference 15). To support my work I have utilised the services of the ONR specialist inspectors assigned to this project by the ONR CNRP management team. I have taken note of the periodic shutdown associated work undertaken by NGL's internal regulator, INA. I have also taken note of the statements of the PSSR competent persons.

23. I have consulted with the Environment Agency (EA) and ONR Civil Nuclear Security (CNS) to establish whether either objects to ONR giving consent to start-up HYB Reactor 7. Their responses are provided in Section 4 of this report.
24. The work undertaken by ONR can be considered in three themes. Firstly, the interventions undertaken by the ONR Radiological Protection Inspector, the Fire Safety Inspector, the ONR Human Factors Inspector and the ONR Site Inspector concentrated on the Licensee's periodic shutdown related safety management. Secondly, Engineering Inspectors have concentrated on the engineering work important to nuclear safety being undertaken during the shutdown. Finally, the formal meetings (the OIM, the MOM and the SUM) looking at the preparations, progress and readiness to restart.

### **3.1 SAFETY MANAGEMENT**

#### **3.1.1 Management systems**

25. The site inspector and human factors inspector conducted an intervention on 23-24 March 2015 to assess the Licensee's arrangements and compliance against LC 17, Management Systems, and LC 22 Modifications on Existing Plant (see next section). The findings of the intervention are presented in the Intervention Record (IR) at Reference 16.
26. The following areas were included as part of the LC17 inspection:
  - Procurement elements and item equivalency.
  - Setting to work process and pre-job briefs.
  - Clarity and scope of work instructions.
  - Safety document compliance.
  - Compliance with instructions and check sheet completion.
  - Field Supervision and the role supervisors in controlling and supervising the work faces.
  - NGL oversight and control of work being performed by contractors.
27. This inspection focussed on two outage work faces; replacement of corroded pipework in the pressure vessel cooling system and refurbishment of the 6.5T condenser cooling water head tank.
28. Based on the evidence sampled during the inspection, ONR considered that the arrangements and their associated implementation for LC17 adequately met the requirements of ONR guidance.

#### **3.1.2 Modifications**

29. An inspection was conducted on 23-24 March 2015 to assess the Licensee's arrangements and compliance against LC 22, Modifications on Existing Plant. The findings of the inspection are presented in the IR at Reference 16.

30. As with the LC 17 inspection, this inspection focussed on two outage work faces; replacement of corroded pipework in the pressure vessel cooling system and refurbishment of the 6.5T condenser cooling water head tank.
31. The inspection identified shortfalls associated with project management arrangements specifically with document control and approval. NGL recognised and agreed with the shortfalls and instigated a review of the other project work being performed as part of the statutory outage. The review found further gaps in compliance and since the inspection, NGL has provided evidence confirming that they have now addressed the gaps and brought themselves back into compliance with the arrangements.
32. From an LC22 perspective, based on the evidence sampled during the inspection ONR considered the arrangements to have been implemented to a standard that fell below ONR expectations.
33. Whilst shortfalls had been identified during the inspection ONR was of the opinion, given the work observed, there were no findings that could significantly undermine nuclear safety and prevent the start-up of Reactor 7.

### **3.1.3 Radiological protection**

34. The radiological protection inspector conducted an intervention on 24 March 2015 to establish the Licensee's statutory outage work programme was being conducted in compliance with the Ionising Radiations Regulations 1999 (IRR99) and whether the Licensee had made adequate arrangements for compliance with LC18, Radiological Protection, of its nuclear site licence. The findings of the intervention are presented in the IR at Reference 17.
35. The following matters were considered:
  - The Licensee's statutory outage work programme and its radiological implications.
  - Radiation protection personnel cadres and monitoring equipment provision. For example: roles, numbers, staffing continuity and contingency planning.
  - Contractor control and supervision.
  - Radiation protection input to outage work planning.
  - Integration of ALARP management principles with personal radiation exposure restriction and contamination control.
  - Training.
  - Radiation survey instrument maintenance and provision.
  - Radiological event investigation and follow-up. For example: exit monitor alarm performance in comparison with the Licensee's key performance indicators.
  - Record-keeping. For example: contamination survey schedules and results, and temporary controlled area management records.
  - Planning for radiologically significant outage tasks, for example:
  - Operational dose management, i.e. day-to-day dose management and profiling during the outage.
36. A visual inspection was conducted of the following areas to assess house-keeping and IRR99 compliance:
  - Pile cap/charge hall
  - Gas circulator quadrant
  - Gas by-pass desiccator plant

- Low-level solid waste segregation and sorting facility
37. Particular attention was paid to radiological area designations, tidiness and their segregation and demarcation, particularly at C0/C2/C3 boundaries, and to radiation monitoring point functionality and calibration. Only one minor shortfall was identified and this did not require resolution prior to start-up.
38. The radiological protection inspector considered the Licensee's arrangements and their implementation for radiological protection to be adequate. From a radiological protection standpoint, the radiological protection inspector was content with the way in which the Licensee was conducting its statutory outage work programme and, accordingly, was of the opinion that there was no evidence of the Licensee's lack of readiness to return Reactor 7 back to power.

#### **3.1.4 Fire safety**

39. A general fire safety inspection was conducted on 26 March 2015 during the shutdown to confirm that the Licensee was compliant with the requirements of the Regulatory Reform (Fire Safety) Order 2005. Reference 18 provides the fire safety inspector's findings of the inspection.
40. The inspection focused on the themes of fire safety management and practical fire safety provision, primarily concentrating on the practical application of the general fire precautions during the shutdown period. Issues identified at the previous fire safety inspection were also reviewed and it was noted that they had all been satisfactorily closed out.
41. The inspection involved a combination of management of fire safety:
- Scaffolding – impact on exit routes, exit signs, emergency lighting and visual fire alarms
  - Lay down areas – management and fire loading
  - Emergency lighting – testing and maintenance
  - Hot work – management and permits

and inspecting a number of buildings and facilities including:

- Temporary accommodation units
  - Turbine hall
  - 400kV replacement project
42. Although the inspection identified a number of areas for improvement and consideration by the site management, the overarching impression was one of a good direction of travel being implemented and a high level of importance being placed on the provision of the required standards for conventional fire safety arrangements.
43. A number of issues were identified during the site walk-down. These were all considered to be minor and their resolution would not affect the consent to start-up.
44. Overall based on the findings of the sampling inspection the Licensee demonstrated an adequate level of fire safety provision and management.

#### **3.1.5 Conventional health and safety**

45. A significant amount of invasive physical work took place during a periodic shutdown, much of which was undertaken by contractors. To ensure that good standards of

health and safety were maintained, HYB developed the Zero Harm Centre to support and manage industrial safety for all staff, both employees and contractors. This facility brought together the H&S staff from HYB and their main supporting contractors to provide an effective focal point on site.

46. All personnel who would be going onto site during the shutdown were also required to attend an outage training session which highlighted good and bad safety practices. This requirement ensured that everyone was made aware of the increased hazards during the shutdown.
47. To date there have been no lost time accidents and minor injuries are at their lowest level for a periodic shutdown at this station. From the behaviours observed during the ONR interventions; the use of the Zero Harm Centre and the Outage Training reinforced with daily safety messages were considered to have been effective in reducing incidents and injuries.

## **3.2 ENGINEERING ASSESSMENTS**

### **3.2.1 Civil engineering**

48. Reference 19 presents the findings of the ONR assessment of the pre-stressed concrete pressure vessel Appointed Examiner's (APEX) Start-up Statement (the statement). The statement reports NGL's progress with the statutory surveillances, inspections and tests on the pre-stressed concrete pressure vessel as described in the Branch Instructions that include the requirements of the MS.
49. The scope of the assessment includes the findings of the inspections and tests of certain key safety related components of the reactor pressure vessel including, tendon loads, tendon anchorages, tendon corrosion, concrete surfaces, foundation tilt and settlements, vibrating wire strain gauges, vessel concrete liner temperatures, reactor coolant leakage, top cap deflections, tendon tensile strength and pressure vessel cooling water leakage.
50. The tendon pre-stress anchorage load is measured on a sample of 38 tendons on a two-yearly frequency. Four tendons out of the 38 are also de-tensioned and two strands removed from each for metallurgical examination and destructive tensile testing. The tendon load checking campaign undertaken in December 2014/January 2015 utilised the Electronic Method of Measurement (EMM) rather than the traditional trap & free (T&F) method. EMM has been implemented due to the industrial safety benefits that the method brings. The EMM was developed over a number of years by correlating the results from the T&F method with the EMM. It is the first time that the EMM has been used to provide all the tendon load checks for an outage.
51. The EMM results are converted to equivalent T&F values so that comparison with historical results which have been determined using the T&F method can continue. The results reported showed that the level of pre-stress in the tendons is significantly lower than anticipated. However, the APEX has not been able to determine if it is due to the use of the new EMM method or to the level of pre-stress in the tendons.
52. ONR judged that the pre-stress tendons in this PCPV will retain a safe level of pre-stress for the next three years of operation. This judgement was based on the existing NGL assessment of the reduced minimum design load value and on previous tendon anchor load predictions. However, it is necessary to determine if the EMM has provided inaccurate results or if the load in the tendons is lower than initially inspected and further action is required. ONR has recommend repeating the tendon load checks



- using the T&F method and investigate if the existing numerical correlation between the two methods (EMM and T&F) is correct.
53. Based on the results of examinations, the tendons and their anchorages were judged to be in a sound condition and would continue to be so for the next three years of operation. The results of mechanical testing of samples from the tendons have shown the selected strands exceeded the minimum requirements and therefore it was judged that the mechanical properties of the tendons would remain at adequate levels.
  54. The examination of PCPV concrete surface defects identified a long term minor pressure vessel cooling system leak, due to be fixed during the outage, and issues with access to a reference crack for measurement. Three recommendations were raised but based on discussions with the APEX and the information presented, ONR judged that the concrete structure of the PCPV will remain in a stable condition for the next three years of operation.
  55. The main reactor coolant leakage rates have remained steady and significantly within the allowable limits. There is a known issue with the blocking of the monitoring ducts used to determine the leakage rates through the PCPV but there is sufficient air flow through the majority of them to obtain a sample reading. Although it was noted that no significant presence of coolant had been recorded, it was recommended that technical specification limits were made available to identify appropriate action levels. On the basis of the information presented, it was judged that the coolant losses will continue to be within acceptable limits.
  56. From the top cap deflection surveys the APEX concluded that the results indicated that the top cap of the PCPV is behaving in an elastic manner with recorded deflections within expected parameters. However, ONR has recommended that the increment recorded in the last on-load survey is substantiated in terms of acceptable limits when considering the concrete creep and temperature effects. Notwithstanding this, ONR does not believe that there is sufficient cause to delay the return to service while this recommendation is addressed.
  57. There were six recommendations raised within the “28 Day Report” for the previous periodic shutdown, in 2011. These were reviewed and found to be adequately addressed and therefore considered closed.
  58. The statement was issued on time and the quality and detail of the report were adequate. During the assessment of the statement, several issues were raised for clarification that were addressed on time and appropriately. Therefore, it was judged that the statement was adequate.
  59. ONR raised no findings and made nine recommendations during the assessment but none of these prevent the start-up of the reactor.
  60. Based on the assessment of the data and information presented in the documents provided, acceptance of the judgements made by the Appointed Examiner and from the results of the surveillances, inspections and tests as reported in the documentation provided, ONR is content to support the return to service of Heysham 2 Reactor 7 pre-stressed concrete pressure vessel for a period of three years.

### **3.2.2 Structural integrity**

61. Reference 20 presents the findings of the ONR assessment of the adequacy of the inspections of welds, pipework, boilers and reactor internals conducted during the 2015 Heysham 2 Reactor 7 Periodic Shutdown in support of compliance with LC 28.

62. The assessment covered the structural integrity aspects of the Licensee's scope and results of the examination, maintenance, inspection and testing steel components that were required to fulfil a nuclear safety function. The Licensee produced three references that detailed the scope of the maintenance and inspections planned for the periodic shutdown. These were considered as part of the assessment of the programme of work completed to support the return to service of Heysham 2 reactor 7.
63. The assessment was carried out in three stages:
- Pre-outage review of the outage intents proposal and attendance at the OIM.
  - A visit to site during the outage to assess the adequacy of the inspections in progress and how the Licensee was complying with the commitments provided in the OID.
  - Monitoring of the Outage Assessment Panel (OAP) minutes throughout the outage to identify how the inspections were progressing and how any issues identified were managed and resolved.
64. ONR identified from the scoping documentation, the following areas for sampling during the site inspection:
- Gas circulator impeller inspections
  - Reactor seawater cooling system inspection and replacement programme
  - Steam and feed system inspections
  - Reactor internal inspections
  - Pipe hanger and restraint inspections
  - Flow accelerated corrosion inspections
65. ONR observed an OAP meeting to confirm that due process was being followed in sentencing inspection results, and to discuss progress on the PSSR examinations with the PSSR competent person.
66. It should be noted that NGL's safety case for Heysham 2 did not have any welds or components that required the highest reliability demonstration. In NGL safety case terminology this was a claim that the reliability of the component was so high that the likelihood of failure was incredible – an incredibility of failure claim. As a consequence ONR's interventions for Heysham 2 did not focus on these components.
67. Following the site inspection, ONR's overall conclusion was that the inspections were being conducted in line with the scoping documentation and associated inspection specifications. The inspections conducted to date had not raised any nuclear safety significant issues of concern and the Licensee was adequately managing the defects or anomalies found. At that time, and from the sample inspections, ONR found nothing that would prevent reactor 7 from returning to service following completion of the 2015 periodic shutdown.
68. The functioning of the OAP was observed and the minutes of the panel reviewed. All defects and anomalies appeared to have been appropriately sentenced by the panel and there were no emerging matters of concern. ONR was satisfied in principle that the inspection programme had been completed, and used the INA clearance for the return to service EC in order to formally confirm that all the necessary inspections were completed and reported prior to the return to service.
69. ONR sampled inspection work associated with the inspection and sentencing process for a Category C defect (indication not meeting the acceptance defect standard and referred to the OAP for acceptance) on the hot reheat line air connection weld. ONR

was content with the inspection that had been undertaken and the sentencing of the results at the time of the visit. Following a more detailed review of the supporting documentation, ONR was satisfied that the inspection sampled raised no concerns with regard to the quality of the inspection undertaken.

70. The OID confirmed that the vent pipework on all 12 hot reheat headers were to be modified to remove the cause of thermal fatigue, in line with the approach taken on reactor 8 during the 2013 periodic shutdown. The OAP took the view that in such circumstances the thermal fatigue damage could be left in place with a further re-inspection at the next periodic shutdown to confirm that no further degradation had occurred. ONR was satisfied with the reasoning and judgement of the OAP.
71. The reactor internals inspection programme included an inspection around the GH02 peripheral in-service inspection standpipe extension sleeve to confirm the condition of the clamping arrangement installed in 2011 in order to support the Licensee's case for a further period of operation without manned vessel entry. The clamping arrangement was confirmed as being in good condition, but it was not possible to confirm the condition of the insulation above the clamp due to access restrictions.
72. The ONR structural integrity inspector who was leading on the standpipe assessment considered whether the inspection results supported the Licensee's case for a further period of operation without manned vessel entry. The ONR inspector confirmed that the Licensee had reviewed the inspection results including the implications of not being able to confirm the condition of the insulation and had concluded that it was acceptable to return the reactor to service, Reference 21. ONR was therefore satisfied that it would be possible to make the justification for a further period of operation of GH02 peripheral in-service inspection standpipe extension sleeve without manned vessel entry. This justification was contained in EC355340, Justification for the Operation of Pressure Tapped PISIs and all FMA Standpipes on Reactor 7 and Reactor 8 following the Reactor 7 Statutory Outage. The Licensee committed to the completion of this EC prior to start-up in their request to consent to start-up, Ref. 1.
73. An unexpected thermal transient was experienced by the boilers during the reactor shutdown. This had the potential to affect both the boilers and the steam pipework. The Licensee assessed implications of the transient and concluded that the transient did not cause significant damage to the boilers or steam pipework and that there were no return-to service concerns. This is discussed in further detail in the Emergent Issues section of this report.
74. Four gas circulator impellers were inspected during the periodic shutdown, and a defect was found in the impeller of a gas circulator that was being exchanged during the outage. The impeller will not be returned to service. The circulator assessment panel reviewed the finding and concluded that the discovery was consistent with the current safety case assumptions, and no additional inspection work was required on other impellers. From the advance information provided, ONR was satisfied that the Licensee had followed due process on this matter and that a justification was included as an appendix within the station's RTS EC, Ref. 9.
75. No significant issues were identified in the pipework hanger survey and restraint load check programme, but during the replacement of a set of axial restraint seismic snubbers it was identified that the pipework clamping arrangement had become loose. This was due to the use of non-creep resistant bolting material. The Licensee has replaced this bolting material with creep resistant material, and ONR was satisfied that the Licensee had considered the wider implications of this finding, including an interim justification for the operation of Heysham 2 reactor 8 and Torness. A specific justification for the RTS of reactor 7 was provided as part of the station's RTS

documentation (RTS Justification for Reactor 7 2015 following the discovery of loose bolts on snubbers providing axial restraint, EC 355564), and ONR was content for the Licensee to follow due process on this matter without further ONR involvement.

76. Based upon the sampling undertaken, the evidence presented and the conclusions above, from a structural integrity perspective, ONR judged that the Licensee had undertaken sufficient inspection and assessment to support the safe return to service of Heysham 2 reactor 7. No issues had been found that would prevent Heysham 2 reactor 7 from returning to service for the next operational period from a structural integrity perspective.

### 3.2.3 Electrical engineering

77. Reference 22 presents the findings of the ONR assessment of the electrical engineering outage work for Heysham 2 Reactor 7, presented as planned work in the OID and emergent issues arising while the outage was underway.
78. The scope of the assessment covered the electrical engineering aspects of the Reactor 7 outage undertaken by the Licensee, against LC 28 requirements. From the proposed scope of electrical system work during the Reactor 7 2015 periodic shutdown the following sections were considered for assessment:
- Section 4.1 – Maintenance schedule routine items.
  - Section 4.3 – Modifications (Engineering Change).
  - Section 4.8 – Generator Transformer 7.
  - Section 5.3 – Protection, Electrical and Data Processing Island.
79. The majority of outage related electrical work was targeted at electrical switchboards, switchgear, generator transformer 7 replacement, station and auxiliary transformer maintenance, gas circulator (GC) maintenance activities and the variable speed drive (VSD) and variable frequency convertor (VFC) exchange project.
80. During the course of the inspection ONR found that, on the basis of the areas sampled, the station was maintaining its electrical plant and equipment in accordance with its arrangements.
81. Immediately following Reactor 7 shutdown, the Licensee advised ONR of an event in relation to potential irregular behaviour of 7BX1 and 7BX2 gas circulator VSDs during Post Trip Sequencing Equipment (PTSE) functional testing. These anomalies were investigated and remedial measures implemented to address them. This is discussed in further detail in the Emergent Issues section of this report.
82. During the periodic shutdown, ONR had several interactions with Heysham 2 electrical engineering staff which identified that the remedial activities undertaken had been conducted in accordance with the station work control system, recorded appropriately in station documents and confirmed as complete by suitably qualified and experienced persons (SQEP). From its inspections, ONR found no electrical issues from this work that would affect the return to service of Reactor 7.
83. The overall outcome from the safety inspection of the outage related electrical engineering work on Reactor 7 was that the implementation of the LC 22, LC 23, and LC 28 arrangements for the electrical equipment were deemed to be adequate.
84. The electrical engineering inspector was satisfied that none of the areas sampled had revealed issues that remained unresolved in relation to the electrical aspects of the

Reactor 7 periodic shutdown and recommended that ONR should grant consent for Reactor 7 start-up.

### 3.2.4 Control and instrumentation systems

85. Reference 23 presents the findings of the ONR assessment of a sample of control and instrumentation (C&I) systems and equipment important to nuclear safety as presented in the OID and its supporting documentation provided by NGL. These documents provided a description of the routine maintenance activities and engineering changes that were implemented during the periodic shutdown of Heysham 2 Reactor 7.
86. The scope of the assessment included the following plant, systems, equipment and activities:
- Inspection of safety circuit thermocouple tests
  - Neutron flux detectors performance characteristics measurements
  - Data processing system (DPS)
  - Reactor shutdown system (RSS) (alarm cubicles)
  - Gas circulator protection
  - Post-trip sequencing equipment
  - Safety circuit end-contactor
  - Modification of obsolete ammonia dosing conductivity transmitters and sensors
87. Based on the sampling of HYB management control procedures, plant item maintenance instructions, pre-outage datasheets, a number of work order cards, and detailed discussions with SQEP C&I engineers, ONR was content that the thermocouple test and maintenance activities are adequately controlled and undertaken.
88. Neutron flux detectors are no longer available from the original supply chain and consequentially, the current rate of failure and deterioration of existing flux detectors are leading to increased risk of reactor shutdown. This is exacerbated by the limited number of spares and challenges associated with re-establishing the supply chain for manufacture of new detectors.
89. A programme of health checks were conducted during the periodic shutdown and the results of the health check testing were assessed by the station SQEP. The station concluded that based on the performance of the detectors and electronics across all the testing it was judged that the systems were fit for purpose to carry out their safety function. ONR inspection of the test results showed that the flux detectors installed at HYB are currently fit for purpose.
90. During the PTSE testing, due to electromagnetic interference generated by the new variable speed drives, the gas circulator over speed protection was activated. This resulted in the PTSE tests being abandoned. The interference fault has now been rectified and the PTSE test will be repeated at the end of the periodic shutdown and the results reported to ONR. This is discussed in further detail in the Emergent Issues section of this report.
91. An inspection of a representative sample of maintenance documentation confirmed the completion of specific activities from the OID. No adverse findings had occurred with any of the completed works nor were expected with the outstanding activities.
92. ONR has placed a number of actions and requested further information as it becomes available. ONR will monitor the responses as part of normal regulatory activities.

93. On the basis of the C&I systems and equipment sampled, the assessment revealed no matters of significant safety concern that were not being adequately addressed. During the inspection a number of safety critical C&I maintenance activities had not started, these items are to be completed as per the 2015 Reactor 7 statutory outage maintenance programme. ONR considered the work undertaken as part of the periodic shutdown supported the safety and reliability of the C&I equipment installed at Reactor 7 following its return to operational service.
94. In respect of the maintenance and modification work undertaken on C&I systems and equipment important to nuclear safety as part of Reactor 7 periodic shutdown, ONR has not identified any matters that should prevent ONR from granting a consent for Reactor 7 at Heysham 2 returning to operational service.

### **3.2.5 Graphite core integrity**

95. Reference 24 presents the findings of the assessment of the graphite core inspections of HYB Reactor 7 during the 2015 periodic shutdown and supporting documentation provided by NGL.
96. The intended scope of the graphite inspections during the periodic shutdown of HYB Reactor 7 was identified by the Graphite Assessment Panel as:
- Inspection of a minimum of 16 fuel channels both visually and dimensionally using the New In-Core Inspection Equipment.
  - Removal of a minimum of 24 with an upper target of 36 graphite specimens to an approximate depth of 65mm.
  - Visual inspection of control rod channel TU36.
97. The inspections were performed within selected channels of the graphite core to determine:
- The number, size and morphology of any cracks observed in the selected channels
  - The change in dimensions of the bricks as a result of irradiation induced dimensional change of graphite
  - Any change in the distortion of the core in terms of fuel channel bow, brick bow and channel tilt
  - The estimated weight loss of the core based upon trepanned specimens removed from fuel channel walls
98. The ONR assessment compared the available results from the inspections against relevant sections of the HYB graphite core safety case, to determine whether they pose any challenge to the return to service of HYB Reactor 7 for a further three years of operation.
99. Combining the remote visual inspection results from the HYB Reactor 7 2015 periodic shutdown with historic inspection data dating back to 1989, a total of 42 channels have been inspected. In that time 1 type III C circumferential axial crack has been observed in channel H15 layer 8 in 2005. Two type III A axial cracks were observed during this inspection campaign. No full height axial cracks (single or double) have been observed at HYB Reactor 7 with approximately 10% of the core having been inspected since 1989.
100. Based on the current number of inspections over the lifetime of the core, there was no evidence to suggest the number of doubly axially cracked bricks challenges the safety

case limit of 10%. On the assumption that the inspected channels were representative of the entire core, there was a substantial margin between the current extent of cracking and the maximum extent of cracking that the HYB graphite core safety case can tolerate. Therefore, ONR judged that the extent of cracking was not an immediate concern.

101. The channel bore measurements were performed to cover diameter/shrinkage, ovality, bow and tilt and in most cases the results were within expected ranges. Overall the measured shrinkages were consistent with historical trends. ONR judged that the results from the graphite core channel bore measurements did not challenge the graphite core safety case.
102. In total 34 trepanned specimens were retrieved across five channels. The specimens were trepanned using a new, longer trepanning tool which removed specimens 65mm in length rather than the previously used 45mm samples. The weight loss and materials properties data derived from the trepanned specimens will not be available for several months.
103. Whilst trepanning one of the samples a problem occurred with the withdrawal of the trepanning tool. The specimen was successfully broken off but was not retrieved from the trepanned hole and sat loosely within the fuel channel brick. It was decided that the specimen should be removed by blowing it out using compressed air and allowing it to fall into the debris catch-pot at the bottom of the fuel channel. Video footage of this procedure was captured as evidence of successful removal and having observed the video footage ONR was content that the specimen was successfully removed to the debris catch-pot. ONR judged that the Licensee's actions were appropriate and that the position of the specimen within the catch-pot posed a negligible hazard and did not present any impediment to consent being granted for the return to service of HYB Reactor 7.
104. A total of 34 specimens were successfully trepanned which exceeds the safety case requirements of a minimum of 24 specimens. In previous periodic shutdowns only 8 channels were inspected and the number of trepanned specimens retrieved was typically 24. Therefore, the increased number of inspected channels and trepanned specimens was a significant achievement for HYB. The data will assist in supporting the current and future safety cases. Therefore, ONR judged the total of 34 trepanned specimens was a good achievement by the station and exceeds the minimum requirements of the safety case by a considerable number.
105. The Licensee's estimate of the earliest stress reversal in graphite bricks at HYB is 24.6 full power years, which is predicted to be reached at the end of 2017. Therefore, the current graphite core safety case is not valid for the entire period between restart and the next periodic shutdown. It was therefore recommended that a post stress reversal safety case must be in place by the end of 2017, and note that this issue was being tracked through ONR's regulatory issue database.
106. The requirements of the graphite core safety case during a periodic shutdown were met. The results of the graphite core inspections performed during the periodic shutdown posed no challenge to the graphite core safety case. Therefore, they presented no impediment to ONR granting consent to the return to service of Heysham 2 Reactor 7.

### 3.3 MEETINGS

#### 3.3.1 Outage intentions meeting

107. On 9 October 2014 the site inspector attended the OIM for statutory outage of Reactor 7 at HYB. An ONR structural integrity specialist inspector also took part in the meeting. The purpose of the meeting was for HYB to present the scope of work intended to be carried out in the Reactor 7 2015 statutory outage to ONR. In addition NGL presented an overview of the outage organisation, infrastructure and management arrangements to deliver the safety related activities being undertaken in order to meet the requirements of the relevant sections of Site Licence Conditions 28 and 30.
108. There were no issues raised during this meeting and no emergent nuclear safety issues that required a change to the proposed intervention task sheet for the upcoming outage. A detailed report on the OIM is given in Reference 25.

#### 3.3.2 Mid-outage meeting

109. The Mid-Outage Meeting was held on 27 March 2015 and was attended by the site inspector and myself. The aim of the meeting was for NGL to provide ONR with an update of the outage progress up to 18 March and highlight any issues which may impact on the outage programme. The Heysham 2 Reactor 7 2015 Mid-Outage Report, Reference 26, was provided prior to the meeting and was used as the basis for the presentations and discussions held during the meeting. Steady progress was being made against the outage schedule and no notable safety issues were identified. Detailed notes from this meeting are given in Reference 16.
110. Five ONR outage actions were discussed; these had been raised through the ONR inspections and assessments to date. Four were identified as 'Consent Issues' requiring closure before ONR grants consent for the reactor start up. These actions primarily related to the supply of documentation and test results and have subsequently been addressed.

#### 3.3.3 Start-up meeting

111. The Start-Up Meeting was preceded by a comprehensive plant walk-down on 22 April 2015. ONR was represented by the superintending inspector, the site inspector and myself. The walk down encompassed many of the major work packages conducted during the periodic shutdown. A number of the work packages were for long term replacement of items; e.g. CO<sub>2</sub> and reactor sea water pipes and 400kV replant, to enhance nuclear safety and/or improve reliability through to the plant end of life.
112. We observed consistently good and positive challenge from the NGL staff and the knowledge and ownership of the plant by each of the system leads was commended. The tidiness and cleanliness of the site at this stage of a shutdown was noted and was considered positive. Whilst most of the intrusive work had been completed there was still a considerable amount of lagging to be replaced and scaffolding to be removed.
113. The Start-Up Meeting was held on 23 April 2015, chaired by the station Technical and Safety Support Manager, and was attended by the ONR superintending inspector, site inspector and myself. The purpose of the SUM was for the Licensee to demonstrate it had adequately met the requirements of the MS, dealt with emergent issues and demonstrated the safety of Reactor 7 for the next operational period. The Heysham 2 Reactor 7 2015 Outage Start-Up Report, Reference 27, was provided prior to the meeting and was used as the basis for the presentations and discussions held during the meeting. A detailed record of the meeting is contained in Reference 28.



114. A discussion relating to the GH02 standpipe work led to ONR raising an action on the Licensee to review the outcome of the upcoming Torness outage inspection and justification for deferral of manned vessel entry to confirm that the HYB safety case remains valid.
115. In support of the on-going Japanese Earthquake Response work, four modifications to plant systems were progressed as planned during this periodic shutdown. This represented all the modifications required to be conducted during the shutdown of Reactor 7. The remaining work associated with these and a number of other modifications will be completed post start-up.
116. A number of actions were identified during the meeting, but none of these required to be completed before the issue of the consent to start-up Reactor 7.
117. The four ONR actions raised during the ONR inspections and assessments which required closure prior to granting consent to start-up Heysham 2 Reactor 7 were confirmed as closed with responses and acceptance recorded in the ONR action tracking log, Reference 29.

### **3.4 EMERGENT ISSUES**

#### **3.4.1 Irregular behaviour of gas circulator variable speed drives**

118. The Licensee advised ONR of condition reports raised in relation to the perceived irregular behaviour of 7BX1 and 7BX2 gas circulator VSDs. Shortly after the trip of Reactor 7, on 27 February 2015, electrical supplies were lost to 7A and 7B quadrants due to operation of Essential Plant Protection Equipment Run On Protection "B" associated with indicated gas circulator over-speed in 7B quadrant. Prior to the trip 7BX1, 7BX2 VFCs had been exchanged for Siemens Perfect Harmony Gen IV VSDs under ECs 0335635 and 352534.
119. The Licensee investigated the matters surrounding these anomalies in accordance with their arrangements and produced an Equipment Failure Investigation report, Reference 30. ONR has examined this report which provided a fairly thorough investigation that identified remedial activities to address the causes of the anomalies in the short, medium and longer terms.
120. The initial investigations, which included support from the VSD manufacturer, indicated that the VSDs behaved as expected. Further investigation revealed that erroneous gas circulator speed indications were detected by the essential equipment plant protection equipment, which led to both VSDs tripping. The Licensee's initial investigations revealed that signal interference caused by electromagnetic interference (EMI)/radio frequency interference (RFI), because of inappropriate local earth arrangements, had caused an erroneous speed signal.
121. To address this aspect, initially, station implemented a temporary modification to the VSD earthing arrangements and confirmed satisfactory operation of the VSDs with the revised earthing configuration. Subsequently station has implemented a permanent modification to the existing VSD earthing arrangements and all future replacements of VFCs with VSDs.
122. The electrical engineering specialist inspector raised actions with the Licensee in relation to these remedial activities. ONR has reviewed the Licensee's response and discussed various aspects of the proposed remediation activities with station's electrical engineering staff. ONR is content with the measures taken by station to

control EMI/RFI in the short term and with its proposals to address the matter in the medium and longer terms.

123. Along with the interference issues on the control systems, the resultant post trip temperature transient was unusual for 7B main and decay heat boilers. The lack of gas flow in the boiler resulted in low gas side temperatures, caused rapid thermal transients in the main boiler and lower than normal temperatures in the decay heat boiler. The decay heat boiler system experienced water hammer as a result of the temperature profile. The Licensee assessed the plant integrity implications of the post trip transients and some limited additional inspections were undertaken. These have been sentenced via the outage assessment panel and the results were reported in the return to service EC, Ref. 9, Appendix 5. In summary the Licensee judged that the transients were not as severe as other transients experienced at Torness or Heysham 2 previously and these were unlikely to require additional justification in the future.
124. The structural integrity specialist inspector reviewed Appendix 5 of Reference 9 and noted the transient was less severe than a similar earlier boiler feed transient of Reactor 7 which took place in 2007. The justification for the return to service was based in part on the justification provided for the earlier transient and on inspection evidence showing that no damage has occurred. ONR was satisfied that this was a suitable basis for the justification and that the appropriate nuclear safety issues were considered in the justification. ONR accepted the conclusion that the 2015 transient caused no significant damage to the boiler, steam pipework or reactors, and that there were no issues that should affect the start-up of reactor 7. ONR noted that the effect of the transient would be reflected in the component life assessment damage calculations when they were updated.

#### **4 MATTERS ARISING FROM ONR'S WORK**

125. I have considered the Licensee's request to ONR to grant a consent under LC30(3) to start-up HYB Reactor 7 on completion of its periodic shutdown. I have followed ONR procedures for delivering a permissioning project, as detailed in How2. To inform my work I have taken note of the statements associated with safety contained in the request letter, the findings of the periodic shutdown associated work undertaken by NGL's internal regulator, INA, the statements of the PSSR competent persons and the findings and opinions of ONR specialist inspectors and the ONR site inspector.
126. In Reference 1, the HYB the Station Director confirmed that all maintenance, operational, training and re-commissioning activities are adequately complete to allow Reactor 7 to be returned to service safely and in compliance with the Station Safety Report, the safety case.
127. INA has provided a concurrence statement (Reference 8), which stated that there were no issues remaining with respect to the requirements of Part A of their work and the Concurrence Part B would therefore be provided for start-up and subsequent operation of Reactor 7 within the constraints of the current safety case.
128. The PSSR competent persons (for the PCPV, the reactor penetrations and the balance of plant) have each confirmed that they are content for Reactor 7 to start up.
129. ONR specialist assessors from the following disciplines undertook inspections to support my permissioning work:
  - Civil engineering systems
  - Control and instrumentation systems, including reactor protection systems
  - Electrical systems

- Fire safety
  - Graphite core integrity
  - Human factors
  - Radiological protection
  - Site inspection
  - Structural integrity
130. Each discipline has produced a report that presents the inspection findings, inspector's opinions, judgments and recommendations. A number of recommendations and actions arose from the inspectors' work, see Reference 29. None of the outstanding actions have been deemed sufficiently significant for ONR to withhold consent to start-up Reactor 7. All the reports contain either a statement supporting issuing consent to start-up Reactor 7, or note that there is no reason to withhold consent.
131. I consulted with other relevant regulators, EA and CNS, to establish if either had any specific objections that would prevent ONR from issuing LI 588, consent to start-up Heysham 2 Reactor 7. Both the EA (Reference 31) and CNS (Reference 32) confirmed they do not object to ONR granting consent.

## **5 CONCLUSIONS**

132. The Heysham 2 Reactor 7 periodic shutdown has been undertaken in accordance with the requirements of the work scope outlined within the OID.
133. The Licensee has followed their arrangements in undertaking the periodic shutdown, culminating in the HYB Station Director writing to ONR requesting consent to start-up Reactor 7. His letter stated that he was satisfied that there were no outstanding significant safety issues associated with return to service of Reactor 7 and that any emergent issues which required safety justifications would be sufficiently dealt with as part of the Engineering Change Process.
134. The Licensee's internal regulator, INA, have provided a concurrence statement that supports return to service of Heysham 2 Reactor 7 post periodic shutdown.
135. The PSSR competent persons have each confirmed that they are content for Reactor 7 to start up.
136. ONR inspectors have sampled the safety management and engineering activities throughout the shutdown and judged them to be adequate, and all support issuing consent to start-up Reactor 7.
137. I have prepared a consent HYB Licence Instrument 588 in conjunction with this PAR. The licence instrument is one of the standard formats given within ONR procedures and does not require review by the Solicitors Office.
138. Following assessment and inspection of matters arising in relation to the Heysham 2 Reactor 7 periodic shutdown 2015, I am satisfied that the Licensee's justification to start-up the reactor and operate for a further period of three years is adequate; consequently, consent to start-up the reactor can be granted.

## 6 RECOMMENDATIONS

139. I recommend that the Superintending Inspector:
- Signs this Project Assessment Report to confirm support for the ONR technical and regulatory arguments that justify issuing Heysham 2 Licence Instrument 588.
  - Signs this Project Assessment Report approving its release for publication, after redaction where appropriate.
140. I recommend that the Deputy Chief Inspector signs Heysham 2 Licence Instrument 588, which grants consent under Licence Condition 30(3) attached to Nuclear Site Licence No.60 to start-up Heysham 2 Reactor 7.

## 7 REFERENCES

- 1 Heysham 2 R715 - HYB51019R - Reactor 7 Periodic Shutdown 2015: Request for Consent to Start Up Reactor 7 Under LC 30(3). 27 April 2015. TRIM 2015/154779
- 2 Heysham 2 – Licence Instrument (Consent) No 568 under LC30(3). Consent to the start-up of Heysham 2 Reactor 7, 10 November 2011. TRIM 2011/592575
- 3 Heysham 2 Power Station - Nuclear Site Licence No. 60 Licence Condition 30(2) Extension of Heysham 2 Reactor 7 Operating Period, HYB51002R, 22 September 2014, TRIM 2014/355588.
- 4 Heysham 2 – R715 Outage Deferral PAR ONR-HYB-PAR-14-013 – Agreement to Extension of Operating Period, 03 November 2014. TRIM 2014/348064
- 5 Heysham 2 - Licence Instrument (Agreement) No 583 Under LC30(2). Agreement to an Extension of the Operating Period, 03 November 2014. TRIM 2014/408010
- 6 Heysham 2 - Reactor 7 Statutory Outage R715 - Outage Intentions Document Rev 002 - HB-REPS-OM029, 12 December 2014. TRIM 2014/457899
- 7 Heysham 2 - R7 2015 Outage - INA Concurrence Part A - SRD/EP/CON/HYB/007A, 7 February 2015. TRIM 2015/47871
- 8 Heysham 2 R715 - HYB51019R - Appendix 13 INA Concurrence Document, 24 April 2015. TRIM 2015/154582
- 9 EC 351387 Heysham 2 R7 2015 Statutory Outage Approval of Inspection Results, version 01. TRIM 2015/153674
- 10 Heysham 2 R715 - HYB51019R - Appendix 12 EC 351387 Statutory Outage Approval of Inspection Results - INSA Approval, 27 April 2015. TRIM 2015/154856
- 11 Heysham 2 R715 - HYB51019R - Appendix 02a Certificate of Maintenance Schedule Completion for Pressure Vessel, 20 April 2015. TRIM 2015/153656
- 12 Heysham 2 R715 - HYB51019R - Appendix 02B Written Scheme of Examinations - Heysham 2 Power Station Reactor 7 - CPV Penetration PSSR Inspections Thorough Examination, 16 April 2015. TRIM 2015/153657
- 13 Heysham 2 R715 - HYB51019R - Appendix 01 Written Scheme of Examination Statement from Bureau Veritas Insurance Inspector, 24 April 2015. TRIM 2015/153655
- 14 Intervention Task Sheet - TS212 - Heysham 2 - 2014/15 R7 Statutory Outage. TRIM 2014/218761
- 15 ONR HOW2 Guide - Purpose and Scope of Permissioning - NS-PER-GD-014 Revision 4. July 2014. <http://www.onr.org.uk/operational/assessment/index.htm>
- 16 NGL - CNRP - Intervention Record - 14-241 - Heysham 2 R7 2015 Periodic Shutdown - Inspection LC17, LC22 and Mid Outage Review Meeting, 30 March 2015. TRIM 2015/121022
- 17 NGL - CNRP - Intervention Record - 14-239 - Heysham 2 R7 2015 Periodic Shutdown - Radiological Protection Inspection, 13 April 2015. TRIM 2015/115543
- 18 ONR - COP - Intervention Record - 14-147 - Heysham 2 R7 2015 Periodic Shutdown - Fire Safety Inspection, 30 March 2015. TRIM 2015/119010
- 19 EDF NGL - Heysham 2 - Assessment Report - 14-111 – HYB R7 2015 Periodic Shutdown -Civil Engineering - Assessment of the Pre-stress Concrete Pressure Vessel Appointed Examiner Start-Up Statement, 20 April 2015. TRIM 2015/92246

- 20 EDF NGL - Heysham 2 - Assessment Report - 15-005 - HYB R7 2015 Periodic Shutdown - Structural Integrity Assessment, 24 April 2015. TRIM 2015/137634
- 21 Heysham 2 R715 - ONR Review of EC 353074 - Outage inspection of the PISI extension piece, 19 April 2015. TRIM 2015/144679
- 22 EDF NGL - Heysham 2 - Assessment Report - 15-008 - HYB R7 2015 Periodic Shutdown – Electrical Engineering Assessment, 22 April 2015. TRIM 2015/148653
- 23 EDF NGL - Heysham 2 - Assessment Report - 15-006 - HYB R7 2015 Periodic Shutdown - Control and Instrumentation (C&I) Assessment, 21 April 2015. TRIM 2015/140211
- 24 EDF NGL - Heysham 2 - Assessment Report - 15-009 - HYB R7 2015 Periodic Shutdown - Assessment of the results of the Graphite Core Inspections, 27 April 2015. TRIM 2015/147443
- 25 NGL-CNRP-CR-14-219 - Heysham 2 Reactor 7 Outage 2015 - Outage Intentions Meeting, 09 October 2014. TRIM 2014/379528
- 26 Heysham 2 R7 2015 Mid Outage Report HB/REPS/MO023 Rev 002, March 2015. TRIM 2015/115670
- 27 Heysham 2 Reactor 7 2015 - HB/REPS/MO024 - Outage Start-Up Report, April 2015. TRIM 2015/143379
- 28 NGL - CNRP - Contact Record - 15-015 – Heysham 2 R715 Outage Start-Up Meeting, 27 April 2015. TRIM 2015/152530
- 29 Heysham 2 - R7 2015 Outage Consent Issues and Action Tracking Log. TRIM 2014/449926
- 30 Heysham 2 R715 - EQUIPMENT FAILURE INVESTIGATION - EFI 926516 - Operation of EPPE Run on Protection B following R7 manual trip for R715 outage, 27 February 2015. TRIM 2015/145244
- 31 Email - Heysham 2 Reactor 7 2015 Outage Start-up Permissioning Environment Agency Response, 24 April 2015. TRIM 2015/153099
- 32 Email - Heysham 2 R7 2015 Outage Start-up - CNS comment, 15 April 2015. TRIM 2015/140975 and Email - Heysham 2 R7 2015 Outage Start-up meeting - Security Statement, 23 April 2015. TRIM 2015/151782