Office for Nuclear Regulation

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Environment Agency	[redacted] Environment Agency Heysham 1 [redacted]@environment-agency.gov.uk	
Licensee	[redacted] Heysham 1 Station Director [redacted]@edf-energy.com [redacted] Heysham 1 Technical and Safety Manager [redacted]@edf-energy.com [redacted] Heysham 1 Independent Nuclear Assurance [redacted]@edf-energy.com	

Heysham 1 Reactor 1 2017 Periodic Shutdown

ONR Consent for Start-up of Heysham 1 Power Station Reactor 1 following Periodic Shutdown

Project Assessment Report ONR-OPF-PAR-16-028
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EXECUTIVE SUMMARY

Title

ONR Consent for Start-up of Heysham 1 Reactor 1 following 2017 Periodic Shutdown.

Permission Requested

EDF Energy Nuclear Generation Limited (NGL) has requested consent from ONR for start-up of Reactor 1 (R1) at Heysham 1 Nuclear Power Station under Licence Condition (LC) 30(3): Periodic Shutdown. This follows Examination, Inspection, Maintenance and Testing (EIMT) on R1 in accordance with requirements set out in the reactor's maintenance schedule under LC 28(4): EIMT.

Background

LC 30(1) states that for the purpose of enabling EIMT of any plant or process the licensee shall, when necessary, ensure that any such plant or process is shutdown in accordance with the requirements of the plant maintenance schedule as referred to in LC 28(4).

LC 30(3) states that when a plant or process is shutdown in pursuance of LC 30(1) the licensee should, if so specified by ONR, ensure that it has the consent of ONR in order to start-up. ONR specified this under LC 30(3) Nuclear Site Licence 60, Licence Instrument No 10, dated 25 March 1996.

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

ONR inspection and assessment activities in consideration of consent for start-up of a power reactor following periodic shutdown were to confirm that:

- Requirements set out in the Station's Maintenance Schedule have been met in accordance with requirements of LC30 (this providing continuing support of claims made in the Station's Safety Case produced under LC23: Operating Rules);
- Required Maintenance Schedule work for the periodic outage has been undertaken in accordance with station's arrangements and by suitably qualified and experienced persons with the appropriate level of control and quality surveillance given the potential impact on safety. These requirements also cover any modification work undertaken in support of delivering the periodic shutdown;
- Safety issues identified by NGL during the periodic outage are adequately addressed with suitable and sufficient safety justification provided to allow a regulatory judgement on reactor start-up and its safe operation until the next periodic shutdown.

ONR carried out a series of planned inspections during the periodic shutdown to evaluate and confirm these requirements were met.

Matters arising from ONR's work

Based on evidence presented by NGL and ONR's inspection activities it is considered that periodic shutdown EIMT requirements have been met and R1 is safe to start-up and operate until its next periodic shutdown. ONR raised one start-up issue with the discovery of foreign material in a small number of boiler super-heater header tail pipes. ONR considered NGL has provided adequate justification for this issue to be closed. A number of issues were also identified during ONR's inspection activities for which resolution was not required before start-up and these will be closed out through routine business.

Conclusion

ONR was satisfied that NGL has complied with its periodic shutdown EIMT requirements for R1 and adequately addressed ONR's re-start issues in providing suitable and sufficient safety justification to allow ONR to support the re-start of Heysham 1 R1.

Recommendation

It was recommended that ONR issue Licence Instrument 612 under LC30(3) for Nuclear Site Licence 60 giving consent for NGL's to start-up Heysham 1 R1.

LIST OF ABBREVIATIONS

APEX	Appointed Examiner
AR	Assessment Report
BCU	Boiler Closure Unit
EC	Engineering Change
EIMT	Examination, Inspection, Maintenance and Testing
GAP	Graphite Assessment Panel
GC	Gas Circulator
GCMF	Gas Circulator Maintenance Facility
GCSE	Gas Circulator System Engineer
INSA	Independent Nuclear Safety Assessment
MS	Maintenance Schedule
NDT	None Destructive Testing
NSL	Nuclear Site Licence
OAP	Outage Assessment Panel
OC	Outage Coordinators
OCC	Outage Control Centre
OID	Outage Intentions Document
ONR	Office for Nuclear Regulation
PCPV	Pre-stressed Concrete Pressure Vessels
PMP	Plant Maintenance Policies
PSSR	Pressure Systems Safety Regulations 2000
RGSRV	Reactor Gas Safety Relief Valve
SE	System Engineer
SQEP	Suitably Qualified and Experience Persons
SUS	Start-Up Statement
WSE	Written Schemes of Examination

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1 PERMISSION REQUESTED

1. This Office for Nuclear Regulation (ONR) Project Assessment Report (PAR) has been produced to record regulatory views and judgment in consideration of the EDF Energy Nuclear Generation Limited (NGL) request for ONR's consent for start-up of Heysham 1 Reactor 1 (R1) in compliance with requirements of Nuclear Site Licence Condition (LC) 30: Periodic Shutdown, clause (3).

2 BACKGROUND

2. (LC) 30: Periodic Shutdown, clause (1) places a requirement on a Nuclear Site Licensee that, where there is a need to carry out periodic examination, inspection, maintenance or testing of any plant or process in the interest of safety, to shutdown such plant or process in accordance with requirements set out in the plant's maintenance schedule as required by LC 28 (4): Examination, Inspection, Maintenance and Testing (EIMT).

3. When a plant or process is shut down in pursuance of LC30(1) then LC30 clause (3) states that, if so specified by ONR, the licensee shall seek ONR's consent before starting up the plant or process. ONR provided such a specification for Heysham under LC 30(3) in Licence Instrument (LI) No 10, dated 25 March 1996, Unique Document No HYA 70566 (Reference 1).

4. NGL has requested ONR's consent for start-up of Heysham 1 R1 under LC 30(3) through letter Unique Reference NSL/HYA/5084(Y) dated 5 April 2017 (Reference 2).

5. ONR's formal engagement with NGL on the Heysham 1 R1 periodic shutdown commenced on 11 August 2016 with the Heysham 1 R1 Outage Intentions meeting. ONR Intervention Record, ONR-OPF-IR-16-099 (Reference 3) summarises points discussed at this meeting. NGL set out the activities to be carried out during the shutdown in its Outage Intentions Document (OID) HYA/M/METHODS/152 Issue 0 (Reference 4). NGL stated that this was a standard outage with no additional requirements being undertaken to those specified in the reactor's Maintenance Schedule (MS) and identified plant modifications. A number of Engineering Change (EC) justifications were identified to address inspection activities and plant modifications.

6. At the Outage Intentions meeting NGL advised ONR that it was seeking an extension to R1's operating period from 17 December 2016 to 28 February 2017. This extended the permitted period of three years as stated in the Station's MS by 73 days, with the outage planned to commence on 6 February 2017. NGL presented its safety justification for extending the period of operation of R1 in EC 356750 (Reference 5). ONR assessed the case and considered it reasonable setting outs its views and judgement in ONR PAR (Reference 6) and issued LI 611 under LC30(2) for NSL 60 giving agreement to the period of operation of R1 to be extended by 73 days.

7. ONR attended the Heysham 1 R1 Outage Start-up meeting on 8 March 2017. NGL updated ONR on progress and findings of EIMT work. ONR Intervention Record ONR-OPF-IR-16-660 (Reference 7) summarises points discussed. NGL presented its shutdown findings to date (Reference 8) and indicated that they were on programme to meet MS requirements for R1 and no issues had been identified that would prevent start-up of R1.

8. Given the identification of foreign material in boiler 1A1 super-heater header tail pipes and the need to replace jacking oil pumps for Gas Circulator (GC) 1C1, the R1 start-up date was extended compared to the original outage programme.

9. The issue of foreign material found in super-heater tail pipes was identified by ONR as a start-up issue requiring NGL to provide a safety justification setting out the cause and

reasons why it was safe to operate prior to the start-up of R1 (discussed further in Section 4.2 of this report).

10. NGL confirmed in (Reference 2) that they had complied with R1 MS requirements; that there were no issues identified to prevent start-up of R1 or that would impact on its safe operation of R1 until its next periodic shutdown. This was supported by NGL's safety justification presented in EC360486 and Independent Nuclear Safety Assessment (INSC) certificate addressing start-up requirements (Reference 2 Appendix 3 and 4 TRIM Ref 2017/136644, 2017/136663) and EC359514 and INSA certificate addressing the discovery of foreign material in boiler super-heater header tail pipes (Reference 2 Appendix 10 and 11 TRIM Ref 2017/130586, 2017/130586). Third party inspection verification was provided for reactor Pre-stressed Concrete Pressure Vessel (PCPV), reactor vessel penetrations and Pressure System Safety Regulations (PSSR) covering steam systems and pipework (Appendix 5, 6 and 7 in Reference 2 TRIM Ref 2017/132052, 2017/134364 and 2017/131429).

11. The NGL Heysham 1 Independent Nuclear Assurance (INA) team provided an interim statement (Reference 2 Appendix 12 TRIM Ref 2017/131432) supporting R1 start-up on the basis of their surveillance activities set out in INA Concurrence Part A NGL document reference SRD/REP/CON/HYA/014A dated January 2017, which had not identified any issues which would challenge R1 start-up.

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

12. The primary regulatory areas of focus for ONR during a periodic shutdown were to confirm that:

- LC 30 requirements as set out in the station's MS have been undertaken and that this work together with inspection findings support continued validation of the Station's Safety Case;
- Identified MS work is in accordance with station's arrangements and undertaken by suitably qualified and experienced persons with the appropriate level of control and quality surveillance given potential impact on safety. These requirement also covers modification work during periodic shutdown activities;
- Safety issues identified by NGL during the periodic shutdown are adequately addressed with suitable and sufficient safety justification provided to allow a regulatory judgement to be made on start-up and safe reactor operation until the next periodic shutdown.

13. ONR's approach when regulating the nuclear industry is to use a sampling regime that targets areas of potential high risk and consequences. On this basis, ONR issued the Heysham 1 Station Outage Plan (Reference 9) setting out ONR's inspection and assessment requirements, based on evaluation of ONR's issues database, operational feedback and wider learning from the nuclear industry.

14. ONR carried out the following discipline-focused inspections during the Heysham 1 R1 periodic shutdown in support of considering issuing start-up consent.

- Civil Engineering**;**
- Structural Integrity;
- Graphite Integrity;
- Mechanical Engineering;
- Electrical Engineering;
- Control and Instrumentation;

4 MATTERS ARISING FROM ONR'S WORK

15. Information presented by NGL and gathered during ONR inspection activities for the Heysham 1 R1 periodic shutdown are used to informed ONR's decision on whether to give consent for start-up. The following summarises the findings and views of ONR's Specialist Inspectors who carried out targeted inspections during the Heysham 1 R1 2017 periodic shutdown.

4.1 Civil Engineering Inspection and Assessment

16. The ONR Civil Engineering Assessment Inspector carried out a site inspection of the Heysham 1 R1 periodic shutdown on 28 February to 1 March 2017 (Reference 10). The Inspector also assessed the Heysham 1 R1 Pre-stressed Concrete Pressure Vessel (PCPV), Appointed Examiners (APEX) report NGL Document Reference E/REP/BNCB/0556/HYA/17 (Reference 11).

17. Inspection activities included:

- Evaluation of Station's compliance against R1 civil MS requirements;
- Review of NGL Heysham 1 Civil APEX inspections and examinations activities;
- Management of PCPV and Boiler Closure Unit (BCU) cooling system leakage and sealing;
- NGL supervision and over-sight of pre-stressing contractor staff.

18. The Inspector sampled NGL's civil maintenance activities in support of the Heysham 1 R1 periodic shutdown. This involved PCPV tendon selections for load testing, removal of tendons for signs of corrosion, installation of new tendons and pre-stressing. From this the Inspector concluded that Station was complaint with R1 MS requirements.

19. The Inspector discussed his inspection and examination activities in support of the Heysham 1 R1 periodic shutdown with the NGL Civil APEX. This dealt with operability of condition monitoring instrumentation fitted to the reactor PCPV, review of inspection records, compliance with Station Operating Instructions and management of cooling water leaks. He concluded that the APEX was addressing inspection and examination requirements to the required standard, noting that the reactor main PCPV was free of cooling water leaks and a clear strategy had been developed to address cooling water leaks on BCU 1B1 and monitoring of BCU 1D2 was in place given "tide marks" identified on outer annulus. The APEX confirmed that no water ingress into BCU Wire Winding Chambers (WWC) had occurred based on no change in conductivity corrosion monitor readings from probes fitted within WWC.

20. The ONR Inspector considered NGL was providing an adequate level of control and supervision of the pre-stressing contractor Vinci. This was based on the observation of regular contact between the NGL supervisor and Vinci's supervisor and NGL's oversight procedural arrangement where NGL has hold-point sign off requirements prior to commencing further stages of work.

21. The ONR Inspector judged that the pre-stressing contractor's supervisor and team were suitably qualified and experienced following his review of their training records, discussions with individuals and findings of NGL's Quality Management inspection. He observed some minor anomalies in the contractor's procedures and quality records and areas of misalignment between Vinci's method statements and NGL's Civil Branch Instructions. These were brought to the APEX's attention and it was agreed that they will be addressed through routine regulatory business.

22. The Inspector's assessment of the APEX PCPV interim report (full report to be issued 28 days after reactor start-up) found that a comprehensive review of the structure and components of the R1 PCPV had been undertaken. The Inspector raised five issues dealing with access difficulties to wetted tendons, tendon probe inspections,

performance of BCU thermocouple and record-keeping. These will be addressed through routine regulatory business.

23. Based upon the ONR Civil Engineering Assessment Inspector's inspection and assessment findings of the Heysham 1 2017 R1 periodic shutdown, the Inspector supports ONR issuing its consent for R1 start-up and its safe operation until the next period shutdown.

4.2 Structural Integrity Inspection and Assessment

24. The ONR Structural Integrity Assessment Inspector carried out a site inspection of the Heysham 1 R1 periodic shutdown 28 February to 2 March 2017 (Reference 12). The Inspector also assessed the adequacy of NGL's inspections of welds, metallic reactor internal structures and components, main cooling water system, pipe hangers and thermal movement supports in line with MS requirements and compliance with PSSR findings (Reference 13).

25. Inspection activities included:

- Main Cooling Water System (MCWS)
- Reactor Internals
- PSSR Inspections
- Weld Inspections and Non-Destructive Testing (NDT)
- Flow Accelerated Corrosion (FAC) of Boiler Tubes and cooling water systems
- Pipe Hanger and Support Inspections
- Boiler Inspections (Including Boiler Closure Unit and Header Penetrations)
- Observation of Outage Assessment Panel

26. The Inspector sampled a range of MS activities from the areas he inspected. In general, he was content with the approach and quality of work undertaken. The Inspector met with the PSSR Competent Person (CP) from Bureau Veritas and sampled inspection arrangements for Start-up Vessel and Deaerator 1. It was identified that a repair was required due to one of four internal splash baffle plates being detached. Based on his discussion and inspection findings the Inspector was content with standards and approach adopted by the PSSR CP.

27. The Inspector also reviewed the meeting minutes of the Heysham 1 Outage Assessment Panel (OAP). These documents record decisions from review of inspection findings and sentencing. He observed meeting 149 held on 1 March 2017 which confirmed due process and governance was applied. He concluded that the Heysham 1 OAP applied due diligence and challenges in the assessment and sentencing of inspection findings referencing appropriate codes and standards.

28. During NGL's inspection of boiler super-heater header 1A1 metallic debris was found inside a number of super-heater tubes. This was identified by ONR as a Start-up issue, requiring NGL to submit a separate safety justification to demonstrate safe return to service of R1 boilers.

29. NGL submitted EC 360486: Return to Service of Heysham 1 R1 following Discovery of Debris in Super-Heater Tailpipes. ONR assessed this case (Reference 14) and concluded that NGL had carried out a suitable level of inspection of R1 boiler super-heater header-tailpipes using remote visual examination, flow testing and metallurgical examination of blockage material. This has allowed sufficient understanding of obstructions which are considered to be austenitic stainless steel oxide from the internal surfaces of the super-heater boiler tubes. It is judged that the spalled oxide will have no detrimental impact on tube integrity until next periodic outage, and there will be no effect on other components or plant within the reactor's secondary circuit. The work done by NGL provides sufficient confidence that potential undiscovered

blockages are of sufficiently low risk that they would not affect the existing reactor safety case claims for seven out of eight boiler operations.

30. NGL has made three commitments in support of their safety submission:

- Conduct flow tests on 1A quad boilers in August 2017 to confirm the condition of any outstanding tubes;
- Investigate the potential to complete a full boiler chemical clean on HYA R1 within an 18 month period of RTS; and
- Perform boiler flow test prior to the boiler being returned to service, following any boiler syphoning operations on HYA R1. If any mono tubes or pair of tubes is identified as restricted they will be pressure tested and jetted to remove the debris. Should this not remove the debris specialist advice from boiler SQEPs will be sought. This commitment is not required if Commitment 2 is completed, on the understanding that once the boilers have been chemically cleaned, the risk of spalled oxide obstructions forming is significantly reduced.

31. Based on surveillance and assessment findings the ONR Structural Integrity Assessment Inspector recommended Start-up of Heysham 1 R1 but placed the following caveats on the ONR Heysham 1 Periodic Shutdown Project Inspector before ONR issue its consent for start-up. Which are

- Satisfactory completion of the steam system inspection programme and completion of work by OAP together with INSA certificate for the Return to Service EC359514.
- Completion of the PSSR inspections and statement from CP that Heysham 1 R1 is safe to return to power following periodic shutdown.
- Completion of reactor penetrations inspections and statement from APEX that Heysham 1 R1 is safe to return to power following periodic shutdown.

32. ONR Heysham 1 Periodic Shutdown Project Inspector confirmed that all of the above requirements have been met given references attached to Reference 2 which were reviewed in support of ONR's decision giving consent for R1 start-up.

4.3 Graphite Integrity Inspection and Assessment

33. The ONR Graphite Integrity Inspector evaluated Heysham 1 R1 graphite core inspection findings by conducting a desktop review of meeting minutes from the Heysham 1 R1 Graphite Assessment Panel (GAP) and assessment of EC360346: Justification for return to service of Heysham 1 R1 following graphite core inspection (Reference 15).

34. The ONR Graphite Assessment Inspector confirmed that NGL had met its graphite MS requirements:

- Carrying out 60 fuel channel TV inspections over a three year period (3-yearly), 17 inspections undertaken during this outage.
- Taking 10 fuel channel bore measurement inspections every periodic shutdown.
- Trepanning a minimum of 30 samples, with a target of 36, from at least 6 fuel channels, subject to reasonable practicability, every periodic shutdown.
- Carrying out 1 TV inspection of a control rod channel at every periodic shutdown.

35. The Inspector confirmed that remote visual inspection findings from TV inspections of fuel channels were within anticipated inspection limits of one to two new single axially cracked bricks and up to one doubly axially cracked brick. Actual inspection findings identified two new single axially cracked bricks but no doubly axially cracked bricks. The Inspector noted NGL's observation that full height axial cracks observed in channel 1L41 and 1M31 indicated the bricks are not significantly beyond stress

reversal, if at all. The Inspector considered NGL's claim was reasonable based on his assessment of inspection findings.

36. Results from channel bore measurements covering brick shrinkage, bore ovality, brick bow, channel bow and channel tilt were considered to be within NGL's expected distortion limits and did not challenge safety operating parameters.

37. A total of 36 complete trepanned samples were taken from the R1 core during this periodic outage. Analysis of these samples added further data points to gain better insight into graphite brick through-thickness weight loss behaviour. This work supports computer modelling predictions of the rate of whole core graphite weight loss.

38. The Inspector noted that the current R1 safety case limit for active core weight loss is based on a figure of 12%. This limit gives a core burn-up value of 12900GWd which will be exceeded by the end of 2019, falling before the date of the next scheduled periodic shutdown of May 2020. Therefore operation beyond 12% active core weight loss needs to be supported by a new safety case for graphite core performance. NGL stated, in EC 360346, that work is in hand to increase core weight loss limit from 12% to 17% to give an extension to R1 graphite core operating period to 2027. ONR has made station aware of the limiting 12% graphite case and that not having a valid safety case in place could result in shutdown of R1. ONR has raised a level 4 issue 1013 to track this matter.

39. The Inspector supports start-up of R1 given that NGL has met its graphite MS requirements and based on the safety arguments presented in EC 360346. The Inspector highlighted that NGL will need to provide a new graphite weight loss safety case before the end of 2019.

4.4 Mechanical Engineering Inspection

40. The ONR Mechanical Engineering Inspector undertook a site-based inspection on 21 February 2017 (Reference 16). This inspection focused on:

- Gas Circulators (GCs) Maintenance
- Reactor Gas Safety Relief Valve (RGSRV) Maintenance

41. The Inspector reviewed maintenance arrangements for GCs and considered these adequate. During his inspection he examined the GC maintenance facility and observed maintenance of a number of GC and noted damage to an aluminium shroud fitted to a GC pony motor. The Heysham 1 GC System Engineer (SE) reported that the cause of this damage was believed to be reactor gas impingement on the shroud exerting force on the component causing distortion and damage. This type of degradation had been observed on other GC pony motors during the refurbishment of GC on their 12 year MS interval. The Inspector reviewed NGL's trending of this damage and was content that NGL were devoting an appropriate level of attention to this issue. ONR issue 5207 has been raised to ensure this observation is recorded and followed up in future outages.

42. The ONR Inspector reported that he considered adequate arrangements were in place for Foreign Material Exclusion (FME) during maintenance of GCs. During commissioning of GC machine 7 installed in location 1A2 foreign material was found in oil gallery tappings for pressure transducers for GC Jacking Oil Pumps (JOP). The FME prevented pressure transducer for JOP working correctly and required additional re-work. The ONR Heysham 1 Periodic Shutdown Project Inspector has requested a copy of the Station's investigation report into this event.

43. The ONR Inspector reviewed Heysham 1 RGSRV maintenance arrangements and considered them adequate. He discussed with the SE the Hinkley Point B RGSRV event where one RGSRV was found inoperable due to corrosion from ingress of rain water. The SE stated that ingress of rain was not likely to happen at Heysham 1 as the

discharge pipe-work is mounted horizontally. When the Inspector asked if full flow RGSRV testing was carried out, the SE replied that this type of testing was not carried out at Heysham 1, but visual camera inspection of discharge lines was undertaken during each outage to check that lines were free from blockages and corrosion. The SE stated that RGSRV are pop tested using nitrogen gas to check their operation and lift pressure. The ONR Inspector reviewed documentation relating to RGPRV testing. At the time of this inspection the RGPRVs had not been pop tested. The Inspector reviewed previous test results from R1 and considered these satisfactory.

44. Overall, no matters of safety significance were identified from this inspection and the ONR Mechanical Engineering Inspector supported ONR giving consent to start-up R1.

4.5 Electrical Engineering Inspection

45. The ONR Electrical Engineering inspection of the Heysham 1 R1 periodic shutdown was conducted on 3 March 2017 (Reference 17). This inspection involved inspection of MS work of the following equipment:

- 11 kV R1 Unit Switchroom
- Generator Transformer 1
- Unit Transformers 1A & 1B
- 415 V R1 Unit Switchroom
- 3.3kV R1 Unit Switchroom

46. The Inspectors were able to confirm that, on the date of their inspection, MS requirements set out in Station's OID were being met. The Inspectors observed maintenance work on 11kV circuit breakers. From discussions with electrical lead and maintenance technicians it was considered that work was carried out to the required standard with work order cards referencing maintenance procedures at point of work and check-sheets completed.

47. The Inspectors were informed by Station that during the testing following maintenance of Generator Transformer 1 (GT 1), high voltage isolation switches on the red phase had not functioned as required. Following closer examination Station decided to replace the switches on the three phases. Overhaul work of GT1 low voltage air blast circuit breakers (ABCB) had been completed. However, post maintenance timing tests revealed misalignment between phase closure of circuit breakers. Station was addressing this issue with support from the equipment manufacturer at time of inspection. Given the nuclear safety significance of the circuit breakers ONR Inspector requested station to confirm completion of this maintenance activity. This requirement has been met in Station confirming completion of work TRIM Ref 2017/123350. No other issues were reported by Station on maintenance of GT 1.

48. The Inspector confirmed that Station's programme of Motor Alternator set replacement with dual static inverters had progressed well with commissioning of installed equipment taking place.

49. Overall, no matters of safety significance were identified from this inspection and the ONR Electrical Engineering Inspector confirmed his support for ONR issuing consent for start-up R1.

4.6 Control and Instrumentation Inspection

50. The ONR Control and Instrumentation inspection of the Heysham 1 R1 periodic shutdown was conducted 28 February to 1 March 2017 (Reference 18). This inspection involved inspection of MS work covering the following systems:

- Neutron Flux Detectors
- Laddic Modules

- Gas Circulator (GC) Speed Trip Instrumentation
- Gas Circulator Vibration Monitoring Instrumentation

51. Together with inspection of modification work covering:

- CO_2 Dryer Control System Panels (EC 344379)
- R1 Safety Circuits for 4 Quadrant Configuration to reduce the increased risk of spurious trips during operation on 7 Pod boilers (EC 358944)

52. With respect to MS compliance, the Inspectors confirmed work was being carried out in line with maintenance instructions which were referenced in work order cards. Where measurements and readings needed to be taken these were being recorded. In the case of Neutron Flux Detectors no sign of significant degradation was reported by station. Test results recorded from GC Speed Trip Instrumentation calibration was confirm to be within set parameters.

53. In the case of plant modifications, visual inspection of the R1 CO_2 dryer control system panel installed through EC 344379 was carried out. Station confirmed Factory Acceptance Testing had been carried out and Site Acceptance Testing was in progress. The Inspectors reviewed the Quality Plan for this work and found it satisfactory. The Inspectors queried the IP rating of the control panel given humidity of the room it was installed in and it having a modified rear access doors which was bi-folding given space constraints. When NGL was asked whether there were regular inspections of the panel to check for moisture ingress NGL replied that no inspections had been proposed. NGL was asked to review their inspection procedure for the CO_2 dryer control system and consider the need for regular inspections. This finding recorded under ONR issue 5216-2 for tracking purposes.

54. In the case of installation of EC358944, which ONR was made aware of just before commencing this periodic shutdown inspection, this modification was not identified in the Heysham 1 R1 OID. NGL stressed that the EC was not intended to justify long-term operation of 5-pod boiler configuration but allow R1 to operate if one of its full boiler quadrants A, B or C tripped.

55. A range of Control & Instrumentation (C&I) aspects were discussed, including flow orifice plate modification, reliability of the Inlet Guide Vane and GS control system given loss of 11kv supply. From these discussions the Inspector was satisfied from a C&I perspective that the proposal was acceptable and did not require any further assessment.

56. Five level 4 regulatory issues were raised from this inspection. None impacted on R1 start-up and all will be followed-up through normal regulatory business. The C&I Inspector did not identify any safety issues which would impact on Heysham 1 R1 return to service and its safety operation until its next periodic shutdown. The ONR Inspector supported ONR issuing consent for R1 start-up.

4.7 ONR Fire Safety Inspection

57. During the Heysham 1 R1 periodic shutdown an ONR Fire Safety Inspector carried out a compliance inspection against Regulatory Reform (Fire Safety) Order 2005 (Reference 19). The inspection focused on the practical fire safety provision during the outage, including fire safety arrangements, equipment and management of fire risks in Turbine Hall, Turbine Hall Basement and the Radiation Controlled Area.

58. The Inspector concluded that Station was complaint with Regulatory Reform (Fire Safety) Order 2005: a good level of fire safety provision and management was in place for the R1 periodic shutdown; site management arrangements were suitable and sufficient; the role of the Fire Safety Coordinator was well understood and these individuals had been trained to the required level.

4.8 ONR Overview of Outage Activities

59. During the Heysham 1 R1 periodic shutdown the ONR Site Inspector and the Periodic Shutdown Project Inspector monitored outage work. This involved a compliance inspection against LC 30 and 26: Control and Supervision of Operations together with reviewing management of Outage Control Centre (OCC) (Reference 20). The view reached was that maintenance work was adequately managed through the OCC. From inspection of maintenance activities it was considered work was carried out in line with maintenance procedures, individuals carrying out work were SQEPed and appropriate supervision of work was in place commensurate with safety significance. It was also considered that appropriate quality control arrangements were in place as required by NGL and its contractors.

60. The ONR Site Inspector and Periodic Shutdown Project Inspector did not identify any issues which challenge the safety of start-up of R1 and its safe operation until its next periodic shutdown. Both ONR Site and Periodic Shutdown Project Inspector support ONR issuing its consent for Heysham 1 R1 Start-up.

61. As part of R1's Periodic Shutdown programme of work a planned deluge test of Turbine 1's firefighting suppression system was required to be carried out. On the 3 April 2017 this system was tested and a leak in the water supply line to both R1 and R2 Fixed Jet Fire Fighting (FJFF) was discovered. The line was isolated to prevent flooding of Station's Turbine Hall basement but resulted in loss of the FJFF system. This is a critical safety system and Station's Technical Specifications required it to be back in service within 4 hours. This requirement could not be met so Station invoked its Organisational Decision Making (ODM) process and R2 was shut-down in accordance with Station's operating procedures.

62. NGL informed ONR of this event and that the FJFF would not be returned to service for possibly up to five days. Station has confirmed their fire detection capability remains intact and that they have implemented a number of increased fire protection measures with enhanced arrangements implemented for hot working in support of R1 shutdown activities.

63. ONR has carried out a review of NGL's actions and event recovery and considers their approach adequate. Given Station requires the FJFF to be operational before start-up of its reactors and has confirmed it will notify ONR when this requirement has been met, this situation is not judged to impact on ONR's decision on granting consent for start-up of R1. All work in support of its periodic shutdown requirements will have been met before the FJFF can be returned back to service.

4.9 Engagement with other Governmental Agencies

64. The Environment Agency Heysham 1 Site Inspector has confirmed that the Environment Agency has no objection to ONR issuing its consent for start-up of R1 following its periodic shutdown (Reference 21).

5 CONCLUSIONS

65. NGL Heysham 1's letter (Reference 2) stated that all MS requirements and modification work set out in the R1 OID (Reference 4) have been completed with all deferrals identified and justified (Reference 2 Appendix 2 TRIM Ref 2017/138074). Station's return to service safety justification for R1 EC360486 (Reference 2 Appendix 3 TRIM Ref 2017/136644) confirmed that no defects impacting on start-up or its safe operation until its next periodic shutdown had been identified. This document has been reviewed by the ONR Periodic Shutdown and Structural Integrity Assessment Inspector in support of R1 Start-up with no issues were identified which would have prevented ONR issuing start-up consent.

66. NGL's APEXs for CPPV and reactor vessel penetrations have provided statements (Reference 2 Appendix 5 and 6 TRIM Ref 2017/132052 and 2017/134364) confirming these items have met required codes and standards. That they can be placed back into service and should operate safely until their next periodic shutdown.

67. Heysham 1's Third Party PSSR assurance organisation, Bureau Veritas, has issued a statement (Reference 2 Appendix 7 TRIM Ref 2017/131429) confirming that all weld and pressure vessel inspections have been undertaken. No none compliance issue against required codes and standards were raised. No objections were raised to placing pressure system equipment back into service.

68. NGL's Heysham 1 INA team have provided a statement in support of R1 Start-up (Reference 2 Appendix 12 TRIM Ref 2017/131432) confirming they have not identified any issues they consider would prevent Station returning R1 to power

69. The ONR Heysham 1 R1 re-start issue dealing with the identification of debris in boiler super-heater tail pipes has been addressed with NGL submitting EC359514 (Reference 2 Appendix 10 TRIM Ref 2017/130586). ONR's Specialist Structural Integrity Inspector has reviewed the safety justification made by NGL and considers the case is reasonable and that there is no safety concern in the start-up of R1 and its safe operation until its next periodic shutdown.

70. Based on evidence gathered from ONR inspection findings in support of the Heysham 1 R1 outage I consider NGL has complied with station's outage MS requirements. Work has been carried out in accordance with the station's procedures by competent SQEP who have worked to required quality standard.

71. In conclusion, I have not identified any issue that would prevent ONR from issuing its consent to allow the re-start of Heysham 1 R1 and its safe operation until its next periodic outage.

6 RECOMMENDATIONS

72. I recommend that ONR issues Licence Instrument 612 against LC30(3) under Nuclear Site Licence 60 giving ONR's consent to start-up Heysham 1 Reactor 1 following its 2017 Periodic Shutdown.

7 REFERENCES

1. Licence Instrument 10 for Nuclear Site Licence 60 Heysham issued 25 March 1996, Unique Document No HYA 70566N, and (ONR TRIM Ref 2015/292878).
2. NGL Letter Reference NSL/HYA/50814(Y) dated 5 April 2017 – Requesting ONR Consent for Start-up of Heysham 1 Reactor 1 following Periodic Shutdown under Site Licence Condition 30(3) (ONR TRIM Ref 2017/138116).
3. ONR Intervention Record ONR-OPF-IR-16-099 (ONR TRIM Ref 2016/333818)
4. NGL Heysham 1 Reactor 1 Outage Intensions Document, issued June 2016, NGL document Ref HYA/M/METHODS/152 Revision 0 (ONR TRIM Ref 2016/423445).
5. NGL Engineering Change proposal EC356750 Heysham 1 Reactor 1 outage deferral justification (ONR TRIM Ref 2016/476804).
6. ONR Project Assessment Report ONR-OFP-PAR-16-017 EDF Energy Nuclear Generation Limited extension to operating period of Heysham 1 Reactor 1 by 73 days.
7. ONR Intervention Record ONR-OPF-IR-16-660 Heysham 1 Reactor 1 Start-up meeting (ONR TRIM Ref 2017/106110)
8. NGL Start-up presentation for R1 Periodic Shutdown TRIM Ref 2017/98251
9. ONR Heysham 1 2017 Reactor 1 Outage Plan (ONR TRIM Ref 2016/423955)
10. ONR Civil Engineering inspection of Heysham 1 2017 Reactor 1 Periodic Outage, ONR Intervention Record ONR-OFP-IR-16-237, (ONR TRIM Ref 2017/95769).
11. ONR Civil Engineering Assessment Report ONR-OFP-AR-16-071 Titled Assessment of civil engineering in support of the restart of Reactor 1 following the 2017 Periodic Shutdown, (ONR TRIM Ref 2017/101846).
12. ONR Structural Integrity Inspection of Heysham 1 2017 Reactor 1 Periodic Outage, ONR Intervention Record ONR-OFP-IR-16-235, (ONR TRIM Ref 2017/89168)
13. ONR Structural Integrity Assessment Report ONR-OFP-AR-16-072 Titled Assessment of Structural Integrity in Support of the Restart of Reactor 1 Following the 2017 Periodic Shutdown, (ONR TRIM Ref 2017/103255).
14. ONR Structural Integrity Assessment Report ONR-OFP-AR-16-075, Titled Assessment of EC 360486 Return to Service Case Following Obstructed Identified in Super-heater Header Tailpipes, (ONR TRIM Ref 2017/111296).
15. ONR Graphite Integrity Assessment Report ONR-OFP-AR-16-069, Titled Assessment of the Results of the Graphite Core Inspections, (ONR TRIM Ref 2017/67686).
16. ONR Mechanical Engineering Inspection of Heysham 1 2017 Reactor 1 Periodic Outage, ONR Intervention Record ONR-OFP-IR-16-239, (ONR TRIM Ref 2017/86765).
17. ONR Electrical Engineering Inspection of Heysham 1 2017 Reactor 1 Periodic Outage, ONR Intervention Record (ONR TRIM Ref 2017/96149).
18. ONR Control and Instrumentation Inspection of Heysham 1 2017 Reactor 1 Periodic Outage, ONR Intervention Record ONR ONR-OFP-IR-16-242, (ONR TRIM Ref 2017/95887).
19. ONR Fire Safety Inspection of Heysham 1 2017 Reactor 1 Periodic Outage, ONR Intervention Record ONR-COP-IR-16-077 (ONR TRIM Ref 2017/100099).
20. ONR Outage Planning and Delivery of Maintenance Work Inspection of Heysham 1 2017 Reactor 1 Periodic Outage, ONR Intervention Record ONR ONR-OFP-IR-16-231, (ONR TRIM Ref 2017/80224).
21. Environment Agency Statement in Support of Office for Nuclear Regulation Consent for Heysham 1 Reactor 1 Start-up, (ONR TRIM Ref 2017/120276).