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Hartlepool Reactor 2 2016 Periodic Shutdown

ONR Consent for the Re-start of Hartlepool Power Station Reactor 2 following 2016 Periodic Shutdown

Project Assessment Report ONR-OPF-PAR-16-012
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EXECUTIVE SUMMARY

Title

ONR Consent for Re-start of Hartlepool Power Station Reactor 2 following 2016 Periodic Shutdown.

Permission Requested

Electricite de France Energy Nuclear Generation Limited (NGL) has requested consent from the Office for Nuclear Regulation (ONR) under Licence Condition (LC) 30(3): Periodic Shutdown to re-start Reactor 2 (R2) at Hartlepool Nuclear Power Station. This follows R2 periodic shutdown in accordance with requirements set out in the plant maintenance schedule under LC 28(4): Examination, Inspection, Maintenance and Testing (EMIT).

Background

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

LC 30(3) states that the licensee shall, if so specified by ONR, ensure that when a plant or process has been shut down in pursuance of LC 30(1), should not be re-started without the consent of ONR. ONR specified under LC 30(3) Nuclear Site Licence 59, Licence Instrument No 6, dated 28 March 1996.

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

ONR inspection and assessment activities in considering giving consent for re-start of a power reactor following periodic outage were:

- To confirm requirements set out in the Station's Maintenance Schedule have been met in support of LC30 requirements this directly linked into claims and justifications set out in the station's Safety Case required under LC23: Operating Rules;
- That Maintenance Schedule work requirements for the outage were carried out in accordance with station's arrangements and is undertaken by suitably qualified and experienced persons with the appropriate level of control and quality surveillance given the potential impact on safety. This requirement also includes any modification work identified to be undertaken during the outage;
- That safety issues identified by the Licensee during the outage are adequately addressed with suitable and sufficient safety justification provided to allow a regulatory judgement to be made in support of re-start of the reactor and its safe operation until the next periodic shutdown.

ONR carried out a series of planned inspections and assessments to confirm the identified requirements had been met.

Matters arising from ONR's work

NGL have provided a safety justification confirming that all outage EMIT requirements have been met and that R2 is safe to re-start and operate until its next periodic shutdown. ONR's inspection activities raised four re-start issues relating to graphite core integrity; compliance with Pressure Systems Safety Regulations; and computer security. NGL have provided adequate justification to allow all these re-start issues to be closed. A number of non-re-start issues were also identified from inspection and assessment activities which are in the process of being closed out and will progressed through routine ONR business.

Conclusions

ONR is satisfied that NGL has complied with its periodic shutdown EMIT requirements for R2, adequately addressed all ONR re-start issues and provided suitable and sufficient safety justification to allow ONR to support the re-start of Hartlepool R2.

Recommendation

It is recommended that ONR issue Licence Instrument 561 for Nuclear Site Licence 59 giving consent for NGL's to re-start Hartlepool R2.

LIST OF ABBREVIATIONS

APEX	Appointed Examiner
ACR	Adverse Condition Report
AR	Assessment Report
AMS	Asset Management System
COLI	Change of Load Indicators
EC	Engineering Change
EMIT	Examination, Maintenance Inspection and Testing
GCMF	Gas Circulator Maintenance Facility
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
SE	System Engineer
SEQP	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 Electricite de France Energy Nuclear Generation Limited (NGL) request for ONR consent to re-start Hartlepool Reactor 2 (R2) in compliance with requirements of Nuclear Site Licence Condition 30 (3) following completion of work during its periodic shutdown.

2 BACKGROUND

2. LC30(3) states that the licensee shall, if so specified by ONR, ensure that when a plant or process is shut down in pursuance of LC 30 (1) it should not be re-start without the consent of ONR. ONR specified under LC 30(3) for Nuclear Site Licence (NSL) 59, Licence Instrument (LI) No 6, dated 28 March 1996, Unique Document No HRA 70609 (Reference 1). This requires NGL to seek ONR's consent before re-start of R2 on the Hartlepool Nuclear Licenced Site following compliance with LC 30(1).

3. ONR's formal engagement with NGL on the Hartlepool R2 periodic outage on 16 December 2015 was through the R2 Outage Intentions Meeting. ONR Intervention Record, ONR-CNRP-IR-15-136 (Reference 2) summaries points discussed. At this meeting NGL presented its outage activities in Outage Intentions Document (OID) HAR/MO/R/020/226 Issue 0 (Reference 3). This document was re-submitted by NGL to ONR in June 2016 (Reference 4) and in August 2016 (Reference 5).

4. At the outage meeting NGL advised ONR that it was looking to seek a deferral to the start of the Hartlepool R2 outage by 101 days moving the shutdown date from 16 April to 25 July 2016. NGL submitted safety justification Engineering Change (EC) 355394 document to ONR under LC 30(2) extension of plant operating period. ONR assessed the case made by NGL setting out its judgement in ONR PAR (Reference 6) and issued LI 558 against NSL 59 agreeing to the deferral of the R2 shutdown date.

5. Prior to the commencement of the outage a number of interventions were carried out to determine Stations preparations for the R2 outage and material condition of equipment (Reference 7 and 8). No issues of concern were identified from this regulatory work.

6. The Hartlepool R2 outage commenced 25 June 2016 and had a planned duration of 49 days giving a planned re-start date of 14 August 2016. Subsequently delays in their programme let to this date being extended to 18 August 2016.

7. The R2 Outage Start-up meeting took place on 3 August 2016. ONR Intervention Record ONR-OPF-IR-16-240 (Reference 9) summaries points discussed. At this meeting NGL presented their R2 Start-up Report (Reference 10) which summarised findings from the R2 outage. This stated that they had complied with MS requirements for the R2 periodic shutdown; and they had not identified any issues preventing re-start of R2 and its safe operation until its next periodic outage. NGL provided justifications to address the 4 ONR re-start issues identified during the outage with other ONR issues being addressed and closed out through routine ONR business with the station.

8. In accordance with this requirement NGL has issued letter titled Application for Consent to Start-up Reactor 2 Under Licence Condition 30(3) Unique Letter Number NSLHRA51115R dated 8 August 2016 (Reference 11) requesting ONR's consent to re-start Hartlepool Reactor 2 (R2).

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

9. The primary regulatory areas of focus for ONR during a reactor outage are:

- To confirm that requirements set out in the station's Maintenance Schedule have been complied with based on LC30 requirements, these linking to the station's Safety Case justification;
- That identified Maintenance Schedule work is carried out in accordance with station's arrangements and that this work is undertaken by suitably qualified and experienced persons with the appropriate level of control and quality surveillance given potential impact on safety. This requirement also includes any modification work identified to be undertaken during the outage;
- That safety issues identified by the Licensee during the outage are adequately addressed with suitable and sufficient safety justification provided to allow a regulatory judgement to be made in support of re-start of the reactor and its safe operation until the next periodic shutdown.

- ONR's approach in regulating the nuclear industry is through a sampling regime that targets areas of potential high risk and consequences. In support of this objective ONR issued Hartlepool R2 Regulatory Station Outage Plan (Reference 12) which set out ONR's inspection and assessment requirements based on an informed evaluation of Hartlepool's regulatory issues, recent permissioning activities, operational experience and events data. The following were subjected to ONR inspection and assessment activities associated with oversight and regulation of the Hartlepool R2 periodic shutdown.

- Civil Engineering**;**
- Structural Integrity;
- Graphite Integrity;
- Mechanical Engineering;
- Electrical Engineering;
- Control and Instrumentation;
- Convention Safety**;**
- Outage compliance activities**.**

4 MATTERS ARISING FROM ONR'S WORK

10. Information presented by NGL and gathered during ONR inspections activities for the R2 outage has been used to inform ONR's decision on whether to give consent for re-start of Hartlepool R2. The following summarised the findings and view of ONR's Specialist Inspectors who have carried out inspections during the R2 periodic outage.

4.1 Civil Engineering Inspection and Assessment

11. The ONR Civil Engineering Inspector carried out his Hartlepool R2 inspection 6 and 7 July 2016 (Reference 13) and produced his assessment of NGL's Appointed Examiner (APEX) outage statement (Reference 14).

12. The ONR Civil Engineering Inspector's inspection focused on:

- Pre-stressing tendon removal, examinations and load checks;
- Refurbishment of Boiler Closure wire winding Change Of Load Indicators (COLIs);
- Pressure Vessel Cooling System (PVCS) leak searching and sealing;
- NGL supervision and oversight of the pre-stressing contractor;
- Training and competency records of the pre-stressing contractor.

13. In the case of pre-stressing tendon removals, examinations and load checks, although no tendon had been removed at the time of this inspection almost all tendon lift-off checks had been completed. The Inspector reviewed lift-off load values and although there was some anomalies considered values recorded by NGL's Civil Engineering contract partner (Vinci) were within limits.

14. The Inspector sampled Vinci procedures for calibration of surveillance test equipment, multi-strand lift-off tests and tendon corrosion monitoring assessment. The Inspector considered Vinci's procedures to be of an adequate standard but highlighted inconsistencies between grease sampling procedures and requirements set out in the APEX Branch Instructions. The APEX gave a commitment to follow up on this issue.

15. The Inspector highlighted to the APEX that originally 2 COLI were to be refurbished in the outage but the station had issued EC358065 for deferral refurbishment of COLI 2PV/5. COLI are the only reliable means of gauging remaining circumferential pre-stressing in the PCPV. The APEX confirmed that he had been consulted on this matter and considered the justification reasonable given that the instruments were very reliable and operated in a benign environment.

16. The APEX stated that 3 leaks had been identified in the R2 PCPV structure with one associated with tendon DDC3. This leak had been sealed. The sources of the other leaks were still being investigated with intention to seal them during this outage. The station has subsequently confirmed that all leaks have been sealed.

17. The Inspector considered NGL's supervision and oversight arrangements of the contractor carrying out pre-stressing was adequate with pre-job briefs undertaken every morning before setting to work. Regular updates on progress between Vinci's Team Leader and NGL's System Engineer and Outage Coordinate took place with appropriate record and information being gathered from testing work.

18. The Inspector sampled training and competency assessments of Vinci personnel and considered the team as experienced and stable in that the sample individuals moved from one outage to the next.

19. The Inspector assessed the APEX R2 statement in support of the R2 return to service and preparation of the 28 day report and did not identify any issues to prevent re-start of R2. NGL issued EC 358953 given an anomaly identified with tolerances of Boiler Closure Unit

(BCU) shim gap for BCUs 2A1, 2A2, 2C2 and 2D2 (Reference 15) and NGL's Independent Nuclear Safety Assessment (INSA) certificate (Reference 16). The Inspector has reviewed this justification and considered a suitable and sufficient case has been made to support re-start given that critical components remain within allowable stresses (Reference 17).

20. The ONR Civil Engineering Inspector concluded that he considered NGL had complied with MS outage commitments and that this work had been undertaken by competent trained individuals. He has not identified any issue preventing him supporting ONR issuing its consent to allow re-start of R2.

4.2 Structural Integrity Inspection and Assessment

21. The ONR Structural Integrity Inspector conducted his Hartlepool R2 outage inspection 26-28 July 2016 (Reference 18), and produced assessment report (Reference 19) from his inspection finding. The main areas inspected were:

- Main Cooling Water System (MCWS)
- Reactor Internals
- Boilers and Boiler Closure Unit (BCU) Steelwork Inspections
- Weld Inspections and Non-Destructive Testing (NDT)
- Flow Accelerated Corrosion (FAC) Boiler Tubes and cooling water systems
- Pipe Hanger and Support Inspections
- Pressure Systems Safety Regulations (PSSR) Inspections

22. The Inspector judged that NGL was complying with the station's outage MS requirements for MCWS. This view was based on the fact that NGL MCWS System Engineer understood the linkage between inspection and maintenance activities for MCWS and how they supported the station's safety case NP/SC 7400. NGL's inspections of large diameter sea water pipes which supply heat exchangers for boilers and auxiliary cooling systems confirmed as structurally sound and free of defects and environmental fouling.

23. The most significant area of work for the cooling water system was the repairs of the concrete structure supporting drum screen 3 enclosure with rebar replacement and reinstatement of concrete structure due to ageing and environmental attack. This work was considered to have been carried out to a high standard based upon visual inspection of repair.

24. The Inspector reviewed NGL's internal reactor core inspection findings covering the base of reactor (diagrid structure and gas circulator penetrations) and reactor top (hot box dome and boiler gas vents). NGL reported no significant findings had been identified with only minor defects identified that were within the acceptance criteria. A sample of inspection findings were reviewed (video and photographic images) with the Inspector supporting NGL's view of the inspection results.

25. The Inspector confirmed the understanding of the station's Fuel Route team members who carry out internal reactor core inspections as well as their perception of how MS inspection activities support the station's safety case validation. The NGL Fuel Route Group Head explained how safety case claims and requirements set out in the Station's safety case are identified and recorded through quality plans and AMS work routines. Qualification of inspection findings are achieved through review of past inspection findings and independent verification sentenced through Outage Assessment Panel (OAP). The Inspector reviewed training records of internal reactor core inspection team and considered these to be adequate.

26. The Inspector reviewed outage MS inspection activities covering boilers and BCU steelwork, steam pipework NDT weld inspections and FAC. In the case of boilers NGL confirmed that all spines in the R2 boilers had been inspected using ultrasonic guided wave Teletest technique with no change in the spines condition recorded. BCU stud bolt testing and

chemistry assessment revealed no deterioration in bolt strength and no presence of aggressive corrosion environments were found in stud tubes. NGL confirmed that they had successfully removed 2 samples of 316 stainless steel and 9%Chromium from boiler tubes in support of Boiler Lifetime Inspection and Monitoring Programme (BLIMP). This was regarded by the ONR Inspector as a significant achievement by station and compliance with MS requirements based upon inspection observation and discussions with operators carrying out this work.

27. The Inspector reviewed NGL's contract partner Engineering Analysis Services Limited (EASL) pipe hanger and support survey and processing of it through the Outage Assessment Panel. The Inspector considered NGL had demonstrated adequate control and management of sentencing of steam pipework supports finding by their contact partner to minimise impact of stress-induced failures and impact of creep / fatigue damage.

28. The Inspector reviewed the work of the Pressure Systems Safety Regulations (PSSR) Competent Person (CP) provided by Bureau Veritas (BV) to determine its progress of assurance and certification of pressure systems vessels and pipework. The BV CP stated that no significant findings had been identified up to the date of this inspection. The Inspector reviewed documentation supporting weld repair to deaerator of DC Heater 1 given thinning that had been revealed in the vessel west side. BV CP stated that inspection findings and any repair procedures were reviewed by NGL Hartlepool OAP. The Inspector concluded that management of PSSR inspections and any subsequent repairs were being adequately controlled and managed.

29. During the Hartlepool R2 outage the station reported to the ONR Hartlepool Site Inspector that an anomaly had been identified in the Main Steam System PSSR Written Schemes of Examination (WSE). That two WSEs were available on its AMS; one issued in 2002 (Document Reference 1020-M-001 Issue 000) which the station was working to and the other issued in 2005 (Document Reference 1020-M-001 Issue 001). The 2005 WSR showed different periodicities for 11 valves when compared to the 2002 WSE. This was identified as a re-start issue by the ONR Hartlepool Site Inspector requested that NGL justify their position before R2 could be return to power. In response, NGL have carried out additional inspection on valves to the 2005 WSE and produced an Engineering Advice Note (Reference 20) justifying continued operation of Reactor 1 and why the 2002 WSE is the most appropriate WSE to be use.

30. ONR's opinion of this PSSR anomaly is that NGL has committed a technical breach of Regulation 8(2bi) - *The said user or owner shall ensure the content of the WSE is reviewed at appropriate intervals by a competent person for the purpose of determining whether it is suitable in current condition of use of the system.* An assessment against the Enforcement Management Model guidance was undertaken (Reference 21). As a result, the ONR Hartlepool Site Inspector is to write to Station highlighting ONR's concern that this breach has occurred and this will be consider though ONR's Operating Reactor Programme fleet-wide intervention on PSSR compliance.

31. The ONR Structural Integrity Inspector has reviewed NGL's justification to demonstrate continued operation of main steam system Reference 20 and considered adequate substantiation has been provided to show no danger arose from this administrative error, the steel valves remain structurally sound based upon past inspections and engineering judgment. Consequently this ONR R2 re-start issue has been closed.

32. The Inspector confirmed that he was satisfied with the operation of the NGL Hartlepool OAP and that his assessment of meeting minutes from OAP proceedings had not given any cause for concern.

33. NGL issued EC 358953 (Reference 22) and INSA certificate (Reference 23) due to concerns over super-heater S 5 weld associated with assessment of fatigue / creep life and thermal impact. The Inspector reviewed EC358953 and was satisfied that a suitable basis for returning R2 back to power had been made, the station was required to shut-down the

reactor to carry out assessment of all quadrant super-heater S5 welds, including ultrasonic examination to confirm weld integrity before the reactor can be returned back to power (Reference 24).

34. The Inspector concluded that he considered NGL had complied with MS outage commitments and that these had been delivered by competently trained individuals. He had not identified any issue to prevent him supporting ONR issuing its consent to allow the re-start of R2.

4.3 Graphite Integrity Inspection and Assessment

35. The ONR Graphite Integrity Inspector carried out his site inspection over the 5 and 6 July 2016 (Reference 25) and focused on:

- Establishing that the various safety case commitments for core inspection and trepanning were being met.
- Consideration of the quality of the examinations, both in terms of data quality and adequacy of training and understanding of those involved in the work.
- Consideration of the results; particularly whether the number and morphology of observed cracks challenges the graphite safety case.

36. From this inspection the Inspector raised 2 re-start issues:

- A need to justify that graphite weight loss will not breach operating limits during next period of operation for Reactor 2.
- Provide justification for operation of R2 given a distorted brick in layer 7 of channel D09.

37. The ONR Graphite Integrity Inspector considered safety case commitments for core inspection and trepanning requirements for the Hartlepool R2 2016 outage had been met:

- 20 fuel channels inspected using TV inspections.
- 10 fuel channels inspected for channel bore measurements.
- 36 trepanning samples taken (based on a minimum target of 30 samples across 6 fuel channels).
- TV inspection of 1 control rod channel.

38. In addition, he considered NGL's use of Prototype Eddy Current Inspection Tool (PECIT) which uses eddy currents to measure electrical resistivity at the brick bore surface, and can, in turn, be used to determine graphite brick weight loss, demonstrated NGL's continuing commitment to improve techniques to evaluate graphite core performance.

39. The ONR Graphite Integrity Inspector's assessment (Reference 26) highlighted that over 64 of the 256 fuel channels making up the Hartlepool R2 reactor had been inspected during previous outages. Of the 20 fuel channels inspected during this outage 10 had been inspected previously. NGL predicted that 4 new full height singly-cracked bricks and 5 full height doubly-cracked bricks would be identified during core inspections. As well as setting an upper damage limit of 14 new full height singly-cracked bricks and 13 full height doubly-cracked bricks which if exceeded would challenge current safety case justification.

40. NGL identified a total of 28 new bore cracks during this outage with 5 new full height singly cracked bricks and 2 new full height doubly-cracked bricks being observed. Two bricks, referenced in channel V15 layer 10 and channel D09 layer 7, were highlighted as showing high level damage by the NGL Graphite Assessment Panel (GAP). The ONR Inspector stated that he was broadly content with the GAPs categorisation of damage observed in graphite brick and he did not consider there were obvious systematic damage mechanisms in operation, justified by diametrically opposing fuel channels showing no defects.

41. In consideration of fuel channel brick ovality measurements, the graphite brick in channel D10 layer 7 was shown to have the largest ovality measurement across the AGR fleet with less than half of the nominal clearance between the fuel sleeve and fuel channel bore

available. NGL stated that the change in ovality had only increased between 2-3mm over the period 2009 and 2016 based on past inspection findings. The ONR Inspector judged that ovality had taken place over seven years and consequently fuel is unlikely to be gripped by this misalignment over the next outage period (three years).

42. In respect to the two re-start issues raised by the Inspector both were closed based on safety justification presented in NGL Category 2 EC358713 Justification for Return to Service of Hartlepool Reactor 2 Following Graphite Core Inspection 2016 Periodic Shutdown.

43. The Inspector concluded that he considered NGL had met its outage MS requirements with regard to graphite core inspections and there was no significant issue to prevent re-start of Hartlepool R2 and its safe operation until its next periodic outage.

4.4 Mechanical Engineering Inspection

44. The ONR Mechanical Engineering Inspector conducted his inspection on 5 July 2016 (Reference 27) and focused on outage maintenance of CO_2 gas Safety Relief Valves (SRVs) and R2 Main Boiler Feed Pump.

45. The Inspector confirmed safety case claims made on CO_2 gas SRVs valves as well as routine and outage maintenance activities. He was content with the scope of testing applied to these valves.

46. During the outage all three CO_2 gas SRVs were replaced with refurbished spares. At the time of the inspection the valves were being replaced so the Inspector was unable to see removed valves being refurbished. An inspection of the facility where the removed values would be refurbished (Gas Circulator Maintenance Facility) was carried out. The Inspector pointed out clear visible signs of paint flakes on working surfaces which he considered could and contributing to poor performance of valves if they became entrapped within their mechanisms. The Inspector considered the general housekeeping of the Gas Circulator Maintenance Facility (GCMF) was poor with waste material being stored in a number of areas. Station responded by stating that they had initiated an improvement project to address the build-up of waste in this facility and took immediate action to clean work surfaces and floor of GCMF. The Inspector considered NGL's actions were reasonable given this should mitigate foreign material exclusion.

47. Inspection of maintenance work in support of replacement of the Main Boiler Feed Pump drive turbine was carried out. In general, the Inspector considered work was being carried out in an orderly manner in accordance with the work instruction and procedures.

48. The Inspector followed-up Significant Adverse Condition Investigation 978110 where Gas Circulators 1A2 in Reactor 1 (R1) had to be replaced due to failure of top oil tank cooling element. This failure resulted in one of the refurbished R2 outage Gas Circulators being installed in R1 and a partially refurbished circulator having to be installed in R2. The Inspector discussed with the Gas Circulator System Engineer the cause of the failure. The System Engineer stated that the reason for the failure had not been clearly identified although there was some evidence that failure had been accelerated due to ingress of sea water into cooling water due to a heat exchanger tube failure.

49. The Inspector concluded that outage MS routes for mechanical systems in the R2 outage were being undertaken and completed to required standards and quality. He stated that he had not identified any issues to prevent the re-start of R2 and recommended that ONR issue its consent in support of R2 restart.

4.5 Electrical Engineering Inspection

50. The ONR Electrical Engineering Inspection supporting the Hartlepool R2 outage was concluded on 19 July 2016 (Reference 28). This inspection focused on:

- 415 V Switchboard Maintenance Interval (EC356216);
- Installation of new 275 kV through-wall bushings (EC349352);
- Replacement of Generator Circuit Breakers (EC344649); and

- Upgrades to Gas Analyser to Generator Transformer 2 (EC355138).

51. The Inspector reviewed EC justification for proposed work prior to visiting site. From his inspection he considered work was being controlled in an appropriate manner with NGL providing adequate control and supervision.

52. During the inspection he noted the additional measures NGL was taking given deterioration of R1 275 kV road trench cover. NGL confirmed that the trench was still adequately supported and mitigation was through steel bridging covers being fitted over trench covers. R2 275 kV road trench cover was considered to be adequate and no additional mitigation measures needed. The Inspector reported his findings to the ONR Hartlepool Site Inspector and this issue is being taken forward through routine business.

53. The Inspector concluded that electrical MS work was being conducted to the required standards and recommended that ONR issue its consent for R2 re-start.

4.6 Control and Instrumentation Inspection

54. The ONR Control and Instrumentation Inspector carried out his Hartlepool R2 outage inspection 13 and 14 July 2016 (Reference 29) focussing on:

- Chloride Ingress Protection
- Neutron Flux Detectors (NFD)
- Gas Circulator Instrumentation
- Diverse Protection System (DPS)

55. The Inspector sampled work-order cards for maintenance of sea water chloride ingress protection system, NFD and Gas Circulator Instrumentation. In all instances shortfalls were identified in calibration readings or anomalies not being addressed. The Inspector requested the NGL reactor systems C&I Group Head follow up on these finding and report to him what action would be taken. The C&I Group Head has confirmed verbally that no serious challenge to safety equipment had occurred and is taking measures to strength working practice through took box briefings and increased quality inspections. The Inspector has confirmed with the ONR Project Inspector that he is content with actions taken by NGL and will follow up this issue in speaking with the ONR Hartlepool Site Inspection in carrying out a further inspection.

56. During a plant walk down the Inspector asked an NGL contractor partner (Doosan Babcock) if the laptop he was using had been checked against the Site's computer security arrangements. The Contactor reported that he was not aware of the Site's computer security arrangements. The laptop was not connected to the Station's network and when checked was found to be clean and released back to the contractor.

57. The Inspector considered this was a challenged the station's cyber security and required that a full audit of all computers used on the Site be carried out against the station's computer security arrangements. Station undertook this, confirming that they had not identified any further computers that had not been processed through the station's computer security arrangements. Station carried out a followed up audit a week later of 25% of computers on Site and confirmed that all computers inspected had been processed through the station's computer security arrangements. The Inspector considered Station had acted responsively to this finding and considered it closed given actions taken.

58. In conclusion, the Control and Instrumentation Inspector considered outage MS requirements for Control and Instrumentation equipment were being undertaken and that he had not identified any serious issues preventing him support ONR issuing its consent for re-start of Hartlepool R2.

4.7 ONR Site Inspector's Overview of Outage Activities

59. During the Hartlepool R2 shutdown the ONR Hartlepool Site Inspector undertook several inspections (Reference 30, 31 and 32) some of which were coordinated with NGL's own internal safety authority Independent Nuclear Assurance (INA). Areas covered were:

- Control and Supervision of Contractors
- Outage Rapid Trending Review
- Fatigue Management
- Incidents on Site
- Adequacy of Site Infrastructure

60. The inspection of control and supervision of contractors was conducted with ONR's Conventional Health and Safety team. The inspection found that Station had adequate arrangements in place for evaluating individuals appointed as Field Supervisors in that they were required to demonstration appropriate skills and competencies through formal assessment.

61. The Outage rapid trending review which is an NGL led activity carried out through their INA function focused on a range of processes and activities including:

- Confirming procedural compliance of staff during outage activities
- Adequacy of risk assessment for work undertaken during outage
- Adequacy of outage arrangements covering defence in-depth plans

62. The Inspector concluded that this process had been effective in highlighting early in the outage emerging trends in safety performance which were being addressed.

63. Inspection of fatigue management and incidents on the site showed that the station had good controls in place and was able to respond to developing situations. In the case of fatigue management, specific criteria had been set which would require a formal risk assessment to be undertaken if an individual was to breach work beyond established limits. The limits set were an individual could not work more than 13 hours in a 24 hours period or 13 days continuously in a 14 day period. The risk assessment determined the impact on the individual as well as work to being carried out in allowing them to continue working.

64. In the case of incidents on the site related to outage work, these have been monitored throughout the outage and 9 related outage events recorded at the time this report was written, with no lost time accidents.

65. The Inspector also monitored the delivery of capital projects on the site in support of maintaining robust nuclear safety standards. Areas covered included Gas Turbine House improvements, where increased equipment segregation to protect against fire and flooding was being installed. Overall the Inspector was satisfied with progress, although noted that the original deadline for completing this work is running 6 to 9 months behind schedule with current handover of facility back to station identified as late 2016. The Inspector also considered Station was actively pursuing NGL's corrosion management initiative with the refurbishment of High Pressure CO_2 tanks and pipework giving findings from resent inspection. This work was initiated in part due to the Heysham 1's CO_2 storage facility pipework failure and recent ONR corrosion management Site compliance Inspection.

66. The ONR Hartlepool Site Inspector came to the view that Station had reinforced expectations and standards to be applied during the R2 outage. This view based upon outage induction training and Field Supervisors safety briefs undertaken throughout the outage. This approach flows through the station's and Contract's control and supervision organisational structures to ensure work was executed to the expected standards. Although improvements were identified, these were not considered significant and were being addressed by Station. Station is still continuing with infrastructure improvements to ensure robust safety standards are delivered. Although this work is not directly related to the outage it has been taken into

consideration when coming to a regulatory view on the overall safety of the station for re-start of R2 and safe operation until next periodic outage.

67. In conclusion, the ONR Hartlepool Site Inspector has not identified any significant issues that would impact on re-start of Hartlepool R2 or impact on its safe operation until its next periodic outage. The Site Inspector recommends ONR issue consent for re-start.

4.8 Conventional Safety Inspection

68. ONR's Conventional Health and Safety team conducted their Inspection in support of the Hartlepool R2 outage over 12-13 July 2016 (Reference 33) this focused on:

- Contractor control (including field supervisors);
- Work in confined spaces; and
- Plant isolation arrangements.

69. Inspection findings identified that NGL had established appropriate procedures for contractor control, with a system of Field Supervisors. The Field Supervisors are formally appointing by NGL to oversee work to ensure it is conducted in the correct way and to required quality standard. They are required to demonstrate the appropriate skills and competencies for the role which is achieved through formal assessment which was reviewed during the inspection and judged effective and robust.

70. In the case of confined space control, which was evaluated against HSE guidance INDG258, the Inspector considered NGL's arrangements were generally consistent and met required standards. Some minor issues were identified during this inspection, such as improving communication between the confined space coordinator and the duty Incident Response Team (IRT) Leader and involving the IRT Leader in development of recovery plans. The implementation of these observations is to be taken forward by Station and monitored by the ONR Hartlepool Site Inspector.

71. A similar view was also reached from inspection of NGL's arrangements for plant isolations which were assessed against HSE guidance, Safe Isolation of Plant and Equipment (HSG 253).

72. The Inspector concluded that this inspection was positive and NGL was complaint.

4.9 Security Inspection

73. ONR's Security Inspector covering the Hartlepool Power Station conducted an outage focused Inspector 27 July (Reference 34) focused on:

- Bag Searching
- Access Control
- Pass wearing
- Office call to Civil Nuclear Constabulary (CNC)

74. The Inspector concluded that security standards were acceptable for the outage in that no significant issues were identified from his inspection. Site was well prepared with the Site Access Vetting Office coordinating security requirements with contract partners and managed Blue Badge Scheme for access into Radiation Controlled Area. Demonstrating of suspect package arrangements showed good compliance and personnel and bag searches were being conducted to required ONR security standards.

4.10 Engagement with other Governmental Agencies

75. The Environment Agency Hartlepool Site Inspector has confirm they have no issues or objects to ONR issuing consent for re-start of R2 (Reference 35).

5 CONCLUSIONS

76. Station's letter (Reference 11) confirming that all MS requirements and modification work set out in their OID (Reference 5) has been successfully completed with exceptions identified in (Reference 11 Appendix 2). Station have produced safety justification EC 354824 for return

to service of Hartlepool Reactor 2 with respect to inspections undertaken during the 2016 Statutory Outage (Reference 36). This is considered acceptable by the ONR Hartlepool Outage Inspector given justification provided showing no impact to safety.

77. The Hartlepool Site Third Party assurance organisation, Bureau Veritas, have issued a statement (Reference 11 Appendix 5) confirming that all weld and pressure vessel inspections have been undertaken and completed to the required standard with no objections raised to allow equipment to be returned back to service.

78. NGL's own Hartlepool INA team have confirmed (Reference 11 Appendix 6) that they have not identified any issues which they consider would prevent Station requesting consent from ONR. On the issue of PSSR breach the Hartlepool INA team will monitor the recovery project initiated by the Hartlepool Engineering Manager to address identified shortfall and provide confidence that PSSR compliance can be met.

79. All 4 ONR re-start issues identified in ONR Hartlepool R2 Regulatory Station Outage Plan (Reference 12) have been satisfactorily closed out. A number of issues not categorised as re-start issue (Reference 12) still remain open and are being addressed by NGL. The closure of these issues will be managed by either the ONR Hartlepool Site Inspector or the Specialist Inspector who raised the issue.

80. Based on evidence gathered from ONR inspection findings in support of the Hartlepool R2 outage I consider NGL has complied with the station's outage MS requirements. Work has been carried out in accordance with the station's procedures by competent suitably qualified and experienced persons who have met required quality levels and been appropriately controlled and supervised.

81. In conclusion, I have not identified any issue that would prevent ONR from issuing its consent to allow the re-start of Hartlepool R2 and its safe operation until its next periodic outage.

6 RECOMMENDATIONS

82. I recommend that ONR issue Licence Instrument 561 TRIM Ref 2016/323592 for Nuclear Site Licence 59 to provide consent to the re-start of Hartlepool Reactor 2 following the 2016 Periodic Shutdown.

7 REFERENCES

1. Licence Instrument 6 for Nuclear Site Licence 59 Hartlepool issued 28 March 1996, Unique Document No HAR 70609, (ONR TRIM Ref 2016/313986).
2. ONR Contact Record ONR-CNRP-CR-15-136 (ONR TRIM Ref 2015/482726).
3. NGL Hartlepool 2016 Outage Intensions Document for R2 Outage, issued November 2015, NGL document Ref HAR/MO/R/020/226 Version 0 (ONR TRIM 2015/443878).
4. NGL Hartlepool 2016 Outage Intensions Document for R2 Outage, issued June 2016, NGL document Ref HAR/MO/R/020/226 Version 1 (ONR TRIM 2016/237663).
5. NGL Hartlepool 2016 Outage Intensions Document for R2 Outage, issued August 2016, NGL document Ref HAR/MO/R/020/226 Version 2 (ONR TRIM 2016/230939).
6. ONR Intervention Record ONR-CNRP-IR-15-174 Site Inspector Compliance Inspection LC28 Maintenance Arrangements, LC36 Organisational Capability (ONR TRIM 2016/121703).
7. ONR Intervention Record ONR-OPF-IR-16-009 Site Inspector Compliance Inspection LC10 Training and 12 Suitably Qualified and Experienced Persons (ONR TRIM 2016/189105).
8. ONR Project Assessment Report ONR-OPF-PAR-16-001 Deferral of Reactor 2 Periodic Outage to 25 July 2016 (ONR TRIM 2016/141031).
9. ONR Intervention Record ONR-OPF-CR-16-240 (ONR TRIM Ref 2016/313464)
10. NGL Hartlepool Reactor 2 2016 Statutory Outage Start-up Report (ONR TRIM Ref 2016/304854)
11. NGL letter Unique Letter Number NSL HRA 51115 R, Titled Application for Consent to Start-up Reactor 2 Under Licence Condition 30(3) dated 9 August 2016 (ONR TRIM Ref 2016/317190).
12. ONR Hartlepool R2 Regulatory Station Outage Plan 20 May 2016 (ONR TRIM 2016/183105).
13. ONR Intervention Record ONR-OPF-IR-16-061, Civil Engineering LC28 Compliance Inspection Hartlepool R2 Outage (ONR TRIM 2016/284461).
14. ONR Assessment Report ONR-OPF-AR-16-019, Assessment of Statutory Examination of R2 Pre-stressed Concrete Pressure Vessel (ONR TRIM 2016/294211).
15. NGL Safety Justification EC359035 for Continued Operation of Heysham 1 Reactor 1, Heysham 1 Reactor 2 and Hartlepool Reactor 1 As Well As The Return To Service Of Hartlepool R2 From Statutory Outage Following Observation Of Out Of Tolerance Shim Gaps Within The Boiler Closure Units (ONR TRIM 2016/321402).
16. NGL Independent Nuclear Safety Assessment certificate for EC 359035 (ONR TRIM 2016/322348).
17. ONR email from Civil Engineering Inspector confirming no issues with NGL's safety justification support EC 359035 (ONR TRIM 2016/320971).
18. ONR Intervention Record ONR-OPF-IR-16-056, Structural Integrity LC28 Compliance Inspection Hartlepool R2 2016 Outage (ONR TRIM 2016/279546).
19. ONR Assessment Report ONR-OPF-AR-16-019, Structural Integrity Assessment of Safety Justification supporting Hartlepool R2 2016 Re-start (ONR TRIM 2016/279541).
20. NGL Hartlepool written statement and Engineering Advice Note Titled justifying Postponing Maintenance Inspection of Valves subject to Main Steam System Written Scheme of Examination 2005, Document Ref E/EAN/BPFB/0166/HAR/16 (ONR TRIM Ref 2016/310373)

21. ONR EMM Form for assessment of Pressure Systems Safety Regulations Breach of Regulation 8(2bi) (ONR TRIM Ref 2016/318095)

22. NGL Safety Justification EC 358953 Return to Service of Hartlepool Reactor 2 for super-heater header S5 welds (ONR TRIM 2016/321498)

23. NGL Independent Nuclear Safety Assessment certificate for EC 359035 (ONR TRIM 2016/321996).

24. ONR email from Strutural Integrity Inspector confirming no issues with NGL's safety justification support EC 358953 (ONR TRIM 2016/322351).

25. ONR Intervention Record ONR-OPF-IR-16-070, Hartlepool R2 2016 Outage Graphite Core Integrity Inspection (ONR TRIM 2016/279030).

26. ONR Assessment Report ONR-OPF-AR-16-020, Hartlepool R2 2016 Outage Graphite Core Integrity Assessment (ONR TRIM 2016/294611).

27. ONR Intervention Record ONR-OPF-IR-16-068, Mechanical Engineering Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/275355).

28. ONR Intervention Record ONR-OPF-IR-16-084, Electrical Engineering Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/294316).

29. ONR Intervention Record ONR-OPF-IR-16-066, Control and Instrumentation Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/290220).

30. ONR Intervention Record ONR-OPF-IR-16-062, Site Inspection Compliance Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/276280).

31. ONR Intervention Record ONR-OPF-IR-16-063, Site Inspection Compliance Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/288414).

32. ONR Intervention Record ONR-OPF-IR-16-085, Site Inspection Compliance Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/294560).

33. ONR Intervention Record ONR-COP-IR-16-024, Conventional Health and Safety Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/291213).

34. ONR Intervention Record ONR-CNS-IR-16-060, Security Inspection in support of Hartlepool R2 2016 Outage (ONR TRIM 2016/298151).

35. ONR Correspondence with the Environment Agency seeking view in support of ONR issuing consent for re-start of Hartlepool Reactor R2.

36. NGL safety justification EC 354824 Return to Service of Hartlepool Reactor 2 with Respect to Inspections undertaken during the 2016 Statutory Outage (ONR TRIM 2016/320957).

37. NGL Independent Nuclear Safety Assessment certificate for EC 354824 (ONR TRIM 2016/322016).