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Heysham 1 – Reactor 2 – 2018 Statutory Outage
Assessment of the Heysham 1 Reactor 2 2018 Periodic Shutdown

Project Assessment Report ONR-HYA-PAR-18-007
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EXECUTIVE SUMMARY

Title

EdF Energy Nuclear Generation Limited (NGL) – Heysham 1 Power Station – Assessment of the Heysham 1 Reactor 2 2018 Periodic Shutdown.

Permission Requested

EdF Energy Nuclear Generation Limited (NGL) [the 'licensee'] has requested that the Office for Nuclear Regulation (ONR) grants Consent under Licence Condition (LC) 30(3) to start-up Reactor 2 following completion of the 2018 Periodic Shutdown carried out in accordance with the requirements of the Plant Maintenance Schedule made under LC 28(4). The licensee has confirmed that the required outage work has been completed and the reactor is safe to restart and operate, until the next periodic shutdown.

Background

LC 30(1): Periodic Shutdown states that for the purpose of enabling any examination, inspection, maintenance or testing of any plant or process to take place, 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: Examination, Maintenance Inspection and Testing (EMIT).

LC 30(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 started up again thereafter without the consent of ONR.

ONR issued a specification, via Licence Instrument No 10, dated 25 March 1996, that the Licensee shall not, without the Consent of ONR, start up a Reactor at Heysham 1 following a periodic shutdown for the purposes of LC 30(1).

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

ONR inspection and assessment activities during a power reactor outage are to establish that:

- requirements set out in the Station's Plant Maintenance Schedule (PMS) have been complied with;
- work has been carried out in accordance with arrangements for identified Structures, Systems and Components (SSC) to the required quality by competent persons;
- Safety issues identified during the reactor outage have been adequately addressed with suitable and sufficient justification provided to allow a regulatory judgement to be made that start-up of the Reactor is safe and will remain in this state until the next outage.

ONR has assessed NGL documentation produced from the outage and EMIT of SSC important to nuclear safety. Site inspections were conducted to confirm work was carried out by competent individuals and to required quality standards.

Matters arising from ONR's work

No issues were identified by NGL to prevent the return to service of Heysham 1 Reactor 2 and safe operations until the next outage. A number of intervention findings were made by ONR specialist inspectors during the outage that have been recorded within respective inspection records and reported to NGL. None of these findings identify matters that need to be

addressed before Consent to start-up Reactor 2 and will be followed up by ONR through routine business.

Conclusions

ONR's assessment and inspection of the Heysham 1 Reactor 2 periodic shutdown confirms that NGL has carried out EMIT in accordance with the requirements of its Plant Maintenance Schedule. Work has been conducted to the required quality standards and by competent personnel. No issues of such significance have been identified by NGL or ONR that would prevent the start-up of Heysham 1 Reactor 2 following its 2018 periodic shutdown and pending safe operation to continue operating up to the next planned shutdown in 2021.

Recommendation

The ONR Outage Project Inspector recommends that Licence Instrument 616 is issued to grant ONR's Consent to start-up Heysham 1 Reactor 2, following its 2018 periodic shutdown.

LIST OF ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
CNS	Civil Nuclear Security (ONR)
HOW2	(Office for Nuclear Regulation) Business Management System
HSE	Health and Safety Executive
ONR	Office for Nuclear Regulation
RGP	Relevant Good Practice
SAP	Safety Assessment Principle(s)
SFAIRP	So Far As Is Reasonably Practicable
SSC	Structure, System and Component
TAG	Technical Assessment Guide (ONR)

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1 PERMISSION REQUESTED

1. This Office for Nuclear Regulation (ONR) Project Assessment Report (PAR) has been produced to support ONR's decision for issuing a Licence Instrument (LI) granting Consent to start-up EdF Energy Nuclear Generation Limited (NGL) Heysham 1 Reactor 2 (R2) following periodic shutdown as required under Nuclear Site Licence Condition (LC) 30(3): Periodic Shutdown.

2 BACKGROUND

2. NGL has requested ONR's Consent to start-up Heysham 1 R2 (Reference 1) as required under Nuclear Site Licence Condition (LC) 30(3): Periodic Shutdown.
3. LC 30(1): Periodic Shutdown states that for the purpose of enabling any examination, inspection, maintenance or testing of any plant or process to take place, the licensee shall when necessary ensure that any such plant or process be shut down in accordance with the requirements of the Plant Maintenance Schedule (PMS) as referred to in LC 28: Examination, Inspection Maintenance and Testing (EMIT).
4. LC 28(1) requires the Licensee to make adequate arrangements for the regular and systematic examination, inspection, maintenance and testing of all plant that may affect safety. LC 28(4) states that these arrangements shall provide for the preparation of a PMS. The PMS draws together requirements from a range of sources, including the facility's Safety Case, regulatory requirements such as Pressure Systems Safety Regulations (PSSR 2000), Lifting Operations and Lifting Equipment Regulations (LOLER 1998) and equipment manufactures guidance etc.
5. LC30(3) states that the licensee shall, if so specified by ONR, ensure that when a plant or process is shut down in pursuance LC 30 (1) it should not be started up again thereafter without the consent of ONR. ONR specified under LC 30(3) through LI No 10, dated 25 March 1996, Unique Document No HYA 70566N (Reference 2) for Nuclear Site Licence 60, that NGL shall seek ONR's Consent to start up a reactor at the Heysham 1 Power Station following a shutdown of the reactor for the purposes of Licence Condition 30(1).
6. Heysham 1 Nuclear Power Station is an Advanced Gas-cooled Reactor (AGR) comprising of 2 reactors, identified as Reactor 1 (R1) and Reactor 2 (R2). The current shutdown period for R1 and R2 is 3 years based upon safety justification set out in the Station's Safety Case and PMS requirements.
7. NGL's preparation for Heysham 1 R2 outage started in late 2017, with formal engagement with ONR in January 2018 through the Outage Intentions meeting (Reference 3). At this meeting NGL set out its intended scope of work through its R2 Outage Intentions Document (Reference 4). This set out PMS requirements as well as identifying other work to be carried out in support of safety. The document also identified Heysham 1's approach for managing safety and quality during the outage which was to be delivered by processes set out in corporate and station arrangements (References 5, 6, 7 and 8).
8. The Heysham 1 R2 outage commenced on 18 June 2018. At the Outage Start-up meeting on 26 July 2018 (Reference 9) NGL presented findings from the R2 Outage (Reference 10). NGL did not identify any issues that would prevent start-up of R2 and no significant incidents occurred during the outage period. A number of conventional safety events did occur during the outage which NGL recorded and investigated to identify learning and prevent further occurrences. A number of minor regulatory matters identified during ONR's outage assessment and inspection activities are discussed in the ONR Matters Arising section of this report.

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

9. The purpose for ONR inspection and assessment activities during a power reactor outage is to establish that:
- requirements set out in the Station's PMS have been complied with;
 - work has been carried out in accordance with arrangements for identified SSC and conducted to required quality by competent persons, and;
 - any safety issues identified during the reactor outage have been adequately addressed with suitable and sufficient justification provided to allow a regulatory judgement to be made that start-up of the Reactor is safe and will remain in this state until the next outage.
10. ONR's mission is to provide efficient and effective regulation of the nuclear industry, holding it to account on behalf of the public. To this aim, the primary focus in carrying out assessment and inspection activities during the Heysham 1 R2 outage was to confirm nuclear safety requirements have been suitably addressed. Prior to the commencement of the periodic shutdown ONR reviewed the outage intentions document (Reference 4) together with operational experience gained from other ONR outage assessments and NGL's own event recording system. This informed the production of Outage Inspection Programmes (Reference 11) for the various specialist discipline inspections and assessments carried out during the Heysham 1 R2 outage:
- Civil Engineering
 - Structural Integrity
 - Graphite Reactor Core
 - Mechanical Engineering
 - Electrical Engineering
 - Control and Instrumentation
 - Regulatory Reform (Fire Safety) Order 2005
 - Conventional Health and Safety
 - Security
11. Inspections and assessments were undertaken in line with ONR internal guidance set out in ONR Technical Inspection and Assessment Guidance.
12. ONR compliance inspections against Conventional Safety (Reference 27), Regulatory Reform (Fire Safety) Order 2005 (Reference 26) and security requirements were also undertaken during the outage to support R2 Start-up.
13. The ONR Site Inspector took on an overview role during the outage including maintaining oversight of the work undertaken by ONR specialist inspectors etc. monitoring events; and providing regulatory input as necessary.

4 MATTERS ARISING FROM ONR'S WORK

14. The following section provides a summary of the ONR Specialist Inspectors' inspection and assessment findings for each of the technical discipline areas evaluated during the Heysham 1 R2 outage. These provide the information and evidence to build ONR's considerations and judgment to consent start-up of Heysham 1 R2 and operation for a further 3 years, until its next statutory outage planned for 2021.

4.1 CIVIL ENGINEERING INTERVENTION AND ASSESSMENT

15. The ONR inspector's opinion and judgement from the site intervention and assessment of the appointed examiner (APEX) pre-stressed concrete reactor pressure vessel

(PCPV) report are recorded in Reference's 12 and 13. The following areas were sampled during the Inspectors interventions;

- Pre-stressed concrete pressure vessel Appointed Examiner's inspections and examinations;
 - Pre-stressing tendon load checks and tendon strand examinations;
 - NGL supervision and oversight of the pre-stressing contractor;
 - Training, competency and quality records of the pre-stressing contractor.
16. The ONR inspector followed up on progress of recommendations made in the APEX Statutory Examination Report following the 2015 R2 periodic shutdown and also discussed those APEX recommendations relevant from the 2017 R1 periodic shut down. The APEX considered that only two recommendations were ongoing and were being addressed during the 2018 statutory outage.
 17. The ONR inspector did not find any significant shortfalls in the surveillances and inspections reported by the APEX, or identify any concerns regarding the integrity of the pre-stressed concrete pressure vessel for Reactor 2. The Inspector considered that the quality and detail in the PCPV report was adequate, clarification was provided to a number of issues and the Appointed Examiner addressed them promptly and appropriately.
 18. The ONR inspector confirmed that documentation for pressure vessel cooling water (PVCW) and CO₂ leakage at tendon locations have been produced and is available when tendon locations are being used to support safety cases. The NGL Civil Branch Instruction for tendon nomination for lift-off testing was confirmed to have been updated; updates include enhanced guidance when selecting tendons for lift-off tests.
 19. The ONR inspector confirmed that the APEX explained that no tendons inspected were identified as being "poor" or "very poor" with a number of tendons showing moderate grease condition. Four areas which were initially identified to inspect by the APEX were not inspected due to restricted access, five alternative areas were identified. The APEX has reviewed the risk of deferring the inspections of the nominated areas and concluded the risk to be low. During the inspections no defects were found likely to affect the structural performance of the anchorages, and the ONR Inspector was content that they will fulfil their safety function for the next 3 years of operation.
 20. The ONR inspector sampled the traceability of information relating to APEX reports on NGL's Asset Management System and was content that the inspection records could be located. An additional sample was undertaken on the APEX assessment of probe inspection for "Tendon DDB4" which had a history of wetting; the APEX explained how he used his judgement, based on guidance and in branch instructions to assess the grease condition. The Inspector was satisfied that the anchorage probe inspections were being carried out in accordance with adequate arrangements.
 21. The ONR inspector asked NGL how it satisfied itself that Workplace Solutions contractor were competent to undertake civil inspections associated with the Heysham R2 periodic shut down. NGL presented the inspector with a sample of training and competency records for a range of engineers and found these records provided assurance that the individuals were trained and competent to carry out a range of technical tasks. Reports are also sample checked by the SCE, and the APEX carries out additional sampling both desk top and physical checks at the work face. Based on the explanations given the ONR Inspector was satisfied that NGL is carrying out sufficient oversight on the contractor conducting the inspections.

22. In conclusion, the ONR's civil engineering inspector supports the return to service of the Reactor 2 pre-stressed concrete pressure vessel for the next operating period of three years.

4.2 STRUCTURAL INTEGRITY INTERVENTION AND ASSESSMENT

23. The ONR inspector's view and judgement from the site intervention and assessment are recorded in Reference's 16 and 17. The following areas were sampled during the Inspectors interventions;
- steam and feed system inspections
 - main cooling water system (CWS) inspections
 - reactor internal remote visual inspections (steel components)
 - pipe hanger and support inspections
 - flow accelerated corrosion inspections
24. The ONR inspector met the PSSR Competent Person (CP) from Bureau Veritas (BV) who reported an improvement of the co-ordination of inspection activities for this outage. The Inspector was content with the Licensees approach in managing inspection work and sentencing findings, this was based on sampling the inspection of Direct Contact Heaters 1, 2 and 3, the low pressure drain vessels and the sentencing of additional inspection work identified. The CP informed the ONR Inspector of a condition report raised for a potential breach of PSSR on the inspection of the gas circulator liner welds. The Licensee is investigating the matter and an ONR level 4 regulatory issue (6520) has been raised to track progress. The ONR Inspector has not noted any further significant findings from the Outage Assessment Panel (OAP) minutes with regards to PSSR compliance.
25. The ONR inspector sampled documentation relating to the repair of valve 4/CW/51 which had suffered coating damage; the reports identified repair techniques which had been authorised by the Systems Engineer, the ONR Inspector observed part of the task and was satisfied that due process was being followed. The inspector identified other areas of work which were ongoing associated with the Cooling Water System including;
- full overhaul on cooling water pump three
 - partial overhaul on cooling water pump four
 - maintenance on the drum-screen bearings and drive
 - modifications to resolve long standing issues associated with corrosion on impulse lines near pump (4/CW/51)
26. The inspector identified no areas of concern during this visit to the CWS and was satisfied with the on-going programme of work.
27. NGL reported an issue to the ONR inspector during the outage associated with the inspection of the lower radial keys, which form part of the core restraint structure. The inspection was performed but did not achieve the right quality images and was therefore discounted by NGL. NGL provided a justification to ONR as to why the component remains fit for service for a further 12 years. The ONR inspector reviewed the justification and is satisfied by the arguments and evidence provided. The footage supports the view that gross failure has not occurred and the likelihood of failure is low and the consequences of single random failure are tolerable.
28. The ONR inspector selected pipe hanger CS4/L for sampling, as this was the only hanger on the list that had been recorded as failed. Evidence was provided to show that the opportunity to replace this hanger had been taken during the refuelling outage in December 2017. The inspector enquired about some bent hanger rods in the boiler

pod (2D1), these were subsequently walked down by the hanger co-ordinator and pipe hanger inspection SQEP. The spring units have been confirmed as undamaged and operating correctly; however the hanger co-ordinator has recommended replacement at the next available opportunity. Overall the ONR inspector was satisfied that the hanger and support surveys requirements set out in the station's PMS have been complied with, and early opportunities for defect rectification are being utilised.

29. The ONR visit was conducted when the flow assisted corrosion (FAC) programme was nearing completion. At the time of the inspection, two components (X16 and X28) had been amended by the OAP for the removal of a thickness check, based on a remote visual inspection that has shown no prevalent FAC. The ONR inspector reviewed the assessment report for these two components which judge FAC to be of a minor nature or not evident. The inspector was satisfied that in both cases, NGL have made a reasonable decision for not carrying out the ultrasonic inspection. The ONR inspector judged that the FAC programme of work is being adequately managed and controlled by NGL during this reactor shutdown.
30. The OAP meeting was observed by the ONR Inspector and found to be efficiently run with sufficient challenge where necessary. The defects were categorised and were discussed in appropriate detail and the inspector judged that the decisions made were reasonable.
31. In conclusion, based upon the items sampled, and the evidence presented, the ONR structural engineering inspector judged that the licensee has undertaken sufficient inspection and assessment to support the safe return to service of Heysham 1 Reactor 2 from a structural integrity perspective.

4.3 GRAPHITE INTEGRITY ASSESSMENT

32. The ONR inspector's views and judgement from the assessment of NGL's Heysham 1, Reactor 2 graphite return to service safety case are recorded in Reference 25 which covers the following areas:
 - Review of EC363869 specific to graphite summarising the graphite inspection results
 - Evaluation of graphite fuel channel inspection results and safety case compliance
33. The ONR inspector assessed the engineering change (EC) document (Reference 30) and compared the findings with the current graphite safety case. Overall, the EC document makes the single claim that the results of the graphite core inspections at Heysham 1 Reactor 2 2018 periodic shutdown are acceptable and do not challenge safe operation. The inspector judged that this is a claim that has been adequately demonstrated. The inspector also noted that the independent nuclear safety assessment (INSA) is also in agreement (Reference 31).
34. The ONR inspector confirmed the licensee has carried out a scope of inspection and trepanning that satisfies its safety case commitments and demonstrates that the extent of bore cracking is consistent with expectations. Thirty-six specimens have been trepanned from the core during this outage; this exceeds the minimum safety requirement by six specimens. The trepanned specimens will be analysed in due course and will provide further data informing the current graphite weight loss predictions. Sixteen fuel channels were visually inspected and the bore measurements from fifteen fuel channels were taken during the outage. A control rod channel was also visually inspected and did not reveal any defects at the bore. The ONR inspector is content that the inspections of the fuel channel and control rod channel bores are well within the safety case requirements, and support the claim that the core condition does not challenge safe operation.

35. The inspector considered that the 12% active core weight loss limit is unlikely to be reached until 2020 at the earliest. The licensee recently submitted a safety case to ONR to seek agreement to increase this limit to 17%. At the time of the ONR inspectors assessment, this safety case is still being reviewed by ONR and does not pose a start-up issue given current weight loss life although this will need to be in place for the next Reactor 2 periodic shutdown planned for 2021.
36. In conclusion, the ONR graphite integrity inspector is currently content that operation until 2020 will be within the existing graphite safety case limits and has no objection to this PAR recommending that consent is given to the return to service of Heysham 1 reactor 2.

4.4 MECHANICAL ENGINEERING INTERVENTION

37. The ONR mechanical engineering inspector carried out a pre-outage compliance inspection against LC 28 on 2nd May 2018 (Reference 18). The purpose of this inspection was to provide regulatory confidence in the implementation of Mechanical engineering aspects relating to the overhaul of gas circulators, this is in readiness for their exchange during the periodic shutdown.
38. The ONR mechanical engineering inspector carried out his LC 28 compliance inspection on 4th July 2018 (Reference 19). The following areas were sampled during the inspection:
- Main and Pilot Reactor Pressure Vessel Safety Relief Valves
 - Hot Gas Release System Dampers and Louvres
 - Main Condenser Pump and Turbine Extraction Pump
 - Standard of Nuclear Significant Maintenance Facilities
39. A number of written instructions used by NGL's operators were sampled and a plant walk down was conducted where the Inspector observed a number of items which had been subjected, or were planned to be maintained. The Inspector took the opportunity to question staff on their understanding of the written arrangements, and their understanding of how these maintenance activities related to the safety case.
40. The ONR inspector examined evidence during his inspection, performed a plant walk down and had discussions with System Engineers. The inspector judged that there are adequate arrangements in place for examination, inspection, maintenance and testing, and these arrangements are being implemented appropriately to meet relevant good practice.
41. In conclusion, the ONR mechanical engineering inspector reported that there were no issues identified from the mechanical work activities which would prevent ONR granting Consent for Heysham 1, Reactor 2 to return to service.

4.5 ELECTRICAL ENGINEERING INTERVENTION

42. The ONR electrical engineering inspector carried out a pre-outage compliance inspection (Reference 20) in May 2018, to take the opportunity to enhance ONR's understanding of the electrical engineering activities that would be undertaken during the periodic shutdown.
43. The ONR electrical engineering inspector conducted an LC 28 compliance inspection on 3rd July 2018 (Reference 21) targeting the planned electrical EIMT activities from the station's outage intentions document, the implementation of the detailed modifications and any reactive electrical work including;
- 11kV short break air-circuit breakers (ACB), Switchboards and Protection Relays.

- Electrical engineering outage modifications (Reference 22).
 - Deferral of non-safety significant routine maintenance items/plant/equipment (Reference 23).
44. The ONR inspector also conducted a plant walk-down of a sample of the station's electrical system and concluded that no matters of significant safety concerns were observed. The electrical systems walked down included;
- Reactor 2 400kV Pylons
 - Reactor 2 Generator Transformer
 - Reactor 2 Unit Transformer & Station Transformer
 - 11kV Unit Switch room
 - 3.3kV Unit Auxiliary Switch room
 - No Break Supplies Switch room
45. Based on the inspection findings the ONR inspector considered that the targeted inspection confirmed that the planned EIMT and modification activities during this outage were appropriate and that electrical plant and equipment was being maintained in accordance with the established arrangements.
46. Following the ONR electrical inspectors intervention, NGL reported that the current availability of electrical plant and equipment has constrained the maintenance timescale available to maintain an electrical distribution switchboard (Unit Board 2B). The timescale is such that there would be insufficient time available to maintain Unit Board 2B. Therefore a decision has been undertaken to postpone the maintenance of Unit Board 2B until the refuel outage scheduled for June 2019.
47. The decision to postpone the maintenance of Unit Board 2B has impacted on the ability to commence the cable replacement works associated with Unit Auxiliary Board Transformer 2B (reference 38) which will now also be postponed until the refuel outage scheduled for June 2019.
48. ONR's electrical inspector has reviewed the intentions reported by NGL (Reference 39) and is satisfied by the arguments and evidence provided.
49. In conclusion, the ONR electrical engineering inspector reported that there were no issues identified from the electrical work activities which would prevent ONR granting consent for Heysham 1, Reactor 2 to return to service.

4.6 CONTROL AND INSTRUMENTATION INTERVENTION

50. The ONR control and instrumentation inspector carried out an LC 28 compliance inspection (Reference 24) focussing on maintenance of the following systems;
- Data Processing System, including;
 - Function Test of Freeze Detection Logic
 - Function Test of Manual Operation of Auto Rods
 - Reactor Safety Systems – Primary Shutdown System
 - Inlet Guide Vane Position Monitoring
 - Laddic Waveform Checks
 - Safety Equipment Thermocouples
 - Reactor Safety Systems - Secondary Shutdown System
 - Reactor Post Trip System
51. The ONR inspector confirmed that the plant maintenance schedule was being complied with for the systems sampled. A number of work order (WO) cards were sampled; system test result data was also reviewed. Overall the Inspector considered that good standards of record keeping of test data were in place for the systems

sampled, however at the time of the inspection some of the WO cards had not been started, so a sample of WO cards from the last outage was undertaken and found to be complete in accordance with the stations arrangements.

52. The ONR Inspector conducted a plant walk down and visited the following areas;
- Reactor 2 Safety Circuit Room
 - Reactor 1 and 2 Data Processing System (DPS) Room
 - Gaseous Activity Monitor (GAM) cubicle (pile cap)
 - Make Up Water Treatment Plant (MUWTP) Control Room
53. During the plant walk-down there appeared to be satisfactory housekeeping in Reactor 2 safety circuit room and Reactor 1 and 2 DPS Room. However in the GAM cubicles at the pile cap, foreign material was found on the floor of the unit 1 panel; NGL committed to address the removal of foreign material in electrical cubicle.
54. NGL provided a demonstration to the ONR Inspector of their arrangements for the control of removable media for the data processing systems (DPS), including the control of keys to a library of disks in the DPS room. The Inspector found these arrangements to be adequate.
55. In general the ONR inspector judged the stations approach to maintenance of the protection and electrical systems to be adequate. A number of minor actions were raised during the inspection relating to defect repair and engineering change (EC) replacement dates including implementation timescales, stations “arrangements” review dates and test equipment suitability. These actions will be tracked through ONR level 4 regulatory issue 6504.
56. In conclusion, the ONR C&I inspector reported that there were no issues identified from the C&I work activities which would prevent ONR granting consent for Heysham 1, Reactor 2 to return to service.

4.7 FIRE SAFETY INTERVENTION

57. The ONR fire safety inspector carried out a pre-outage compliance inspection against Regulatory Reform (Fire Safety) Order 2005 on 22nd March 2018 (Reference 26).
58. The ONR inspector reported no shortfalls in regulatory compliance during the inspection that required further actions, with the response of the site management team positive throughout. The fire safety arrangements were found to comply with legal requirements and the inspector was of the opinion that the required standard was met.

4.8 CONVENTIONAL SAFETY INTERVENTION

59. The ONR conventional health and safety inspector conducted a compliance inspection (Reference 27) against the Health & Safety at Work etc Act 1974 from 3rd – 5th July 2018 focusing on;
- Management of conventional health and safety hazards present during the Heysham 1 R2 outage, including workplace transport issues.
 - Compliance with Danger Substances and Explosive Atmosphere Regulations (DSEAR) 2002.
 - Management of legionella risks.
60. A walk-down of a number of work areas was undertaken to sample outage activities and inspect the management arrangements in place, focussing on the plant/hazards identified above. The areas walked down included;

- Turbine Hall Basement
 - Cooling Water Pump house
 - Cooling Water Towers 1 and 2
 - Battery Room and Hydrogen Storage Compound
61. A number of areas for improvement were highlighted during the inspection relating to the adequacy of DSEAR risk assessments on site. NGL informed the ONR inspector that this issue has already been acknowledged and resolution is being coordinated at a fleet wide level. To ensure this work is made a priority, and to clarify the regulatory requirements, ONR intend to write a letter to NGL outlining the shortfalls in DSEAR compliance; an ONR regulatory issue (6515) has also been raised to tracked progress. The inspector reported that the shortfalls found in relation to DSEAR compliance should not prevent ONR giving consent to start-up the Reactor following periodic shutdown.
62. Examples of good standards were also observed during the visit, specifically around the morning safety briefing which was well attended and important safety messages were exchanged and issues from the previous shifts were discussed and addressed. The briefings were good quality with EDF NGL and contract partners being well engaged in the process.
63. In conclusion, although some areas for improvement were identified, the ONR conventional health and safety inspector reported that there were no issues identified from his inspection which would prevent ONR granting consent for Heysham 1, Reactor 2 to return to service.

4.9 SECURITY

64. Security requirements during and for start-up were reviewed by the ONR security inspector and who confirmed that there are no security issues which would prevent ONR granting consent for Reactor 2 to return to service following its statutory outage (Reference 28).

4.10 ONR SITE INSPECTOR'S OVERVIEW OF OUTAGE ACTIVITIES

65. During the first week of the periodic shut down the ONR site inspector attended a number of meetings including the plan of the day and quality management meetings. There was clear focus on the periodic shut down key safety focus areas of Time Out for Personal Safety (TOPS), Human Performance (HuP), Foreign Material Exclusion (FME) and Quality. The key outage and discovery milestones were reviewed for the next 48 hours and discussions were held around the presence of failed fuel being at the lower end of predictions. The ONR site inspector considered the meetings were well attended and focused on key activities being undertaken during the outage.
66. The ONR Site Inspector held discussions with the Quality Management Group Head who provided an outline of the QM programme/ plan for the outage. Areas of particular interest this outage include general housekeeping, FME, contractor SQEP (training files), work order cards, in-core inspection, supply chain (deep dive on valves/ actuators overhaul process at the original equipment manufacturer OEM). The FME plan for the turbine island had been signed off by the (corporate) turbine group. Quality leads had been embedded into each of the outage islands to identify and manage the quality inspections.
67. A number of plant walk downs were conducted by the ONR inspector during the periodic shutdown along with area safety coordinators, safety representatives and outage management. The ONR inspector observed discussions on recent condition reports associated with the expectations for wearing hand protection. Housekeeping

TOPS, FME and HuP themes were also discussed and the practical application of these tools was sampled by the ONR inspector. The Site Inspector observed good use of the tools and housekeeping/ work area planning was considered to be good.

68. The ONR site and Outage project inspectors participated in the Heysham 1 R2 rapid trending review (RTR) which focussed on identifying performance shortfalls in the early stages of the shutdown. This enables the station's management to reduce or eliminate undesirable behaviours and conditions that could have an adverse impact on shutdown performance. Two areas for improvement (AFI) and one opportunity for improvement (OFI) were identified by NGL during the RTR. The outage management team accepted the findings and committed to making further improvements during the remainder of the outage;

- AFI 1 – Quality Assurance and Control Arrangements Not Consistently Followed
- AFI 2 - Lack of Auditable Control of Turbine Work Procedures
- OFI 1 – FME behaviours can be further improved

69. The ONR site and Outage project inspectors undertook an unannounced LC 26 compliance inspection where a number of planning and setting to work meetings were observed. The four shutdown safety focus themes were discussed (TOPS, HuP, FME and Quality) at all meetings attended and discussion points were relevant to the level of meetings attended. The meetings were all well attended and nuclear safety was appropriately considered.

70. The ONR inspectors sampled a planned, 3 yearly maintenance activity and judged that the appropriate level of control and supervision was implemented commensurate with the safety significance of the task. Observations of control and supervision activities at the workplace, and the setting to work activity were conducted in accordance with RGP and involved the appropriate disciplines. The maintenance task was well executed and no significant shortfalls were identified.

71. A sample of the maintenance teams training records were provided by the Heysham 1 training department, a sample of authorisation/ nomination forms were provided as evidence and confirmed that the maintenance team leader was SQEP to supervise his team and his training was in date. Over all the ONR inspectors were content that people were adequately SQEP and authorisation to control activities that may affect safety.

72. The observations made by both ONR's site and Outage project inspector are recorded in references 34 and 35. Neither inspector identified any issues impacting on the safe return of R2 back to power nor its safe operation until its next periodic shutdown planned in 2021.

4.11 ENGAGEMENT WITH OTHER GOVERNMENTAL AGENCIES

73. ONR has engaged with the Environment Agency who has confirmed (Reference 29) that they are not aware of any environmental issues that should prevent the start-up of Heysham 1 R2 following the 2018 statutory outage.

5 CONCLUSIONS

74. NGL's request to ONR for consent to start-up Heysham 1 R2 following periodic shutdown in compliance with LC 30(1) has been supported by their letter (Reference 1) stating that all plant maintenance schedule requirements and modifications identified in the R2 outage intentions document (Reference 4) have been met. This excludes testing of equipment which can only take place when the reactor becomes pressurised and steam-raising commences. Based upon ONR's intervention evidence I am of the

opinion that the station has complied with their plant maintenance schedule requirements.

75. NGL has submitted the Heysham 1 R2 APEX report reference 14 following completion of civil inspection and maintenance of PCPV. This confirms that there are no safety issues in returning the vessel back to service. This report was reviewed by the ONR civil engineering inspector and found to be accurate and balanced based on site intervention findings and assessment of claims and arguments set out in the APEX report. The ONR inspector supports NGL's conclusion that the PCPV is safe to return to service and will remain in this condition until its next periodic shutdown. The ONR inspector supports ONR issuing consent for R2 start-up.
76. NGL's return to service safety justification for R2, set out in EC363869 and EC363345 covering graphite and steel components respectively (Reference 30 and 32) confirmed no safety issues have been identified from EMIT activity to challenge safety case claims preventing R2 start-up or its safe operation until its next periodic shutdown planned in 2021. NGL supporting this claim with statements from their independent third party PSSR Competent Person, Bureau Veritas, who confirmed that there were no compliance issues from inspections carried out in accordance with PSSR written schemes of examination. NGL's findings from thorough examination of PCPV penetrations were found to be satisfactory. These documents have been reviewed by ONR Inspectors supporting the R2 shutdown, who agreed that claims and arguments presented are in line with their views from intervention findings and assessment. The ONR Inspectors support ONR issuing consent for R2 start-up.
77. Heysham 1 Independent Nuclear Assurance (INA) has provided a statement (Reference 36) that based on their R2 shutdown concurrence activities to date no issues have been identified that would challenge their support for start-up of R2.
78. Based on evidence gathered from ONR's intervention and assessment activities for the Heysham 1 R2 shutdown together with claims, arguments and evidence presented by NGL in its request for start-up of R2, it is my judgement that Heysham 1 power station has complied with its LC30(1) requirements for R2 in carrying out required EMIT work in accordance with the station's Plant Maintenance Schedule. The work was carried out in accordance with the station's procedures by competent SQEP personnel working to identified quality arrangements and appropriately supervised. Where EMIT findings were anomalous with safety case requirements, NGL has provided adequate safety justification that relevant safety case limits and conditions are not challenged.
79. In conclusion, ONR has identified no matters of concern that would prevent ONR granting consent for Heysham 1 Reactor 2 to start-up following its periodic shutdown and pending continued safe operation to continue operating up to the next planned shutdown in 2021.

6 RECOMMENDATIONS

80. I recommend that, in response to the request by NGL, ONR issue Licence Instrument 616 granting consent under LC30(3) of Nuclear Site Licence 60 to start-up Heysham 1 Reactor 2 following the 2018 Periodic Shutdown.

7 REFERENCES

1. NGL Letter NSL/HYA/50841 (Y) – Request for Consent to Start up Reactor 2 Following its Periodic Shutdown under Site Licence Condition 30 (2018/261947).
2. Licence Instrument 10 for Nuclear Site Licence 60 Heysham issued 25 March 1996, Unique Document No HYA 70566N, (2015/292878).
3. ONR Intervention Record ONR-OFD-IR-17-200, Issued 7 February (2018/26046).
4. Outage Intensions Document R2 Outage Statutory Outage 24, NGL document Ref HYA/M/Methods/170/Rev 0 (2017/446582).
5. HYA/T/NS/144 – Independent Shutdown Safety Review of the outage R2 2018 station outage
6. BEG/SPEC/OPS/007 REV 7 Outage Safety Arrangements.
7. BEG/SPEC/OPS/008 REV 9 Model Quality Assurance Arrangements.
8. BEG/ICP/OPS/009 REV 10 Outage Management Process.
9. ONR Intervention Record Heysham 1 R2 start-up meeting ONR-OFD-CR-18-303 (2018/241008).
10. NGL ONR Start up Meeting presentation (2018/242209).
11. ONR Heysham 1 R2 2018 outage technical discipline inspection plans Structural Integrity (2018/234469), Civil Engineering (2018/238063), Mechanical Engineering (2018/212361), Electrical Engineering TRIM (2018/238050), Control and Instrumentation (2018/232536), Conventional Health and Safety (2018/185105).
12. ONR Civil Engineering Intervention Record ONR-OFD-IR-18-068 (2018/235536).
13. ONR Civil Engineering Assessment Report ONR-OFD-AR-18-023 (2018/242826).
14. Heysham 1 - Statutory Examination of the Pre-stressed Concrete Pressure Vessel of Reactor 2 – 2018, E/REP/BNCB/0584/HYA/18, Revision 000, EDF Energy, July 2018, (2018/240773).
15. Heysham 1 R2 2018 APEX report E/REP/BNCB/0584/HYA/18 Revision 000 (2018/240773)
16. ONR Structural Integrity Intervention Record ONR-OFD-IR-18-081 (2018/234347).
17. ONR Structural Integrity Assessment Report ONR-OFD-AR-18- 025 (2018/238439).
18. ONR Mechanical Engineering Pre-outage Intervention Record ONR- OFD-IR-18-021 (2018/153861).
19. ONR Mechanical Engineering Intervention Record ONR- OFD-IR-18-082 (2018/234935).
20. ONR Electrical Engineering Pre-outage Inspection ONR-OFD-CR-18-107 (2018/187052).
21. ONR Electrical Engineering Intervention Record ONR-OFD-IR-18-073 (2018/226544).
22. Electrical engineering outage modifications (2018/219400).

23. Deferral of non-safety significant routine maintenance items/plant/equipment (2018/220272).
24. ONR Control and Instrumentation Intervention Record ONR-OFD-IR-18-071 (2018/243631).
25. ONR Graphite Assessment Report ONR- OFD-HYA-AR-18- 027 (2018/250001).
26. ONR Fire Safety Inspection Intervention Record ONR-COP-IR-17-256 (2018/113903).
27. ONR Conventional Health and Safety ONR-OFD-IR-18-078 (2018/236836).
28. Email from ONR Security Inspector (2018/242490).
29. Email from Environment Agency - Statement to Support the Return to Service of Reactor 2 at Heysham 1 following its Statutory Outage. (2018/227190).
30. NGL Heysham 1 2018 Return to Service Safety Justification for R2 from review of graphite core inspections EC363869 (2018/259075)
31. NGL Independent Nuclear Safety Assessment approval statement Graphite integrity (TRIM 2018/261202)
32. NGL HEYSHAM 1 2018 Return to Service Safety Justification for R2 from review of reactor core steel components EC363345 (2018/262725)
33. Heysham 1 INA statement Structural Integrity Steel (2018/262678)
34. ONR-OFD-IR-18-077, Rapid Trending Review/LC26 Compliance Inspection (2018/214688)
35. ONR-OFD-CR-18-221, Heysham 1 (R2) Periodic Shut Down 024 Intervention (2018/209169)
36. NGL independent Nuclear Safety Assessment in support of start up of reactor 2 following 2018 periodic shut down (2018/257373)
37. Conventional Health and safety e-mail- Statement to support the return to service of Reactor 2 at Heysham 1 following its Statutory Outage. (2018/253685).
38. NGL Justification for current status of UATx2B supply cables EC362463 (2018/261111).
39. ONR Electrical Inspectors e-mail clarifying he is content with arguments and evidence provided to defer Aux board 2B maintenance. (2018/261152 & 2018/261111).