



PROJECT ASSESSMENT REPORT			
Unique Document ID and Revision No:	ONR-HPB-PAR-14-033 Revision 0	TRIM Ref:	2015/122955
Project:	Reactor 4 Periodic Shutdown 2015		
Site:	Hinkley Point B		
Title:	EDF Energy Generation Limited Hinkley Point B Power Station – Request for Consent for Start Up of Reactor 4 Under Licence Condition 30 (3)		
Licence Instrument No: (if applicable)	548		
Nuclear Site Licence No:	62C		
Licence Condition:	30 (3)		

Document Acceptance and Approval for Issue / Publication

ROLE	NAME	POSITION	SIGNATURE	DATE
Author	[REDACTED]	Inspector	[REDACTED]	30 th March 2015
Reviewer	[REDACTED]	Principal Inspector	[REDACTED]	31 st March 2015
Accepted by ¹	[REDACTED]	Superintending Inspector	[REDACTED]	31 st March 2015
Approval for publication ²	[REDACTED]	Superintending Inspector	[REDACTED]	31 st March 2015

Revision History

Revision	Date	Author(s)	Reviewed By	Accepted By	Description of Change
A	29 th March 2015	[REDACTED]	[REDACTED]	n/a	1 st draft for AUH review
B	31 st March 2015	[REDACTED]	[REDACTED]	n/a	2 nd draft incorporating AUH comments
0	1 st April 2015	[REDACTED]	[REDACTED]	[REDACTED]	First accepted issue

Circulation (latest issue)

Organisation	Name	Date
Office for Nuclear Regulation	[REDACTED]	1 st April 2015

¹ Acceptance of the PAR to allow release of LI

² Approval is for publication on ONR web-site, after redaction where relevant

	[REDACTED]	
Environment Agency	[REDACTED]	1 st April 2015
Licensee	[REDACTED]	1 st April 2015

Hinkley Point B Reactor 4 2015 Periodic Shutdown

EDF Energy Generation Limited Hinkley Point B Power Station – Request for Consent for Start Up of Reactor 4 Under Licence Condition 30 (3)

Project Assessment Report ONR-HPB.-PAR-14-033
Revision 0
1st April 2015

© Office for Nuclear Regulation, 2015

If you wish to reuse this information visit www.onr.org.uk/copyright for details.

Published April 2015

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

EXECUTIVE SUMMARY

Title

EDF Energy Generation Limited Hinkley Point B Power Station – Request for Consent for Start Up of Reactor 4 Under Licence Condition 30 (3)

Permission Requested

EDF Energy Nuclear Generation Limited (NGL), the licensee of Hinkley Point B nuclear power station, has applied for Consent from the Office for Nuclear Regulation (ONR) to start-up Reactor 4, in compliance with Licence Condition (LC) 30 (3) attached to Nuclear Site Licence 62C.

Background

Hinkley Point B power station is a nuclear licensed site operating two Advanced Gas-cooled Reactors, known as Reactors 3 and 4. To continue to operate safely and reliably the reactor plant requires examination, inspection, maintenance and testing. Continuous improvement also requires plant upgrades to be implemented where deemed to be reasonably practicable. Whilst some of these activities can take place when the reactor is at power, many of them require it to be shut down. The licensee's arrangements require that periodic shutdowns (also referred to as statutory outages) are carried out every three years at each reactor at Hinkley Point B, providing the opportunity to undertake such activities. On completion of a periodic shutdown the reactor cannot be started up without Consent from ONR under LC 30 (3). During the 2015 Reactor 4 periodic shutdown, which commenced on 23rd January 2015, the licensee has conducted:

- Examinations, inspections, maintenance and testing (EMIT) activities in accordance with the Plant Maintenance Schedule (MS).
- Inspections to support the station safety case.
- Work to comply with statutory requirements (such as Pressure Systems Safety Regulations).
- Remedial work to rectify plant adverse conditions and emergent work
- Work to modify and/or enhance the plant where deemed appropriate.

The Hinkley Point B Station Director has written to ONR requesting Consent to start-up Reactor 4. In his letter, the Station Director confirmed that following completion of the outstanding work, as controlled by the Operational Safety Review Committee (OSRC), Reactor 4 will be safe to return to service. The licensee's internal regulator, Independent Nuclear Assurance (INA), has indicated there are no issues that prevent the start-up or continued operation of reactor 4. INA has issued a Concurrence Part B confirming that its assessment programme has been concluded. Release of Concurrence Part B is a requisite component that informs the OSRC's decision to authorise return to service.

The third party Pressure Systems Safety Regulations (PSSR) competent person has issued an inspection report that is included in the licensee's request for Consent. The final inspection report will be included in the licensee's final outage report issued within 28 days of reactor restart. The Appointed Examiner for the Reactor pre-stressed concrete pressure vessel (PCPV) has issued a start-up report that concludes the PCPV is in satisfactory condition and fit for return to service for a further period of three years subject to normal in-service surveillance.

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

The ONR project inspector, nominated site inspector and specialist inspectors have sampled the licensee's arrangements for controlling and completing the examination, inspection, maintenance and testing requirements of the maintenance schedule (MS), and other plant modifications of nuclear safety significance, as identified within the outage intentions document. Inspectors have undertaken inspections throughout the periodic shutdown to:

- Inspect samples of the licensee's implementation of arrangements under LC28.
- Inspect and assess the licensee's implementation of LC22 modifications, delivered through NGL's Engineering Change process
- Assess the adequacy of control and supervision under LC26 and the Management of Health & Safety at Work Regulations (1999).
- Assess the adequacy of the licensee's quality management arrangements associated with activities carried out during the periodic shutdown.

The specialist inspectors have undertaken assessments and produced reports for each specialism. I have considered these reports to assist in the compilation of this Project Assessment Report (PAR) and development of a regulatory judgement that Reactor 4 is fit for return to service.

The regulatory interventions carried out by ONR inspectors have not identified any issues that would prevent ONR from issuing its Consent to start-up Reactor 4 under LC 30(3).

Matters arising from ONR's work

There are no outstanding matters preventing issue of Licence Instrument (LI) 548 arising from the work undertaken by ONR inspectors in relation to the Hinkley Point B 2015 periodic shutdown.

Conclusions

Following assessment and inspection of matters arising in relation to the 2015 periodic shutdown of Hinkley Point B Reactor 4, I am satisfied that the licensee's justification to start-up the reactor and operate for a further period of three years is adequate, and that consequently a Consent to start-up the reactor should be granted.

Recommendation

I recommend that in accordance with the request from the licensee, ONR should issue LI 548 under LC 30 (3) Consent to start-up Hinkley Point B Reactor 4.

LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
APEX	Appointed Examiner
ATS	Anti-thermosyphon Seals
BAP	Boiler Assessment Panel
BS	British Standards
CBIU	Channel Bore Inspection Unit
C&I	Control & Instrumentation
CNRP	Civil Nuclear Reactor Programme
CNS	Civil Nuclear Security
EBFP	Emergency Boiler Feed Pump
DHD	Diverse Hold-down
DSD	Diverse Shut-down
EA	Environment Agency
EC	Engineering Change
EMIT	Examination Maintenance Inspection and Testing
FME	Foreign Material Exclusion
GAP	Graphite Assessment Panel
GC	Gas Circulator
HPB	Hinkley Point B
HOW2	Office for Nuclear Regulation Business Management System
INA	Independent Nuclear Assurance
INSA	Independent Nuclear Safety Assessment
IR	Intervention report
IRR99	Ionising Radiation Regulations 1999
KWRC	Keyway Root Crack
LI	Licence Instrument
LC	Licence Condition
MS	Maintenance Schedule
MITs	Maintenance Inspection Testing Schedule [EDF]
NGL	EDF Energy Nuclear Generation Limited
NICIE2	New In-Core Inspection Equipment mark 2
OAP	Outage Assessment Panel
ODH	Off-load Depressurised Handling
OID	Outage Intentions Document
ONR	Office for Nuclear Regulation
OSRC	Operational Safety Review Committee
PAR	Project Assessment Report
PCPV	Pre-stressed Concrete Pressure Vessel
PRV	Pressure vessel Relief Valve
PSSR	Pressure Safety Systems Regulations 2000
RTR	Rapid Trending Review
RP	Radiological Protection
QA	Quality Assurance
SAP	Safety Assessment Principle(s) (HSE)
SACI	Significant Adverse Condition Investigation
SSC	Structures, Systems and Components

TABLE OF CONTENTS

1	PERMISSION REQUESTED.....	8
2	BACKGROUND.....	8
3	ASSESSMENT AND INSPECTION WORK CARRIED OUT BY ONR IN CONSIDERATION OF THIS REQUEST	11
4	MATTERS ARISING FROM ONR'S WORK.....	20
5	CONCLUSIONS	21
6	RECOMMENDATIONS	22
7	REFERENCES	23

:

1 PERMISSION REQUESTED

1. EDF Energy Nuclear Generation Limited (NGL), the licensee of Hinkley Point B nuclear power station, has applied for Consent from the Office for Nuclear Regulation (ONR) to start-up Reactor 4, in compliance with Condition 30 (3) attached to Nuclear Site Licence 62C (Ref.1). This Project Assessment Report (PAR) presents my consideration of this request and recommends issuing Licence Instrument 548, Consent to start-up Reactor 4.

2 BACKGROUND

2.1 GENERAL

2. Licence Condition (LC) 30 (periodic shutdown) of the nuclear site licence issued to NGL for Hinkley Point B power station requires the licensee to shut down the reactors in accordance with its plant maintenance schedule (MS), to enable examination, inspection, maintenance and testing to take place in accordance with the requirements of LC28 (examination, inspection maintenance and testing). At Hinkley Point B, reactor periodic shutdowns are undertaken triennially as specified in the MS preface, which is an Approved document under LC28 (4). As part of the shutdown, the licensee also carries out work associated with the requirements of Pressure Systems Safety Regulations (PSSR), previous commitments, and the installation of plant modifications.
3. The licensee requires Consent from ONR under LC30 (3) to start-up Reactor 4 on completion of its periodic shutdown. The previous Consent to start-up Reactor 4, LI 535 is dated 23rd December 2011 (Ref.2). The Reactor 4 2015 periodic shutdown commenced on 23rd January 2015, following ONR agreement to extend the operating period (Ref.3).
4. In addition to planned routine activities, the licensee also undertook a significant amount of work to improve the safety and reliability of the station. This work included:
 - Inspection of 31 graphite channels using channel bore measurement and TV systems, trepanning of graphite samples from 6 channels and eddy current inspection of others.
 - One super articulated control rod and channel was inspected by remote viewing.
 - Inspection of internal parts of the pressure vessel and associated systems including boilers, structures and hangars.
 - Exchange of two gas circulators, replacement of six pairs of IGV (inlet guide vane) couplings and repairs/exchange of lubrication oil pumps.
 - Replacement of reactor pressure relief valves.
 - Surveillance of the pre stressed concrete pressure vessel.
 - Inspection and repair of drum screens and other cooling water systems.
 - Replacement of the low pressure turbine motor replacement and inspection of intermediate pressure turbine.
 - Major inspection of the main boiler feed pump and steam admission valves, and other work activities and modifications.
5. It should be noted that HPB Site Licence number is 62C, originally it was 62A which became 62B when HPC obtained their licence and leased land from HPB on 31/10/12. 62C was issued to cover relicensing of HPA & HPB on 3/12/12.

2.2 OUTAGE PLANNING AND MANAGEMENT

2.2.1 Licensee's Management

6. NGL produced an outage intentions document (OID) for the Reactor 4 periodic shutdown 2015 (Ref.4). The document outlined the NGL outage organisation, infrastructure and management arrangements to deliver the safety related activities being undertaken during the outage. The activities were in accordance with the MS, statutory inspections, modifications and significant work in order to meet the requirements of the relevant sections of LC22, 28 and 30. The document, together with the referenced scope related supporting documents, comprised the outage intentions proposals for Reactor 4.
7. The licensee's outage process includes a series of meetings with ONR such as the outage intentions meeting and the start-up meeting:
 - NGL provided ONR with a copy of the OID prior to holding the outage intentions meeting held on 14th August 2014, during which the organisational arrangements and programme of work for the shutdown were discussed. The ONR project inspector, lead structural integrity assessor and the nominated site inspector attended the meeting (Ref.5) and provided feedback to NGL on the document. Minutes of the meeting were provided by NGL (Ref 6). Note that these minutes remained at draft status until formally accepted as being accurate at the later start-up meeting.
 - The start-up meeting was held on 18th & 19th March 2015 and was attended by the ONR project inspector, superintending inspector and the nominated site inspector (Ref.7) . The purpose of the start-up meeting was for the licensee to demonstrate it had adequately met its statutory outage objectives, dealt with emergent issues and demonstrated the safety of Reactor 4 for the next operational period. A start-up meeting report (Ref.8) was provided prior to the meeting and additional information was presented at the meeting (Ref.9).
8. On 31st March 2015 the Hinkley Point B Station Director wrote to ONR requesting its Consent to start-up Reactor 4 (Ref.1). In his letter, the Station Director confirmed that following completion of the outstanding work, as controlled by the Operational Safety Review Committee (OSRC), Reactor 4 would be safe to return to service. The request letter was supported by a series of appendices:
 - At the Reactor 4 Start Up meeting held on 19th March 2015 it was agreed that certain actions had to be completed prior to start-up of Reactor 4. Responses to these actions have been tracked via the 'R4 2015 Statutory Outage ONR Action Tracker' TRIM 2015/49204. Version dated 31/03/2015.
 - All maintenance schedule work was complete, with the exception of those items which can only be carried out during the return to service of the unit.
 - Confirmation that all the plant will be in satisfactory condition for return to service, listing all of the outage associated Category 1 and Category 2 submissions.
 - The INA concurrence report supporting return to service of Reactor 4 subject to satisfactory completion of INA assessment, resolution of ONR Start Up issues and completion of the outstanding outage work plan.
9. Attachment 4 contained details of the INA position on the Reactor 4 2015 return to service. INA demonstrates its assurance by undertaking a series of surveillance activities both before and during the outage. This includes inspections, oversight of management processes and document reviews as defined in the Concurrence Part A report (Ref.10). On completion of these activities, INA issues a further report,

(Concurrence Part B) (Ref.11) which presents the findings of their work and includes a statement supporting the start-up. INA has submitted its Concurrence Part B report to the Hinkley Point B OSRC as part of the licensee's consideration as to whether Reactor 4 is fit for return to service, in accordance with NGL's company arrangements.

10. ONR noted that there had been some changes and / or deferrals to the outage plan. NGL have stated (Ref. 32) that deletions from the programme considered safety case and Technical Guidance Notes requirements before acceptance by the Outage Assessment Panel.

2.2.2 ONR's Intervention Management Process

11. ONR business management process within the Civil Nuclear Reactor Programme (CNRP) requires that a task sheet is produced for activities exceeding five man days' work. The task sheet provides the background to the proposed intervention, the anticipated outcomes, duration, prioritisation, lists specialisms assigned to the project and the intervention strategy.
12. The nominated site inspector for Hinkley Point B produced task sheet TS233 (Ref.12) for the Reactor 4 periodic shutdown. The task sheet was endorsed by the CNRP sub programme management board. The anticipated outcomes of the project included the licensee delivering:
 - An outage that was safely managed and appropriately regulated.
 - Closeout of significant issues raised by interventions to the satisfaction of the Inspector raising the issue, prior to the conclusion of the outage (wherever possible), or an acceptable plan is made to address the issue beyond the outage).
 - Safe delivery of the required work activities, enabling ONR to produce a PAR that considers NGL's request to start up Reactor 4 on completion of the shutdown.
13. The following ONR specialisms were assigned to the project:
 - Management systems & human factors.
 - Civil engineering systems.
 - Radiological protection.
 - Mechanical systems
 - Electrical systems.
 - Structural integrity.
 - Graphite core.
 - Control and Instrumentation systems, including reactor protection systems.
 - Radioactive waste management.
 - Site inspection oversight.
14. ONR's process for delivering a permissioning project requires preparation of a PAR for the permissioning decision by the Delegated Authority. The PAR is informed by the intervention findings of the inspectors assigned to the project to allow the Delegated Authority to consider issuing Consent for the restart of the reactor.
15. As the ONR project inspector I have maintained a spread sheet (Ref.13) to monitor progress and status of all restart and non-restart related actions.

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

16. I have considered the NGL request for ONR's Consent to start-up Hinkley Point B, Reactor 4 on completion of its periodic shutdown in my capacity as project inspector. I have followed ONR procedures for delivering a permissioning project, as detailed in HOW2 (Ref.14). To support my work I have utilised the services of the ONR specialist inspectors assigned to this project by the ONR CNRP management team. I have taken note of the outage-associated work undertaken by the NGL internal regulator, INA.
17. I have consulted with the Environment (EA) to establish whether they object to ONR giving Consent to start-up Reactor 4. Their response is provided in Section 4 of this report.
18. I summarise below the inspection and assessment work undertaken by specialist inspectors, the nominated site inspector and myself during the course of the periodic shutdown.

3.1 MANAGEMENT SYSTEMS (SUPPORTED BY HUMAN FACTORS)

19. An ONR quality management (QM) systems inspector, supported by a human factors inspector, carried out an inspection and assessment at Hinkley Point B (HPB) to review the adequacy of the outage QM arrangements. The inspection was undertaken against LC17, Management Systems, and sampled the following activities:
 - Quality Assurance (QA) Oversight.
 - Management of Outage Work Closure.
 - Supply Chain and Contract Management.
 - Field Supervision.
 - Investment Delivery Management.
20. The QM inspector produced an assessment report (Ref.15) for the assessment/inspection. The salient points of his work are presented below:
 - Outage Surveillance Programme: he judged that overall there was an adequate monitoring of quality, a view which takes into account both the station surveillance programmes and the deployment of the HPB Quality Control (QC) model.
 - Weekly Quality Forum: he observed the weekly Quality Forum which was attended by the contract partners and a number of NGL representatives including an Independent Nuclear Assurance (INA) Evaluator from HPB. He considered that all parties were engaged in the discussion which was centred on a composite report compiled from individual contract partner reports.
 - Surveillances: he was satisfied, based on the records provided of surveillances undertaken by the Station Quality Engineer (SQE) and the Investment Delivery Team Quality Assurance Lead that surveillances were being undertaken in accordance with procedures and fleet practice.
 - Outage Work Management Arrangements: he discussed the additional quality control arrangements that have been introduced to support the closing of work packages and returning plant back into service after maintenance and was satisfied that these arrangements were adequate.
 - Supply Chain Management: he discussed outage supply chain management, procurement and contract management arrangements and found these to be adequate and in accordance with relevant procedures.
 - Investment Delivery Projects: he discussed the general arrangements for delivery of projects and found them to be in accordance with relevant

procedures. He sampled a project being undertaken and found it to be managed in accordance with relevant procedures with appropriate records being maintained.

- Field Supervision: he discussed Field Supervision arrangements with the maintenance manager and found these to be well managed, with the role understood and implemented in accordance with fleet procedural requirements.
- Hunterston B Gas Circulator Event Lessons Learnt at HPB: The HF specialist inspector found that station personnel understood the causes that had contributed to the HNB event, were aware of the potential impact on successful HPB operations and were managing the risk appropriately.

21. The inspector found that HPB's compliance with LC17 Management Systems for the areas inspected was adequate and consistent with relevant quality management oversight arrangements. No actions were raised and he recommended that, based on the areas examined during his intervention, that the LC17 Management Systems arrangements for the statutory outage R4 2015 should be considered adequate to permit a return to service.

3.2 CIVIL ENGINEERING

22. NGL has an appointed examiner (APEX) to oversee the maintenance and inspection activities related to the reactor pre-stressed concrete pressure vessel (PCPV) and associated systems, as identified within the OID. On completion of this work, the APEX provides a start-up statement, which identifies the inspections undertaken, what was found, what remediation was required and the justification for returning the reactor to service.
23. The ONR civil engineering inspector has produced an assessment report (Ref 16) of the APEX start-up statement (SUS). The scope of the assessment included findings from inspections and tests of certain key safety related components of the reactor pressure vessel including: tendon loads, tendon anchorages, concrete surfaces, foundation tilt and settlements, vibrating wire strain gauges and consideration of tendon corrosion, vessel concrete liner temperatures, reactor coolant leakage, top cap deflections, tendon tensile strength and pressure vessel cooling water leakage.
24. Tendon load checks have been carried out during the previous operating period consisting of the Maintenance Schedule requirement for a 1% sample of both top and bottom tendon anchorages and a further 1% sample (recommended by the APEX) of the top tendon anchorages. The load check data has been assessed by the APEX who concludes that the residual pre-stress level is adequate to satisfy the minimum design load for the next 3-year period of planned operation.
25. The ONR civil engineering inspector visited the site in December 2013 to observe tendon stressing activities and found the Licensee and its specialist contractors to be following their procedures for equipment calibration and tendon shimming (i.e. re-stressing) operations.
26. A full and detailed report of the surveillance results and their assessments will be provided to ONR within 28 days of the consent to restart the reactor.
27. The ONR civil engineering inspector considered that the inspections, tests and monitoring undertaken by the Licensee and described in the APEX report, satisfied the relevant ONR Safety Assessment Principles. Based upon his assessment of the surveillance activities the APEX concludes that the Hinkley Point B Reactor 4 PCPV is in a satisfactory condition for returning to service for a further period of operation of three years.

3.3 RADIATION PROTECTION

28. An ONR Radiation Protection (RP) inspector undertook a planned readiness inspection to evaluate NGL's compliance with the Ionising Radiations Regulations 1999 (IRR99) in preparation for and during its planned statutory outage of reactor 4. Given that dose accrual would be highest for NGL's programme of work for man-entries to the reactor vessel, this work was a particular focus of his inspection.
29. The following NGL compliance matters were considered in detail during the inspection and assessment:
- Contamination control during entry and egress from the vessel entry complex and other contamination controlled areas declared as such by NGL for compliance with the Ionising Radiations Regulations 1999 (IRR99).
 - Personal dose management.
 - Vessel entry complex critical examination as required by Regulation 31 of the IRR99.
30. In addition the ONR RP inspector discussed ONR's Control of Occupational Radiation Exposure (CORE) questionnaire, which the Licensee had completed prior to his inspection, in order to establish a 'benchmark' for its radiation protection performance
31. The inspector produced an assessment report (Ref.17) for his assessment/inspection. The salient points of his work are presented below:
- From a radiological protection standpoint, he was content with NGL's current state of readiness and preparation for its vessel entry programme and for the completion of its other scheduled statutory outage maintenance and inspection work.
 - He was satisfied that the Licensee had established a robust system of man-entry management at its reactor vessel entry complex and that its systems and practices met the requirements of the IRR99, particularly in relation to its on-going need to restrict personal radiation exposures so far as is reasonably practicable.
 - However, NGL was notified of:
 - The need to improve the local exhaust ventilation performance at its solid low-level waste (LLW) sorting cabinet. The RP inspector will address this matter via the Corporate Headquarters.
 - Improve the segregation of solid LLW within temporary storage areas set up during the conduct of the statutory outage. This was resolved during the outage.
 - The inspector noted these issues raised during the inspection were not prejudicial to ONR giving consent to the start-up of Reactor 4, nonetheless, they were progressed with the Licensee separately by correspondence and the Action tracker (Ref.13).
32. The ONR RP inspector concluded that his inspection and assessment at HPB and his discussions with its radiation protection management and staff did not expose any issues that would be a contraindication of NGL's readiness and capability to bring reactor R4 back to power in accordance with sound radiological protection practice and in compliance with applicable law in this regard. Accordingly, it is his recommendation that, all other nuclear and conventional safety matters notwithstanding, ONR should give Consent to the Licensee to bring reactor Unit 4 back to power in due course in accordance with LC30.

3.4 MECHANICAL ENGINEERING

33. The ONR mechanical inspector gathered information from two mechanical engineering interventions undertaken in support of the statutory outage. His inspection and assessment focused on the nuclear safety significant mechanical engineering subjects listed below:
- EIMT Arrangements; ensuring safety case assumptions are achieved.
 - Gas Circulator EIMT; providing forced gas circulation.
 - Control Rod Assembly EIMT; providing reactor control and shutdown.
 - Safety Critical Valves EIMT; providing fluid control and isolation.
 - EIMT Facilities; used to undertake safety significant activities.
34. The first addressed supporting EIMT arrangements, the next three addressed the adequacy of EIMT on Structures, Systems and Components (SSC's) that were important to nuclear safety either in terms of maintaining the plant within the normal operating envelope or protecting against faults. The final one examined the adequacy of facilities in which EIMT in support of the outage is undertaken and that tasks performed on SSCs important to nuclear safety are appropriate.
35. He also undertook a review of specific items identified in the OID, Engineering Changes (ECs) relevant to R4 and findings during outage activities reported to ONR through Condition Reports (CRs).
36. The inspector produced an assessment report (Ref.18) for his assessment/inspection. His assessment concluded:
- Gas Circulators had been subjected to adequate EIMT in support of the R4 statutory outage consistent with the SAP expectations and the risks have been reduced to ALARP.
 - Control Rod Assemblies and Super Articulated Control Rods had been subject to adequate EIMT in support of the R4 statutory outage consistent with the SAP expectations and the risks have been reduced to ALARP.
 - Safety critical valves had been subjected to adequately EIMT in support of the R4 statutory outage consistent with the SAP expectations and the risks have been reduced to ALARP.
 - He intends to follow up separately with the NGL Chief Mechanical Engineer at Barnwood the arrangements for establishing a systematic and consistent approach in determining EIMT requirements for valves that provide a nuclear safety significant function.
 - Control rod assembly, gas circulator and Contractors valve maintenance facilities were adequately performing EIMT on SSC important to nuclear safety in support of the R4 statutory outage consistent with the expectations of SAP EMT.2.
 - Improvements identified through his assessment to the Contractors valve maintenance facility will be progressed as part of routine regulatory business.
37. On the basis of his assessment, the ONR mechanical specialist inspector concluded of the HPB R4 statutory outage, from a mechanical engineering perspective, the EIMT performed on SSC important to nuclear safety is adequate, the risks are being managed to ALARP and he did not determine any items of significance that would prevent a return to service upon completion of the statutory outage.

3.5 ELECTRICAL SYSTEMS

38. An ONR electrical systems inspector undertook a planned outage inspection at HPB and carried out an assessment of the supporting documentation. In his assessment, the inspector considered the electrical aspects outlined in the OID and supporting documentation. The assessment included an examination of a sample of outage related electrical maintenance activities and relevant documentation, that had been applied to electrical switchboard maintenance and other electrical systems that were important to the safety of Reactor 4.
39. The majority of outage related electrical work was directed towards electrical switchboards, switchgear, generator transformer 8 replacement, station and auxiliary transformer maintenance and gas circulator (GC) maintenance activities.
40. The inspector produced an assessment report (Ref.19) for his assessment/inspection. The salient points of his work are presented below:
41. The licensee identified the following emergent issues:
- Station Transformer 8A 11kV circuit breaker arcing horn contacts slightly corroded and resistance value of an insulation board below the acceptable value.
 - Gas circulators 17B and 20B displayed anomalous behaviour during reactor shutdown sequencing equipment (RSSE) functional testing during shutdown.
42. The licensee has investigated the matters surrounding these anomalies and implemented remedial measures to address them. The ONR electrical inspector examined the station investigation reports in relation to these anomalies, discussed various aspects of the proposal with the licensee's electrical engineering staff, and was content with implementation of the proposed measures subject to the submissions completing station's process for plant modifications, where necessary.
43. The electrical inspector made the following judgements and conclusions during the course of his inspection and assessment.
- While a small number of activities remained to be completed, no issues of significant safety concern had occurred and it is considered unlikely, because of the nature of the outstanding work that issues with the potential to affect return to service of Reactor 4 would occur. He had received assurance from the station that the remaining work will be completed in full, or the proposed way forward will be recorded under the station's outage arrangements. ONR electrical inspectors will, as necessary, follow up progress to complete any outstanding electrical work as part of normal regulatory business.
 - In addition, several interactions with HPB's electrical engineering staff during the outage have identified that the activities undertaken have been conducted in accordance with the station's work control system, recorded appropriately in station documents and confirmed as complete by Suitably Qualified and Experienced Persons.
44. On the basis of the work sampled, he concluded that the outage electrical work has revealed no matters of significant safety concern that are not already being adequately addressed, and they have confirmed that any remaining outage work will be managed under their established outage arrangements. Therefore, he considered that the electrical work undertaken as part of this outage should support the safety and reliability of the electrical plant and equipment, during the start-up and operation of Reactor 4 following its return to service.

45. He recommended that ONR grants consent for the start-up of HPB Reactor 4 following its 2015 periodic shutdown.

3.6 CONTROL AND INSTRUMENTATION (C&I) SYSTEMS

46. An ONR C&I inspector carried out an inspection and assessment (Ref.20) of Reactor 4 outage related C&I activities as part of the programme of outage related safety inspections.
47. During the course of the inspection he observed that the licensee was maintaining C&I equipment in accordance with its arrangements, on the basis of the areas sampled. His inspection considered the C&I work specified for the Reactor 4 periodic shutdown, including the planned work from the OID, a sampled inspection of outage related maintenance activities and any emergent work in the area. He judged that for those areas sampled, the commitments made in the OID for C&I systems and equipment important to nuclear safety at Reactor 4 had been satisfied. He also found that the workmanship applied was adequate and consistent with the standards expected from C&I suitably qualified and experienced persons (SQEPs).
48. In addition he inspected three modifications that were in progress or had recently been completed and was satisfied that this work was covered by adequate arrangements to ensure that these were adequately conceived and installed to be fit for their intended purpose. He also inspected the final documentation and considered this to be completed satisfactorily.
49. He raised two actions during the course of his inspection and liaised with the ONR electrical Inspector on a third action. These actions have been captured and tracked, along with other disciplines actions, on HPB R4 Statutory Outage 2015 action tracker (Ref.13).
50. The ONR C&I inspector was content with the correspondence received to discharge these actions. In addition, while a small number of activities remain to be completed, no issues of significant safety concern had occurred, and it was considered unlikely, because of the nature of the outstanding work, that issues with the potential to affect return to service of Reactor 4 will occur. He has received assurance from the station that the remaining work will be completed in full, or the proposed way forward will be recorded under the station's outage arrangements.
51. He concluded that his inspection showed that all station C&I activities undertaken had been conducted in accordance with the station work management system, recorded appropriately in station documents by SQEPs.
52. His inspections found that no issues have been identified from HPB C&I work that should affect the return to service of R4, on completion of the planned and emergent work.
53. The overall outcome from the safety inspection of the outage related control and instrumentation work on R4, was that the implementation of the LC27, LC28 and LC22 arrangements for the C&I equipment was deemed to be satisfactory.
54. In his opinion, on the basis of his assessment of the C&I aspects of the HPB R4 2015 statutory outage, he recommended that support be given for a Consent to allow R4 to return to normal operating service.

3.7 GRAPHITE CORE

55. During the statutory outage, NGL undertook inspections, measurements and samples of the reactor graphite core, as required by the graphite core safety cases. ONR specialist graphite inspectors visited HPB to inspect how NGL was performing the various periodic shutdown related activities necessary to ensure the integrity of the graphite core.
56. This included the following activities:
- Consideration of the scope and extent of the planned campaign to determine if NGL met the relevant commitments for inspection and trepanning of the graphite.
 - Visited HPB to carry out inspection activities related to the quality of the work performed and to discuss the results that had been obtained.
 - Considered documents such as the graphite assessment panel (GAP) minutes and the graphite return to service (RTS) EC to confirm that the Licensee has considered the results adequately and confirmed that the results are consistent with the safety case.
57. The findings of their inspection is given in their assessment report (Ref.21)
58. The most significant finding was that there was a difference in apparent shrinkage for some channels. This was noticeable in that these channels had been inspected in 2011, 2013 and 2015. For some of these, the shrinkage was greater in the second two year period. NGL provided an explanation which was that the difference in shrinkage was due to the time at which refuelling occurred and that new fuel produces a higher flux, leading to an increased rate of shrinkage. The Graphite specialist inspectors considered that NGL should conduct a more in-depth investigation into the causes of the anomalies in shrinkage, as although the channel fluence could be used qualitatively to explain the observations, it did not provide a comprehensive explanation, and other factors may need to be considered. A full record of the interactions that ONR had with NGL is recorded as (Ref.22). The Graphite specialist inspectors judged though that the matter was not of such consequence that ONR should object to the RTS. The need for such analysis has been recorded on the ONR issues database in issue 1014.
59. EC 355026: Justification for the return to service of HPB R4 following the Graphite Core inspections at the 2015 periodic shut-down (Ref.23) comments that the core, channel and brick distortions were within expectations. The ONR specialist inspectors have assessed this EC and considered that the claims, arguments and evidence supported this comment.
60. EC 355026 (Ref.23) also noted that the most recently available graphite weight loss data for HPB, which was from Reactor 3 samples extracted in 2012 had not shown any out of trend behaviour. The ONR specialist inspectors did not consider that the Assessment Report was an appropriate place to comment on weight loss measurements, which are normally considered in the context of other safety case assessments. However they did note that ONR had an open issue (1013) relevant to graphite weight loss at HPB. ONR does not necessarily agree that the progression of weight loss is adequately understood and will pursue this matter with NGL in the coming year. The ONR specialist inspectors understand though that it is considered unlikely that any relevant graphite weight loss limits could be transgressed within the period covered by the consent.
61. The specialist inspectors noted that a number of new cracks were identified, but that none of these had been categorised as keyway root cracks.

62. The specialist inspectors considered the results of the inspections discussed at the Graphite Assessment Panel (GAP) and recorded in the GAP minutes. Overall they consider that NGL has met its pre-outage commitments in terms of the activities performed at HPB for the graphite.
63. The specialist inspectors concluded, on the basis of their assessment of the graphite aspects of the HPB R4 2015 statutory outage that support be given for Consent to allow R4 to return to normal operating service.

3.8 STRUCTURAL INTEGRITY

64. An ONR structural integrity inspector undertook a planned outage inspection and assessment to determine the adequacy of: the inspections of welds, reactor internals, essential cooling water systems, pipe hangers and thermal movement supports and compliance with Pressure Systems Safety Regulations undertaken during the HPB Reactor 4 periodic shutdown. The assessment has been conducted in three stages;
- Review of the scope of inspections undertaken prior to the periodic shutdown.
 - A site visit during the periodic shutdown to review progress and assess the results of the inspection, maintenance and repair activities, and sample documentation.
 - Followed up actions arising from the site visit and monitored inspection progress by checking the NGL, Outage Assessment Panel minutes and liaising with the ONR HPB site inspector and the ONR project inspector. The structural integrity inspector also assessed the Return to Service Engineering Change document as part of her assessment.
65. The findings of the structural integrity inspectors' assessment and inspection is given in her assessment report (Ref.24). The structural integrity inspector concluded that;
- From a structural integrity view point, she found no regulatory reason to prevent the issue of consent. This was dependent on satisfactory conclusions of the activities as evidenced by the internal regulator's support to the return to service engineering change.
 - The reactor internal inspections (steel components) had been completed in line with the outage proposals document for in-service inspections. Alterations, deletions and additional inspections were dealt with following NGL's company guidance. The structural integrity inspector judged that no problems had been identified that would prevent HPB Reactor 4 from returning to service.
 - Adequate examination, inspection, maintenance and testing had been undertaken on a number of systems essential to safety including the seawater cooling and pipework thermal movement systems. All defects identified of any significance had been adequately dealt with by NGL according to their procedures and processes.
66. The structural integrity inspector recommended that:
- The project inspector should consider her assessment report in deciding whether to recommend that consent to RTS should be granted. He should consider her view that in terms of the steels structural integrity, there is no reason to prevent the RTS. However, this recommendation is contingent on the Project Inspector receiving the following:
 - To demonstrate satisfactory completion of the steam system inspection programme and completion of the work of the Outage Assessment Panel, the INSA concurrence certificate for the Return to Service

Engineering Change should be submitted as part of NGL's application for consent to return to service.

- To demonstrate satisfactory completion of the Pressure Systems Safety Regulations inspections, a statement from the Competent Person should be submitted as part of NGL's application for consent to return to service.
- To demonstrate satisfactory completion of the inspections not covered by the APEX and PSSR competent person, namely the gas side penetrations of the reactor pressure boundary, NGL must provide a statement supporting the fitness for return to service.

67. These recommendations are addressed in Section 4.

3.9 RADIOACTIVE WASTE MANAGEMENT

68. An ONR specialist radioactive waste management inspector carried out a joint inspection with the Environment Agency and produced an assessment of Reactor 4 outage related waste management arrangements (Ref.25).

69. She considered that proactive management of radwaste as it arose was demonstrated through training, planned resourcing and processing of waste for disposal during the outage. The site was actively pursuing waste minimisation measures by implementing the use of decontaminable materials and reusable containers. A physical control over waste arising's was demonstrated through limited access to waste facilities, which were in good repair, with waste and equipment stored in an orderly fashion.

70. The evidence gathered during the inspection demonstrated adequate compliance of LC32 for accumulation of radioactive waste. She concluded that there were no findings that could significantly undermine nuclear safety and delay the Hinkley Point B Reactor 4 return to service.

3.10 SITE INSPECTOR OVERSIGHT

71. The nominated site inspector undertook regulatory oversight of Hinkley Point B's overall outage programme, and worked closely with me to coordinate ONR's specialist inspections during the course of the outage. He undertook station-based regulatory activities in the following areas:

- An examination of INA's rapid trending review (RTR).
- Inspections of licensee and contractor control and supervision.
- Response to emergent incidents and assessment of subsequent investigations.
- Maintained good communications with INA and the licensee throughout the outage.
- Attended the start-up meeting.

72. He discussed the Rapid Trending Review (RTR) , undertaken by INA to establish and redress developing safety trends associated with the Reactor 4 statutory outage (Ref.26). No Areas for Improvement were identified although four opportunities for improvement were determined. Overall, the nominated inspector judged the RTR to have been effective at highlighting early and emerging trends in safety performance.

73. The nominated site inspector undertook compliance inspections against LC 26 (Ref.27) with specific emphasis on supervision of contract partner work during the early stages of the Reactor 4 statutory outage. He also examined aspects of work control through sampling of individual work packages. He judged contractor field supervision arrangements to be mature and aligned to well-defined company standards. He considered that overall standards of supervision observed during the

inspection period were adequate. Control of work through work planning, pre-job briefs and work-packs was satisfactory.

74. At the time of writing there had been two Technical Specification non-conformances (fuel handling at the buffer store and removal of fire jackets), and two significant near misses (hot water ejection from auxiliary steam system and ejection of closure unit at the buffer store). The site is investigating these events and the nominated site inspector will follow up on these issues out with the outage.
75. In addition, following the start up meeting two items of emergent work arose, these were:
- Double super bung channels; these are fuel assemblies discharged from R4 fitted with double anti-thermosyphon seals (ATS). Four of these assemblies were discharged as part of planned fuel vacations to enable core inspections to take place. On lifting the assemblies at the buffer store prior to recharging them to R4, three of the four assemblies were observed to have displaced seals around the bio-shield section of the plug unit. The forward strategy is to not recharge the three damaged double ATS assemblies but to leave these in the buffer store for now and replace with new fuel stringers fitted with double ATS. ONR are content with this course of action being a conservative way forward and hence of no safety significance.
 - Closure actuator event - this was not outage related as it occurred during a routine operational manoeuvre at the supplementary buffer store. The closure actuator having been used on the shutdown reactor, had served its purpose and was being stored in the buffer store. It could have been removed from the buffer store at any point post outage, however on this occasion it was decided to remove the closure actuator and place in store to free up a buffer storage tube. ONR are content there was no nuclear safety significance due to this event, however the ONR nominated site inspector is following this up with a fact finding visit.

3.11 START-UP MEETING

76. The Reactor 4 start-up meeting was held on 18th & 19th March 2015 and followed NGL's arrangements for such meetings. The station provided a comprehensive site tour, start-up report (Ref.8), which formed the basis of the meeting agenda, and supplementary presentation material (Ref.9). Start-up meetings are classified as Level 3 interactions and NGL took minutes of the meeting, which will be provided to ONR in due course and filed in the Reactor 4 periodic shutdown TRIM folder.
77. ONR was represented by the CNRP operating reactor sub-programme lead (superintending inspector), the nominated site inspector and myself. The salient points of the meeting were recorded in an intervention report (Ref.7). There were no outstanding actions or issues arising from the start-up meeting that would prevent Reactor 4 returning to service for a further period of three years.

4 MATTERS ARISING FROM ONR'S WORK

78. I have considered the licensee's request to ONR to issue Consent under LC 30 (3) to start-up Hinkley Point B Reactor 4 on completion of its periodic shutdown. I have followed ONR procedures for delivering a permissioning project, as detailed in HOW2. I have taken note of the statements associated with safety contained in the request letter, the findings of the outage associated work undertaken by NGL's internal regulator (INA) and the findings and opinions of ONR specialist inspectors.

79. Each ONR specialist inspector has produced an assessment report (where appropriate), that presents the inspection findings, inspector's opinions, judgements and recommendations. A number of recommendations and actions arose from the inspectors' work, resolution of which is required before ONR issues a Consent to restart Reactor 4:
80. The structural integrity specialist inspectors recommended that:
- To demonstrate satisfactory completion of the steam system inspection programme and completion of the work of the Outage Assessment Panel, the INSA concurrence certificate for the Return to Service Engineering Change should be submitted as part of NGL's application for consent to return to service. This has been provided as (Ref. 29).
 - To demonstrate satisfactory completion of the Pressure Systems Safety Regulations inspections, a statement from the Competent Person should be submitted as part of NGL's application for consent to return to service. This has been provided as (Ref.1).
 - To demonstrate satisfactory completion of the inspections not covered by the APEX and PSSR competent person, namely the gas side penetrations of the reactor pressure boundary, NGL must provide a statement supporting the fitness for return to service. This has been provided as (Ref.1).
81. Other recommendations made by specialist inspectors are sufficiently captured as new regulatory issues, none of which have been deemed sufficiently significant for ONR to withhold Consent to start-up Reactor 4. The nominated site inspector will follow up on the two technical specification non-conformances and the two significant near misses in due course.
82. Each specialist inspector assessment report contains a statement supporting issuing Consent to start-up Reactor 4, or there is no reason to withhold Consent.
83. The nominated site inspector has consulted EA to establish if they had any specific objections that would prevent ONR from issuing LI 548, Consent to start-up Hinkley Point B Reactor 4 EA has confirmed they do not object to ONR issuing Consent (Ref.30).

5 CONCLUSIONS

84. The Hinkley Point B Reactor 4 periodic shutdown has been undertaken in accordance with the requirements of the work scope outlined within Hinkley Point B's OID and start-up report.
85. The licensee has followed their arrangements in undertaking the outage, culminating in the Hinkley Point B Station Director writing to ONR requesting Consent to start-up Reactor 4. In his letter, the Station Director confirms that following completion of outstanding work, as controlled by the Operational Safety Review Committee (OSRC), Reactor 4 will be safe to return to service and operate for a further period. He commits to personally review the OSRC recommendation prior to sanctioning the commencement of start-up and will perform a walk-down prior to start-up to satisfy himself that Reactor 4 is safe to return to service.
86. INA will submit its Concurrence Part B report to Hinkley Point B's OSRC as part of the Station's consideration as to whether Reactor 4 is fit for return to service, in accordance with NGL's company arrangements.

87. ONR inspectors have sampled the LC28 MITs and LC22 modification activities throughout the shutdown and judged them to be adequate, and all support issuing Consent to start-up Reactor 4.
88. The nominated site inspector has consulted with EA, which has confirmed it does not object to ONR issuing Consent.
89. I have prepared a Consent LI 548 for review in conjunction with this PAR. The licence instrument is one of the standard formats given within ONR procedures and does not require review by the Solicitors Office.
90. I judge that, based on the evidence presented within this report, the outage activities on Reactor 4 have been satisfactorily completed and there is nothing to prevent ONR granting Consent to start-up Hinkley Point B Reactor 4.

6 RECOMMENDATIONS

91. I recommend that the Superintending Inspector should:
 - Sign this Project Assessment Report to confirm acceptance for the ONR technical and regulatory arguments that will help to justify issuing Licence Instrument 548.
 - Sign this Project Assessment Report approving its release for publication, after redaction where appropriate.
92. I further recommend that the Deputy Chief Inspector signs Licence Instrument 548, which grants Consent under Licence Condition 30 (3) to start-up Hinkley Point B Reactor 4

7 REFERENCES

1. Request for start-up of reactor 4 made under licence condition 30(3) – 31st March 2015 - HPB51330R Trim Ref 2015/123495, 123508 & 123617.
2. Hinkley Point B - Licence instrument No. 535 – Consent to restart reactor 4 following statutory outage - December 2011 - TRIM 2011/653885.
3. Hinkley Point B - Licence instrument No. 545 – Agreement to an extension of operating period of HPB Reactor 4 from 22 Decemebr 2014 to 6 february 2015. Trim ref 2014/441470.
4. NGL – Hinkley Point B – Outage Intentions Document – Unit R4/TA8, 2015 Statutory Outage, Unique No. HINB/R/MOZ/299. Trim ref 2015/43598.
5. Intervention Record-ONR-HPB-IR-14-118; Planned Compliance Inspection of Hinkley Point B Site – August 2014. Trim Ref 2014/319968
6. Outage Intentions Meeting Minutes Trim Ref 2015/123559
7. Intervention Record ONR-HPB-IR-14-233; Planned intervention including start-up meeting 16-19 March. Trom ref 2015/118679.
8. Start-up meeting report. Trim ref 2015/123082
9. Start-up meeting presentation. Trim ref 2015/123065
10. INA Concurrence Part B. Trim ref 2015/123635
11. INA Concurrence Part A. Trim ref 2015/122869
12. HPB outage task sheet. Trim ref 2015/242681
13. HPB R4 Statutory Outage 2015, ONR action tracker spread sheet. Trim ref 2015/49204.
14. HOW2 Guidance NS-PER-GD-014 Revision 4 Purpose and scope of permissioning. Trim ref 2014/261952
15. Assessment Report; QMS Oversight Arrangements for HPB Statutory Outage 2015. ONR-CNRP-AR-14-117. Trim ref 2015/107261.
16. Assessment Report; Assessment of the Appointed Examiners Start Up Statement for the Pre-stressed Concrete Pressure Vessel. ONR-CNRP-AR-15-123. Trim ref 2015/113129.
17. Assessment Report; Compliance with Ionising Radiations Regulations 1999 in preparation for and during its Statutory Outage 2015. ONR-CNRP-AR-110. Trim ref 2015/85539.
18. Assessment Report; Mechanical Engineering Specialist Assessment in Support of HPB R4 Statutory Outage and Return to Service. ONR-CNRP-AR-14-109. Trim ref 2015/114620.
19. Assessment Report; Electrical Engineering Assessment. ONR-CNRP-AR-14-122. Trim ref 2015/120983.
20. Assessment Report; HPB R4 Statutory Outage 2015 Control & Instrumentation Assessment. ONR-CNRP-AR-14-120. Trim ref 2015/116849.
21. Assessment Report; HPB R4 Return to Service after the 2015 Statutory Periodic Shutdown – Graphite Integrity Aspects. ONR-CNRP-AR-14-125. Trim ref 2015/115408.
22. Email – Graphite Interactions – Trim ref: 2015/102277.
23. Graphite Assessment Panel – Return to Service EC 355026. Trim ref 2015/109671.
24. Assessment Report; HPB Structural Integrity Aspects of the Reactor 4 Periodic Shutdown in 2015. ONR-CNRP-AR-15-126. Trim 2015/114899.
25. Assessment Report; Hinkley Point B Reactor 4 Return to service following 2015 statutory outage – Radwaste. ONR-CNRP-AR-14-119. Trim 2015/117290.
26. Rapid Trending Review presentation. Trim ref 2015/123591.
27. Intervention Record ONR-HPB-IR-14-127; Planned intervention LC26. Trim ref 2015/30334.
28. Outage Assessment Panel (OAP) Return to service EC 349675 and INSA statement. Trim ref 2015/120148.
29. Boiler Assessment Panel (BAP) Return to Service EC 349673 and INSA statement. Trim ref 2015/118377.

30. Lower boiler annulus doors Retrun to Service EC 355315 and INSA statement. Trim ref 2015/118996.
31. Response from EA to confirm no objection to Hinkley Point B request for consent to restart Reactor 4. Trim Ref 2015/123573.
32. Email NGL – ONR re outage scope changes and post start-up meeting emergent work. Trim ref 2015/124604.