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Role	Name	Position	Signature	Date	TRIM Ref
Author	[Redacted]	[Redacted]	[Redacted]	12/11/2018	2018/316922
Reviewer	[Redacted]	[Redacted]	[Redacted]	12/11/2018	2018/367095
Accepted by <sup>1</sup>	[Redacted]	[Redacted]	[Redacted]	12/11/2018	2018/367934
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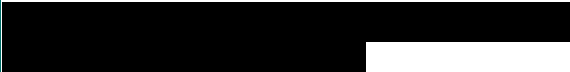

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## Torness Reactor 2 Periodic Shutdown 2018 Consent to Start-Up Reactor 2 Following Periodic Shutdown

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## EXECUTIVE SUMMARY

### Title

Torness Reactor 2 Periodic Shutdown 2018 - Consent to Start-Up Reactor 2 Following 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 Torness 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, Inspection, Maintenance and Testing (EIMT).

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 specified, under LC 30(3) of Torness Nuclear Site Licence Sc.14 Licence Instrument No 6 dated 28 March 1996, that NGL shall seek ONR's consent to start-up a reactor at Torness Power Station following shutdown under LC 30.

### 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 EIMT 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 Torness 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 Torness Reactor 2 periodic shutdown confirms that NGL has carried out EIMT 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 Torness Reactor 2 following its 2018 periodic shutdown to continue operating up to the next planned shutdown in 2021.

## **Recommendation**

The ONR Outage project inspector recommends that Licence Instrument 556 is issued to grant ONR's Consent to start-up Torness Reactor 2, following its 2018 periodic shutdown.

## LIST OF ABBREVIATIONS

ALARP	As Low As Reasonably Practicable
APEX	Appointed Examiner
C&I	Control and Instrumentation
CGOT	Channel Gas Outlet Temperatures
CNS	Civil Nuclear Security (ONR)
EDF	Électricité de France
EIMT	Examination, Inspection, Maintenance and Testing
EPPE	Essential protection plant equipment
HOW2	(Office for Nuclear Regulation) Business Management System
HSE	Health and Safety Executive
LC	Licence Condition
LOLER	Lifting Operations and Lifting Equipment Regulations
NFD	Neutron Flow Detectors
NGL	Nuclear Generation Ltd
ONR	Office for Nuclear Regulation
PAR	Project Assessment Report
PCPV	Pre-stressed Concrete Pressure Vessel
PMS	Plant Maintenance Schedule
PTSE	Post trip sequencing equipment
PSSR	Pressure Systems Safety Regulations
R2	Reactor 2
RGP	Relevant Good Practice
SAP	Safety Assessment Principle(s)
SFAIRP	So Far As Is Reasonably Practicable
SI	Structural Integrity
SSC	Structure, System and Component
TAG	Technical Assessment Guide (ONR)
TOLCS	Torness plant control system
UMD	Unlined Monitoring Duct
VFC	Variable Frequency Converters
VSD	Variable Speed Drives

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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) Torness 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 Torness Reactor 2 (Reference 1) as required under Nuclear Site Licence Condition (LC) 30(3): Periodic Shutdown. Torness Nuclear Power Station is an Advanced Gas-cooled Reactor (AGR) comprising 2 reactors, identified as Reactor 1 (R1) and Reactor 2 (R2). The current shutdown period for Reactor 1 and Reactor 2 is 3 years based upon safety justification set out in the Station's Safety Case and PMS requirements.
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 (EIMT).
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 of LC 30 (1) it should not be started up again thereafter without the consent of ONR. This is the case for Torness Power Station reactors as ONR specified under LC 30(3) by issuing Licence Instrument (LI) No 6, dated 28 March 1996, Unique Document Ref TOR 70861 N under Torness Nuclear Site Licence Sc. 14 (Reference 2).
6. NGL formally engaged with ONR in April 2018 through the Outage Intentions meeting (Reference 3). At this meeting NGL set out its intended scope of work through its Reactor 2 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 the Torness approach for managing safety and quality during the outage which was to be delivered by processes set out in corporate and local Torness arrangements (References 5, 6, 7 and 8).
7. The Torness Reactor 2 outage commenced on 07 September 2018. At the Outage Start-up meeting on 23 October 2018 (Reference 22) NGL presented findings from the Reactor 2 Outage. NGL did not identify any issues that would prevent start-up of Reactor 2 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**

8. The purpose of 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.
9. 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 Torness Reactor 2 outage was to confirm nuclear safety requirements have been suitably addressed.
10. Prior to the commencement of the periodic shutdown ONR specialist inspectors 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 Shutdown Intervention Plan (Reference 25) for the various specialist discipline inspections and assessments carried out during the Torness Reactor 2 outage:
  - Civil Engineering
  - Structural Integrity
  - Graphite Reactor Core
  - Mechanical Engineering
  - Electrical Engineering
  - Control and Instrumentation
  - Fire (Scotland) Act 2005
  - Conventional Health and Safety
  - Radiological Protection
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 9) and the Fire (Scotland) Act (Reference 10) were also undertaken during the outage to support Reactor 2 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 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 Torness Reactor 2 outage. These provide the information and evidence to build ONR's considerations and judgment to consent start-up of Torness Reactor 2 and operation for a further 3 years, until its next statutory outage which is 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 References 11 and 12. The following areas were sampled during the inspector's interventions;
  - Previous APEX recommendations relevant to Reactor 2;
  - Previous ONR recommendations;
  - Pre-stressed concrete pressure vessel Appointed Examiner's inspections and examinations;
  - Visual inspection of concrete surface condition;
  - Visual inspection of pre-stressing anchorages;
  - Tendon residual load tests;
  - Pre-stressing strand and grease condition;
  - Strand tensile testing;
  - Settlement and tilt survey;
  - Review of embedded strain gauge readings;
  - Review of vessel concrete temperatures;
  - Review of reactor coolant leakage;
  - Review of pressure vessel cooling water leaks;
  - Top cap deflection survey;
  - Visual inspection of PCPV support bearings.
16. During the pre-outage inspection (Reference 12), the specialist inspector discussed the status of the APEX's recommendations contained in the 28 day Statutory Examination Report for the Reactor 2 periodic shutdown in 2015 (Reference 13).
17. The ONR inspector also discussed the status of the APEX recommendations contained in the 28 day Statutory Examination Report for the Reactor 1 (R1) periodic shutdown in 2017 (Reference 28) that were also relevant to Reactor 2 and the status of the outstanding recommendations from ONR's assessment of the APEX's Start up Statement for the 2015 Reactor 2 periodic shutdown (Reference 14).
18. Based on the areas sampled, the ONR inspector did not find any significant shortfalls in the surveillances and inspections reported by the Appointed Examiner and did not identify any concerns regarding the integrity of the pre-stressed concrete pressure vessel for Reactor 2. The pre-stressing surveillances demonstrated that the vessel had an adequate margin of pre-stress in excess of the design minimum.
19. The reactor is expected to return to service with one minor cooling water leak. The inspector concluded that the temperature monitoring results presented by the APEX provided adequate assurance that the pressure vessel cooling water system is operating in an acceptable manner without significant detriment to the integrity of the PCPV. The inspector was therefore satisfied that the leak is relatively minor, is being appropriately managed to reduce the risk of concrete degradation and that the licensee intends to carry out work to find and if possible seal the leak after return to service. The inspector is content that the APEX has recommended that the leak be addressed at the earliest opportunity and they intend to follow up progress with the leak searching and sealing activities following return to service as part of normal regulatory business.
20. An investigation report identified that there was potentially a single blocked Unlined Monitoring Duct (UMD) on Reactor 2. The UMDs are used as part of the surveillance regime to detect main reactor coolant loss. The APEX had raised a recommendation that NGL undertakes further investigations into the flow path through the UMDs to confirm that there is a clear passage for reactor coolant gas (CO<sub>2</sub>) that would enable leaks to be detected. As there is no evidence that there are any significant leaks of

reactor coolant gas into any of the UMDs the inspector is content to follow up this matter as part of normal regulatory business after return to service.

21. The ONR civil inspector has therefore concluded based on assessment of the results of the surveillances and inspections (as reported in the documentation provided), the site inspection, discussions held with the APEX, and acceptance of the judgements made by the APEX, that from the civil engineering perspective that they are content to support 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**

22. The ONR inspector's view and judgement from the site intervention and assessment are recorded in References 15 and 16. The inspector sampled aspects of the inspection programme undertaken during the periodic shutdown on the steam and feed systems and other safety related systems external to the reactor pressure vessel. Other aspects of the inspection programme on the metallic components internal to the reactor were also sampled.
23. Based on the information sampled during the visit to site, the inspector did not identify any nuclear safety significant issues of concern. The inspector was satisfied that the licensee is adequately managing any defects or anomalies identified and judged that, from a structural integrity perspective, the licensee has performed the examination, inspection, maintenance and testing work to an adequate standard against the requirements of LC28. At the time of the visit, the remediation work identified as part of the routine inspections was being progressed satisfactorily and will be subject to further inspections in accordance with the licensee's internal arrangements before a request for consent to return to service is made.
24. Based on the inspection, the structural integrity inspector found no issues likely to affect nuclear safety, which would prevent the return to service of Torness Reactor 2 following the 2018 periodic shutdown.
25. The ONR inspector also monitored the Outage Assessment Panel (OAP) minutes throughout the outage to identify how the inspections were progressing and how any emergent issues identified were being managed and resolved.
26. During leak testing of new thermocouples installed in the reactor vessel during the outage the external bolted flange failed its leak test. The outermost seal has been proven to be leak-tight, as well as the thermocouple glands, however the innermost seal was leaking. Following review of the return to service EC (Reference 27), the structural integrity inspector is now satisfied that the sealing of the leak on the flange interspace on the modified gas sampling penetration, that NGL have appropriately dealt with this issue in restoring the design intent of the component (Reference 33) .
27. Based upon the sampling that the inspector undertook, and the evidence presented, it was judged that the licensee has undertaken sufficient inspection and assessment, from a structural integrity perspective, to fulfil the arrangements required made under LC28 and hence supports the return to service Torness Reactor 2.

#### **4.3 GRAPHITE INTEGRITY ASSESSMENT**

28. The ONR inspector's views and judgement from the assessment of Torness, Reactor 2 graphite return to service safety case and LC28 inspection are recorded in Reference 17 & 18.
29. The specialist inspector carried out a site intervention at Torness during the periodic shutdown on 1 October to assess the licensee's arrangements with regard to the

graphite core and peripheral bricks inspections. The activities examined were selected due to their nuclear safety significance and agreed in advance of the visit with station and the site inspector. At the time of the intervention, NGL had inspected fifteen fuel channels out of the sixteen required from the PMS. During the intervention, the inspector carried out the following activities:

- Confirmation of PMS requirements and progress against them;
- Inspection of the core inspection and peripheral bricks inspection equipment;
- Inspection of the calibration records of the inspection equipment;
- Inspection of the quality of the inspection video footage;
- Inspection of the training records of inspection staff.

30. At the time of the intervention on site, the graphite inspections carried out were within expectation and no cracks had been found in the channels inspected within the core. NGL had completed the inspection of the first five faces of the peripheral wall around the core. NGL presented the findings of the inspection. From the specialist inspector's observations, it was concluded that NGL's LC28 arrangements appeared to be satisfactory.
31. During the periodic shutdown, NGL carried out visual inspection and bore channel measurements from sixteen fuel channels and visual inspection of one control rod channel. Thirty-five samples were trepanned from the core. This satisfies the requirements from the PMS. The trepanned samples will be analysed in due course to provide information on the properties of the core. No new defects were found during the inspections of the graphite core. According to the information provided by the Licensee, the measurements from the bore of the fuel channels were within expectations and did not reveal any adverse findings.
32. During the periodic shutdown, eleven of the sixteen faces of the graphite peripheral wall were inspected, five of which had already been inspected in 2015. Approximately 2.0% of the total number of peripheral bricks were found to be cracked. The findings from the re-inspected faces of the peripheral bricks indicate that progress of damage had been slow and insignificant between 2015 and 2018. The findings of the peripheral wall inspections are generally consistent with previous observations in all four reactors at Heysham 2 and Torness. The inspector considered that the inspection findings appear to be consistent with the safety case and should not prevent the return to service of the reactor.
33. During trepanning and after the inspector had completed their assessment, an error in the angular setting of the trepanning tool was made. This error affected one sample only in fuel channel V75, brick 4. The inspector questioned whether the trepanning error could have resulted in damage to a keyway. The inspector has reviewed the evidence presented in the RTS EC 363392 (Reference 27) and in NGL's replies to requests for further information (Reference 30).
34. Concerning the possible trepanning into a keyway, NGL claims that '*the sample is far enough from the keyway that there will be negligible effect on propensity to keyway root cracking*'. To support this claim, NGL provided a diagram showing the location where trepanning has been carried out. NGL estimated that the distance between the trepanned hole and the corner of the keyway is ~15mm and that cracking should therefore not be a concern. The inspector is satisfied that the information presented in the RTS EC 363392 and in the e-mail (Reference 30) supports NGL's view. It also noted that NGL will carry out an investigation on the cause for the error (Reference 31). The inspector is therefore satisfied with the evidence provided by NGL concerning this issue (Reference 32).

#### 4.4 MECHANICAL ENGINEERING INTERVENTION

35. The ONR mechanical engineering inspector carried out an LC 28 compliance inspection on 2 – 3 October 2018 (Reference 19). The following areas were sampled during the inspection:
- Gas Circulators 7B 2AX1, 2BX1 exchange and 2AX2 and 2CX1 impellor inspection,
  - Results of Control Rod Drop Tests,
  - Shutdown Boron Bead Injection System 12 yearly flow checks.
36. The inspection also covered NGL arrangements for compliance with LC28 Examination, inspection, maintenance and testing (EIMT).
37. The inspector sampled and examined written instructions used by operators to undertake examination, inspection, maintenance and testing and confirmed that activities are carried out in accordance with written instructions with a specified periodicity and that this interval is specified appropriately in the plant maintenance schedule. A clear auditable trail existed from the specified EIMT through to completion of the activities.
38. Quality plans for EIMT work were examined and found to be comprehensive, containing suitable hold points, ensuring that work did not progress unchecked.
39. The inspector concluded that from a mechanical engineering standpoint, they were content with the way in which the licensee was conducting its statutory shutdown work programme and is of the opinion there is no actual or emerging issues prevent the licensee bringing the Torness Reactor 2 back to power in due course.
40. At the time of writing their record, there were no significant recommendations that they consider would prevent ONR granting consent, under licence condition 30 of the licensee's nuclear site license allowing the licensee to return the Torness Reactor 2 to power following its 2018 statutory shutdown.

#### 4.5 ELECTRICAL ENGINEERING INTERVENTION

41. The ONR electrical engineering inspector carried out a pre-outage teleconference (Reference 20) in July 2018, to take the opportunity to enhance ONR's understanding of the electrical engineering activities that would be undertaken during the periodic shutdown.
42. The ONR electrical engineering inspector conducted an LC 28 compliance inspection on 3 October 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;
- EC 360395 - Gas Circulator 2AX1 11kV cable replacement.
  - EC 361209 - GEC M80 low voltage circuit breaker replacement.
  - EC 361292 - Gas circulator Variable Frequency Converters (VFC)/Variable Speed Drives (VSD) replacement.
43. The ONR inspector also conducted a plant walk-down of a sample of the station's electrical system which included:
- Unit Transformer 2D 23.5kV/11kV.
  - 3.3kV Switchgear 2C.
  - 3.3kV Switchroom Unit 2B.
  - Unit 2B Switchroom and 2BX2/2BX1 VSDs.
  - 2AX1 11kV circuit breaker, 11kV cables and phase imbalance CTs.

- 132kV/11kV Station Transformer 2.
  - 250V DC Unit Charger/Battery Board 2.
  - Main Protection Suite, including Generation Transformer Protection 1.
44. Based on the discussions, explanations and the sample inspected, the inspector was satisfied that there are no significant shortfalls identified with the implementation of the established arrangements for LC28 EIMT in relation to the planned electrical work undertaken as part of the Torness power station Reactor 2 2018 periodic shutdown. The targeted inspection undertaken confirmed that the planned EIMT and modification activities during this shutdown were appropriate and that electrical plant and equipment that was being maintained and modified in accordance with the established arrangements.
45. There was one finding related to the need to review the acceptance criteria for insulation resistance checks. A Level 4 Regulatory issue was raised to provide regulatory oversight of the review (and if needed revision) of the relevant instructions.
46. To conclude based on these targeted interventions there were no issues identified from the electrical work activities which would prevent ONR granting Consent for Torness to return to service from the current outage and periodic shutdown.

#### **4.6 CONTROL AND INSTRUMENTATION INTERVENTION**

47. The ONR control and instrumentation inspector carried out an LC 28 compliance inspection (Reference 29) focussing on maintenance of the following systems;
- Reactor safety circuits, including:
    - Neutron flux detectors (NFDs) and related electronics testing;
    - Main and diverse guardlines maintenance and testing;
    - Auxiliary guardlines maintenance and testing;
    - Channel outlet gas temperature (COGT) and quadrant protection equipment (QPE) thermocouples testing;
  - Post trip sequencing equipment (PTSE) maintenance and testing;
  - Essential protection plant equipment (EPPE) maintenance and testing;
  - Torness plant control system (TOLCS);
  - Engineering changes (ECs);
  - Recent INF1 reports.
48. During the inspection, the specialist inspector found examples of good ageing and obsolescence forward planning and management. The inspector also found the plant areas and equipment cubicles inspected were clean, tidy and free from foreign materials, which demonstrated that good housekeeping practices were being followed. The individuals consulted demonstrated a good level of knowledge of the systems they were responsible for and adequate appreciation of the nuclear safety implications of related failures. Examples of good leadership and nuclear safety culture were also apparent from the discussions with the protection and electrical group head and the system engineers. Based on the discussions during the outage, the inspectors also noted a positive management of cyber security risk.
49. As part of the inspection, the inspector also identified some additional areas of interest which could not be addressed in full during the inspection because of the level of progress in the maintenance activities or due to the need of additional investigation from the station for their resolution. These outstanding areas of interest were captured with actions under an ONR regulatory issue (number 6690). Based on the confidence gathered during the outage inspection, the inspectors do not consider these actions to be sufficiently relevant from a nuclear safety perspective to prevent the return to service of Torness Reactor 2. ONR will monitor progress in resolving the regulatory issue database as part of the normal regulatory business.

50. On the basis of the inspection of the C&I aspects of the Torness Reactor 2 outage, no issues were identified that should prevent ONR Consent to allow Reactor 2 at Torness to be started up again following successful completion of the planned maintenance activities in accordance with LC30.

#### **4.7 RADIOLOGICAL PROTECTION INTERVENTION**

51. ONR radiological protection specialists carried out an inspection to provide regulatory confidence in the implementation of the Torness Power Station Reactor 2 Statutory Outage Intentions Document in relation to RP and compliance with Ionising Radiations Regulations 2017 (IRR17) which included:
- RP aspects of the Torness Power Station Reactor 2 Statutory Outage Intentions Document TOR/OM/030/PW/18.
  - Review of the Pre-Outage ALARP Records including the Vessel Entry ALARP Record and the Overarching Vessel Entry ALARP Review.
  - Overall RP arrangements for staff and contractors during the outage.
  - Suitability of Radiation Work Permits (RWPs) and Local Rules.
  - Man access arrangements for vessel entry.
  - Contingency plans for vessel entry work.
  - Contingency plans for open vessel pile cap operations.
  - Arrangements for providing adequate contamination monitoring of persons and areas.
  - RP resources and implementation of arrangements.
  - Control and supervision of RP support contractors.
  - Vessel entry complex arrangements.
  - Designation of temporarily C2 contamination areas.
  - Radiological protection arrangements for:
    - New In-Core Inspection Equipment/Trepanning inspection work
    - Site radiography
52. The inspectors were content with the Licensee's conduct of its statutory outage work programme and with its level of compliance against its associated radiological protection documentation (policies & procedures). The inspectors raised one regulatory issue concerning clarification of the actions to be undertaken by specific work groups in response to fire and nuclear emergency alarms. Advice was also given concerning other potential areas for improvement, which the site undertook to respond to.
53. The RP inspection identified no matters that should prevent ONR granting a Consent under licence condition 30 allowing the Licensee to return Reactor 2 to power in due course.

#### **4.8 FIRE SAFETY INTERVENTION**

54. The ONR fire safety inspector carried out a compliance inspection against the Fire (Scotland) Act on 26 September 2018 (Reference 10). The inspection focussed on the safety of people from the danger of fire during the Reactor 2 outage targeting the measures adopted to maintain compliance with the requirements of the Fire (Scotland) Act 2005 due to changes in the fire risk profile caused by the outage.
55. The inspector concluded that findings in relation to the areas inspected demonstrated a good level of life/fire safety provision and that suitable fire precautions were in place to support the consent for the return of power to for Torness Reactor 2.

#### **4.9 CONVENTIONAL SAFETY INTERVENTION**

56. ONR conventional health and safety inspectors carried out an inspection on site during the first week of the outage. (Reference 9). A number of areas were identified where improvements are required; in addition examples of good standards were seen during

the visit. These were summarised during feedback provided at the conclusion of the visit. The Industrial Safety Engineer and the Technical, Safety & Support Manager were present at the feedback session.

57. Workplace transport was identified as an area for improvement during the inspection. The ONR Inspector highlighted the issues discussed above and requested that NGL address the lack of pedestrian and vehicle segregation in a number of areas to ensure that vehicles are banked when reversing on site and to review the policy on vehicle key control on site. ONR will monitor the work to ensure the EDF NGL take action to ensure that the correct controls are put in place.
58. The inspectors also witnessed an issue with confined spaces; the ONR conventional health and safety inspector asked that NGL review the current rescue plans for the activity observed at the Pile Cap and all confined space work on site in the same category (Cat 1 Beta) and test the revised rescue plans to ensure that they are suitable and sufficient.
59. The actions required to improve the workplace transport issues and confined spaces were shared with EDF NGL and they agreed to take action to remedy these issues. Issues will be added to the ONR Regulatory database, and are subject to ONR's governance processes. These shortcomings aside, health and safety management standards were acceptable in general, and the inspectors are confident that the Licensee will respond positively and effectively. Issue 6676 and 6677 have been raised on the ONR issues database but it was concluded that there were no issues that would challenge the return to service of Reactor 2.

#### **4.10 ONR SITE INSPECTOR OVERVIEW OF OUTAGE ACTIVITIES**

60. During the first week of the periodic shut down the ONR site inspector attended the Rapid Trending Review with ONR conventional safety inspectors (Reference 9).
61. The ONR Site Inspector found the Rapid Trending Review to be a well-targeted and helpful intervention by a competent team who demonstrated objectivity in arriving at their conclusion.
62. The ONR site inspector concluded that there were no findings from their inspection that indicate that nuclear safety is significantly undermined, or which would result in changes to the planned interventions and inspections of Torness Power Station.

#### **4.11 RETURN TO SERVICE MEETING**

63. A return to service meeting was held on the on 23 October 2018. The purpose of the meeting was for NGL to present the findings to date of the Torness Reactor 2 2018 periodic shutdown to ONR. The shutdown of Reactor 2 has been undertaken in compliance with NGL's Nuclear Site Licence.
64. Prior to the start-up meeting, ONR inspectors were given the opportunity for a plant walk down to visit some of the areas where work has been completed during the outage. Areas visited included:
  - The vessel entry complex including the control room, the communications control room and some work being carried out on a boiler closure unit;
  - The gas circulator annulus where the inspector was able to see a gas circulator (AX2) undergoing installation and commissioning tests;
  - The uninterruptable power source (UPS) battery and electrical cabinet replacement;
  - Turbine hall including foreign material exclusion (FME), auxiliary cooling water (ACW) pipe replacement and hydrogen gas detection system.



65. The areas visited were all in good condition with good housekeeping observed in all areas. The plant visit gave a good perspective on the work being done during the outage and all representatives from the licensee were knowledgeable with a good understanding of the work being carried out and safety implications.
66. During the return to service meeting, the licensee gave an overview of completed activities highlighting any events and challenges.
67. Overall the outage has proceeded to plan. No significant conventional safety, radiological protection or nuclear safety events have occurred during the outage to date.

#### **4.12 ENGAGEMENT WITH OTHER GOVERNMENTAL AGENCIES**

68. ONR has engaged with the Scottish Environment Protection Agency who has confirmed that they have no objections to the completion of the outage and the restart of Reactor 2 (Reference 23).

### **5 CONCLUSIONS**

69. NGL's request to ONR for consent to start-up Torness Reactor 2 following periodic shutdown in compliance with LC 30(3) has been supported by their letter (Reference 1) stating that all plant maintenance schedule requirements and modifications identified in the Reactor 2 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.
70. NGL has submitted the Torness Reactor 2 APEX report (Reference 24) 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 civil engineering inspector supports ONR issuing consent for Reactor 2 start-up.
71. NGL's return to service safety justification for Reactor 2 is set out in EC363392 covering graphite and steel components (Reference 27). It confirms that no safety issues have been identified from EIMT activity to challenge safety case claims that would prevent Reactor 2 start-up or its safe operation until its next periodic shutdown planned in 2021. NGL support 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 Reactor 2 shutdown, who agreed that claims and arguments presented are in line with their views from intervention findings and assessment. ONR SI and graphite specialist inspectors support ONR issuing consent for Reactor 2 start-up.
72. Torness Independent Nuclear Assurance (INA) has provided a statement (Reference 26) that based on their Reactor 2 shutdown concurrence activities to date no issues have been identified that would challenge their support for start-up of Reactor 2.
73. Based on evidence gathered from ONR's intervention and assessment activities for the Torness Reactor 2 shutdown together with claims, arguments and evidence presented

by NGL in its request for start-up of Reactor 2, it is my judgement that Torness power station has complied with its LC30(1) requirements for Reactor 2 in carrying out the required EIMT 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 EIMT findings were anomalous with safety case requirements, NGL has provided adequate safety justification that relevant safety case limits and conditions are not challenged.

74. In conclusion, ONR has identified no matters of concern that would prevent ONR granting consent for Torness 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**

75. I recommend that, in response to the request by NGL, ONR issue Licence Instrument 556 granting consent under LC30(3) of Nuclear Site Licence Sc.14 to start-up Torness Reactor 2 following the 2018 Periodic Shutdown.

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