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<b>Project:</b>	Amendment to Nuclear Safety Requirements at Hunterston B		
<b>Site:</b>	Hunterston B Power Station		
<b>Title:</b>	Request for Approval under Licence Condition 23(5) of amendment to Nuclear Safety Requirements at Hunterston B Power Station		
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# **Amendment to Nuclear Safety Requirements at Hunterston B Power Station**

## **Revision to Nuclear Safety Requirement 6**

Project Assessment Report ONR-HNB-PAR-15-014  
Revision 0  
11 September 2015

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## EXECUTIVE SUMMARY

### Background

EDF Energy Nuclear Generation Ltd (NGL) complies with Licence Condition 23 through Technical Specifications, which form the principal means by which it demonstrates the requisite conditions and limits necessary for safety. Nuclear Safety Requirements (NSR) constitute a subset of Operating Rules that are approved by ONR under Licence Condition (LC) 23(4), amendments to which are subsequently approved under LC 23(5).

NSR 6 specifies the minimum extent and availability of plant required to provide adequate electrical supplies necessary for equipment to successfully perform its intended nuclear safety function. NGL considers that the current version of NSR 6 does not adequately consider recent plant improvements and upgrades in the electrical systems. As a result, NGL considers that the NSR and associated Technical Specification Limiting Conditions of Operation (LCO 6) for the electrical systems are unduly conservative and restrictive, in the extent to which they require plant availability.

NGL has claimed that the removal of unnecessary conservatisms and restrictions from NSR 6, as an enabler to a future amendment to supporting LCOs, will provide wider benefits to nuclear safety, associated with increased flexibility in maintenance and equipment reliability and will alleviate undue commercial vulnerabilities.

### Permission Requested

NGL has requested approval under LC 23(5) of an amendment to replace NSR 6 - Revision 3, dated 03 May 2002, with NSR 6 – Revision 4, dated 30 September 2015. NGL's application proposes changes in the applicability of the NSR to '*at all times*' and alterations to the availability requirements for a number of electrical systems to better reflect the safety claims on those systems.

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

Assessment of this submission has been undertaken according to the following parameters:

1. An examination of the associated Engineering Change Category 2 proposal, focussed upon verifying appropriate evidence to underpin the relaxations in availability requirements of nuclear safety-significant electrical systems;
2. A sample examination of the associated nuclear safety justification presented for individual NSR changes for selected components of the electrical systems;
3. An examination of the consistency between the Category 2 Engineering Change and associated amendments to NSR 6;
4. Confirmation of appropriate rigour of Independent Nuclear Safety Assessment (INSA) and submission to the Nuclear Safety Committee in accordance with arrangements made under LC22(1);
5. Confirmation of appropriate margin, where practicable, between the LCOs in-draft and the proposed NSRs.

## **Matters arising from ONR's work**

During the course of assessing this submission, ONR has sampled the nuclear safety justification for two specific NSR amendments relating to:

- NSR 6.1.2 – 11kV, 3.3kV and 415V diesel generators. This was selected on the basis the NSR amendment constitutes a significant simplification from the extant version for equipment of high profile within the safety case and emergency preparedness under LC11.
- NSR 6.4.1 – Motor Generator sets and 415V AC no-break power supply. This was selected on the basis that the station proposes to implement associated LCOs as early as October 2015 (?), and claims this will reap immediate benefit in terms of operational flexibility.

In each case, ONR was satisfied that the proposed changes to NSR 6.1.2 and 6.4.1 are demonstrably underpinned by an appropriate nuclear safety justification for both operational configurations. ONR was further satisfied that both configurations are appropriately conservative to the extant LCO.

ONR has examined NGL's Independent Nuclear Safety Assessment (INSA) approval statement and considers that it constitutes an independent assessment of the licensee's submission of appropriate rigour and depth.

The modification was duly noted, in accordance with the licensee's LC 22 arrangements, at the June 2015 Nuclear Safety Committee.

## **Conclusions**

ONR judged that each of the five assessment parameters has been satisfactorily addressed. ONR was satisfied, based on the areas of the submission examined, that appropriate nuclear safety justification has been presented by the licensee to demonstrate sufficient levels of conservatism between the proposed NSR 6 Revision 4 and the extant LCOs.

## **Recommendations**

It was recommended that the ONR deputy chief inspector or other inspector with delegated authority should sign Licence Instrument No.548 and thus approve NGL's request under Licence Condition 23(5) to amend NSR 6, replacing Revision 3 with Revision 4.

## LIST OF ABBREVIATIONS

AC	Alternating Current
ALARP	As low as reasonably practicable
CCR	Central Control Room
DC	Direct Current
EC	Engineering Change
HNB	Hunterston B
HPB	Hinkley Point B
INSA	Independent Nuclear Safety Assessment
LC	Licence Condition
LCO	Limit and Condition of Operation
MG	Motor Generator
NGL	EdF Energy Nuclear Generation Limited
NSC	Nuclear Safety Committee
NSR	Nuclear Safety Requirement
ONR	Office for Nuclear Regulation

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## 1 PERMISSION REQUESTED

1. EDF Energy Nuclear Generation Ltd [NGL] has written to the Office for Nuclear Regulation [ONR] in letter HNB 50511R, dated 23 July 2015 <sup>[1]</sup> to request Approval from ONR to an amendment to Nuclear Safety Requirements [NSR] at Hunterston B.
2. Approval is sought, under LC23(5) to replace NSR 6 Revision 3, dated 03 May 2002, with NSR 6 Revision 4, dated 30 September 2015.
3. This request is supported by a Category 2 Engineering Change [EC 353586] <sup>[1]</sup> that outlines the safety case justification for the proposed amendments to NSR 6. The EC presents claims, arguments and evidence to support the assertion that the amendment will constitute an overall benefit to nuclear safety by allowing increased flexibility in maintenance schedules and equipment reliability programmes.

## 2 BACKGROUND

4. NGL complies with Licence Condition 23 through Technical Specifications, which form the principal means by which it demonstrates the requisite conditions and limits necessary for safety. Nuclear Safety Requirements constitute a subset of Operating Rules that are approved by ONR under Licence Condition 23(4), amendments to which are subsequently approved under Licence Condition 23(5).
5. Nuclear Safety Requirement [NSR] 6 specifies the minimum extent and availability of plant required to provide adequate electrical supplies necessary for equipment to successfully perform its intended nuclear safety function. The functional requirements for the electrical system covered under NSR 6 relate to the nuclear safety requirement for safe shutdown and post-trip cooling, both immediately following a reactor trip and in the longer term for a shutdown reactor. The electrical systems each have a role in provision of forced circulation cooling. There are two principal operating conditions when driving gas circulators, the most onerous of which are detailed below:
  - When the reactor is pressurised concurrent with loss of grid supplies, a single 11kV diesel generator, per reactor, is capable of driving up to three gas circulators;
  - When the reactor is de-pressurised concurrent with loss of grid supplies, a single 11kV diesel generator is capable of driving up to six gas circulators.
6. The gas circulator auxiliary systems and other supporting equipment must also be supplied at the appropriate voltage levels in each case; the entire safety related station load at the relevant voltage level can be supported by a single 3.3kV diesel generator, a single 415V diesel generator or a single battery. Therefore, in a shutdown sub-critical state, a single diesel generator or appropriate battery is sufficient to support cooling at any time, with the exception of the 11kV diesel generators and Motor-Generator [MG] sets where one per reactor is required.
7. NGL states in its submission that it considers the current version of NSR 6 does not adequately consider recent plant improvements and upgrades in the electrical systems. As a result, NGL considers that the NSR and associated Technical Specification Limiting Conditions of Operation [LCO 6] for the electrical systems are unduly conservative and restrictive, in the extent to which they require plant availability.
8. NGL has claimed that the removal of unnecessary conservatism and restrictions from NSR 6, as an enabler to a future amendment to supporting LCOs, will provide wider benefits to nuclear safety associated with increased flexibility in maintenance and equipment reliability and alleviate undue commercial vulnerabilities.

9. NGL's submission presents analysis and justification for each of the areas of the electrical system below, leading to proposed relaxations and simplifications to the NSR in each case:

- NSR 6.1.2 – Emergency Generators [11kV, 415V, and 3.3kV]
- NSR 6.2 – Essential electrical boards and interconnectors
- NSR 6.3 – DC essential systems
- NSR 6.4 – AC No-break systems

10. In each case, NGL's analysis is structured within two claims in accordance with *claims–evidence–arguments* format; this is consistent with its arrangements made under licence condition 14:

**Claim 1:** The proposed NSR changes specify acceptable plant levels required to support the essential functions of trip, shutdown and post-trip cooling.

**Claim 2:** The existing LCOs will be conservative with respect to the proposed NSR changes; i.e. there will be no conflict on implementation of the proposed NSR.

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

11. Assessment of the nuclear safety justification has therefore been focussed according to the following parameters:

1. An examination of the associated Engineering Change Category 2 proposal, focussed upon verifying appropriate evidence to underpin the relaxations in availability requirements of nuclear safety-significant electrical systems;
2. A sample examination of the associated nuclear safety justification presented for individual NSR changes for selected components of the electrical systems. This is limited to verification that the evidence provided in each case is clear and auditable. The assessment also examines associated claims for the extant LCO remaining conservative relative to the proposed NSR;
3. An examination of the consistency between the Category 2 Engineering Change and associated amendments to NSR 6;
4. Confirmation of appropriate rigour of INSA assessment and submission to the Nuclear Safety Committee in accordance with arrangements made under LC22(1);
5. Confirmation of appropriate margin, where practicable, between the LCOs in-draft and the proposed NSRs.

12. NGL's submission claims that the proposed relaxations to NSR 6 will result in an overall benefit to nuclear safety by allowing increased flexibility in maintenance schedules and equipment reliability programmes. I have sought further information from the licensee as to the detail and basis for these claims to ascertain better the relative urgency of the submission request. NGL has responded with further rationale,<sup>[2]</sup> summarised below:

- The current NSR 6 plant levels and the related LCO 6 plant availability and action completion times were derived simply from a recasting of the original Hunterston B Operating Rules. As a result, the NSR failed to take cognisance of the Electrical System redundancy;

- Once LCO 6's have been revised to accurately reflect the real Nuclear Safety Risk presented by individual plant configurations, then this benefit will also flow through to the Nuclear Risk Indicator, which is used as a decision making tool for planning and managing plant maintenance and repairs. Future operation and maintenance decision making based on the Nuclear Risk indicator will be enhanced as a result;
  - The relaxation of LCO 6 Action Completion times [to follow once approval of NSR 6 has been issued], to better reflect actual Nuclear Safety Risk for each plant configuration, will result in Operators not being placed under undue time pressures to restore/repair plant in short duration timescales;
  - The schedule for the delivery of the corresponding LCO 6 Technical Specification revisions will initially focus on LCO's 6.4.1 and 6.4.2 as the proposed alleviations in their Action Completion Times represents the greatest benefits derived in terms of Nuclear Safety and Operations. The Station Engineering and Design Authority resources required supporting the production of the LCO 6.4.1 & LCO 6.4.2 safety cases has already been agreed and committed to.
  - Historical incidents have occurred that have imposed disproportionate technical specification action times to avert double unit trip due to unduly onerous availability requirements for Motor Generator sets and associated no-break main boards.
13. Taking this information into account, I have judged <sup>[3]</sup> in this instance that a full assessment by a fault studies or electrical engineering specialist is not necessary based on the lower category of modification, NGL's extensive and systematic analysis in each case and verification by INSA. In addition, the Heysham 2 equivalent NSRs are actually non-specific around individual electrical availability requirements as they are embedded within the supporting LCOs in that case. NGL has presented clear rationale as to the benefits of increased flexibility in delivering maintenance programmes will be realised as early as October 2015.
14. I have noted that this submission is non-standard insofar as the supporting LCOs have yet to be submitted through NGL's internal processes. NGL has stated that the NSR was submitted first as an enabler for LCOs to be completed in due course. I do not consider that the absence of supporting LCOs at this stage should preclude consideration of this submission; this judgement is made on the basis that Claim 2 of the licensee's submission states that the existing LCOs will remain conservative with respect to the proposed NSR changes.

#### **4 MATTERS ARISING FROM ONR'S WORK**

15. During the course of assessing this submission, I have sampled two specific NSR amendments relating to:
- NSR 6.1.2 – 11kV, 3.3kV and 415V diesel generators. This is selected on the basis the NSR amendment constitutes a significant simplification from the extant version for equipment of high profile within the safety case and emergency preparedness under LC11.
  - NSR 6.4.1 – MG sets and 415V AC no-break power supply. This is selected on the basis that the station proposes to implement associated LCOs as early as October, and claims this will reap immediate benefit in terms of operational flexibility.

#### 4.1 Diesel Generators

16. The tables below are extracts from the licensee’s submission <sup>[1]</sup> to illustrate the extant and proposed text for NSR 6.1.2:

Current text for NSR 6.1.2:

NSR Table 6.1.2-1

Minimum AVAILABILITY Requirements for Diesel Generators

Diesel Generator Type		11 kV	3.3 kV	415V
<b>Plant State</b>				
Both reactors <b>OPERATING AT POWER</b>	<b>EITHER</b>	3	1	1
	<b>OR</b>	2	2	1
One reactor <b>OPERATING AT POWER</b>	<b>EITHER</b>	2	1	1
	<b>OR</b>	1	2	1
Both reactors <b>SHUTDOWN</b>	<b>EITHER</b>	2	1	1
	<b>OR</b>	1	2	1

Proposed new text for NSR 6.1.2:

Minimum AVAILABILITY Requirements for Diesel Generators

Plant State		11 kV	3.3 kV	415V
At all times	<b>EITHER</b>	2	1	1
	<b>OR</b>	4	0	1

17. NGL’s submission argues that the proposed changes do not represent a relaxation for a shutdown reactor. Rather, the principal change relates to minimum plant availability levels now being specified on an ‘at all times’ basis. For the 2-1-1 configuration, NGL has presented analysis to demonstrate that:

- Two 11kV diesel generators are required [one per reactor] to support forced gas circulation for post-trip cooling under ‘at power’ and ‘shutdown’ states under loss of grid conditions;
- A single 3.3kV diesel generator and a single 415V diesel generator are sufficient to support their respective electrical systems. I have examined the supporting audit trail from which I have verified the claim that a single 3.3kV diesel generator, rated at 3.5MW, is sufficient for the 1.95MW essential demand of 1.95MW <sup>[8]</sup>.

18. For the 4-0-1 configuration, NGL has presented analysis [via Claim 1] to demonstrate that:

- Should both 3.3kV diesel generators be unavailable, the ‘A’ 11kV diesel generator can be made available to supply 3.3kV short-break system loads, with the ‘B’ diesel generators continuing to support the gas circulators. The licensee’s analysis further acknowledges that, in order for the 11kV system to supply the 3.3kV short-break system loads, the additional loading from the new Nitrogen plant on the 3.3kV system would require both the ‘A’ 11kV diesel generators to be available, hence the 4-0-1 configuration. I have verified the supporting audit trail for these claims <sup>[9]</sup>.

19. NGL’s submission includes a broad claim [Claim 2] that the existing LCOs will be conservative with respect to the proposed NSR changes; i.e. there will be no conflict on implementation of the proposed NSR. I have examined the permitted unavailabilities specified within the extant LCO 6.1.2 <sup>[1]</sup>; I am duly satisfied that the proposed amendment to NSR 6.1.2 presents no conflict and that the LCO remains appropriately conservative to the NSR.
20. Overall, I am satisfied that the proposed changes to NSR 6.1.2 are demonstrably underpinned by appropriate nuclear safety justification for both operational configurations. I am further satisfied that both configurations are appropriately conservative to the extant LCO.

#### 4.2 Motor Generator sets and 415V AC no-break power supply

21. The table below is an extract from the licensee’s submission <sup>[1]</sup> to illustrate the extant and proposed text for NSR 6.1.4:

NSR 6.4.1 – MG Sets and 415V AC No-Break Power Supply	
Existing NSR 6 Requirement	Proposed NSR 6 Requirement
During <b>OPERATION AT POWER</b> : (a) All four 415V AC No-Break board sections shall be <b>IN SERVICE</b> ; <b>AND</b> (b) At least four Motor Generator (MG) sets shall be <b>IN SERVICE</b> .	At all times: At least three 415V AC No-Break main board sections shall be <b>IN SERVICE</b> , supplied by at least two <b>IN SERVICE</b> Motor Generator (MG) sets.

22. NGL’s submission states that the 415V essential no-break system comprises the scheme of electrical plant that is used to convert supplies from the 240V DC system to three phase and neutral 415V AC and distribute them to provide continuity of electrical supplies to loads fed from this system. It is based on five Motor Generator [MG] sets. The loads essential for nuclear safety include certain boiler feed and steam vent valves; gas circulator oil pumps and various diesel generator controls and auxiliaries. NGL has presented analysis to demonstrate that:

- All of the equipment required to support the essential functions of trip, shutdown and post-trip cooling is dual supplied from either of the ‘A’ or ‘B’ board sections. I have not examined this claim. The NSR 11.2 requirement to have CCR emergency lighting available at all times requires at least three 415V AC No-break main board sections to remain available at all times.
- One MG set is sufficiently rated to support both its respective ‘A’ and ‘B’ section loadings if required. I have examined the supporting audit trail for this claim <sup>[10]</sup> such that the maximum loading in each section is below the nominal rating of 220kW. The supporting reference indicates less than 5% margin between the rated load of 220kW and the greatest loading in the most onerous loss of grid conditions [i.e. double reactor trip concurrent with loss of grid]. I sought further clarification from the licensee as to the degree of confidence associated with the manufacturer declared MG set rating of 220kW.

NGL has responded <sup>[11]</sup> to confirm that it carries out 5 yearly MG set exchanges as part of its LC28 arrangements. As part of the 5 yearly maintenance, the refurbished MG set is load tested using a load bank as per Maintenance Job Instruction EB336-08-13. The MG Set Load test consists of a Dynamic Test and 4-hour Load Test by increasing the load on the load bank up to a nominal 215kW. The licensee has



confirmed that MG Set 4A completed its Dynamic Load test on 24th July 2015 and the records show that for a nominal load bank setting of 215kW, the true load taken by MG Set 4A was 225kW.

I am satisfied that the licensee's response demonstrates that the MG sets deliver their required nuclear safety function and to appropriate tolerance against the worst case electrical loading.

23. NGL's submission includes a broad claim that the existing LCOs will be conservative with respect to the proposed NSR changes; i.e. there will be no conflict on implementation of the proposed NSR. I have examined the permitted unavailabilities specified within the extant LCO 6.4.1 <sup>[1]</sup>; I am duly satisfied that the proposed amendment to NSR 6.4.1 presents no conflict and that the LCO remains appropriately conservative to the NSR.
24. Overall, I am satisfied that the proposed changes to NSR 6.4.1 are demonstrably underpinned by appropriate nuclear safety justification for both operational configurations. I am further satisfied that both configurations are appropriately conservative to the extant LCO.

#### **4.3 Alignment to NSR Revision 4**

25. I have compared the proposed amendments to Revision 3 <sup>[6]</sup> within the EC against the draft text within NSR 6 Revision 4 <sup>[5]</sup>; I have confirmed that the text in Revision 4 is consistent with the EC in each of the elements of the NSR that have been amended.

#### **4.4 Independent Nuclear Safety Assessment and Nuclear Safety Committee**

26. NGL's INSA Approval Statement <sup>[4]</sup> judges that the justifications presented, which are in some cases relaxations to the current NSR 6 requirements are robust and will allow future nuclear safety benefits to be realised once the LCOs are updated to remove unnecessary conservatism. I am satisfied that the INSA assessment was undertaken to the appropriate rigour.
27. I further judge that there has been adequate consideration <sup>[7]</sup> from the Nuclear Safety Committee, to an extent commensurate with a Category 2 modification [Engineering Change] under arrangements made under LC22(1).

### **5 CONCLUSIONS**

28. I have judged, in my capacity as nominated site inspector, that each of the five assessment parameters has been satisfactorily addressed. I am satisfied, based on the areas of the submission examined, that appropriate nuclear safety justification has been presented by the licensee to demonstrate sufficient levels of conservatism between the proposed NSR 6 Revision 4 and the extant LCOs.

### **6 RECOMMENDATIONS**

29. I recommend that the ONR deputy chief inspector or other inspector with delegated authority should sign Licence Instrument No. 548 and thus Approve NGL's request under Licence Condition 23(5) to amend NSR 6, replacing Revision 3 with Revision 4.

## 7 REFERENCES

1. TRIM 2015/287778 [NSL HNB50511R] letter from EDF NGL: Request for Approval under Licence Condition 23[5] of amendment to nuclear Safety Requirements – 23 July 2015.
2. TRIM 2015/332527 Email response from Hunterston B – Further information on NSR 6 nuclear safety benefits and implementation schedule – 13.08.2015.
3. TRIM 2015/332521 Email to CNRP head of assessment specifying assessment strategy for Hunterston B NSR 6 submission.
4. TRIM 2015/332662 Hunterston B - NSR 6 approval under LC23(5) - INSA certificate.
5. TRIM 2015/332675 Hunterston B - NSR 6 approval under LC23(5) - Revision 4 of NSR text
6. TRIM 2015/332682 Hunterston B - NSR 6 approval under LC23(5) - Revision 3 of NSR text
7. TRIM 2015/332689 Hunterston B – NSR 6 approval under LC23(5) – NSC minutes
8. TRIM 2015/333089 Hunterston B – supporting analysis for NSR 6 approval – September 2015
9. TRIM 2015/333597 Hunterston B – supporting analysis for NSR 6 approval – September 2015
10. TRIM 2015/333645 Hunterston B – supporting analysis for NSR 6 approval – September 2015
11. TRIM 2015/337308 Hunterston B – NGL response to assessment enquiry – September 2015