ONR Approval under LC23(5) – Approval of an Amendment to Table 1 of the Wylfa Operating Rules

Generation Extension Maximisation – Review of T2op Temperature Limit and Proposal to Amend the Operating Rules

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EXECUTIVE SUMMARY

Generation Extension Maximisation – Review of T2op Temperature Limit and Proposal to Amend the Operating Rules

This report presents the findings of ONR's consideration of Magnox Ltd's request for Approval of an amendment to the Wylfa Operating Rules resulting from a proposed adjustment to the reactor protection set point (T2op) Temperature Limit.

Permission Requested
Magnox Limited, the Licensee for the Wylfa nuclear site, has proposed to amend the station Operating Rules for the T2op Temperature Limit. Magnox Ltd has requested ONR's 'Approval' to this amendment under Licence Condition (LC) 23(5) of nuclear site licence number 58A.

Background
The proposal aims to facilitate the operation of Wylfa power station Reactor 1 until the final shut-down on 31 December 2015 or when fuel irradiation of 34.1 GWd/tU is achieved – whichever comes first. The amendments will bring commercial and safety benefits by allowing Wylfa Reactor 1 to operate under the design arrangements after power decreases below 1500 MWth.

The Safety Case presents arguments and evidence that the requested amendment will not affect the overall plant safety during normal operation or accident conditions, and that the nuclear and radiological risk for the plant workers and for the public will remain As Low as Reasonably Achievable (ALARP).

Assessment and inspection work carried out by ONR in consideration of this request
ONR has carried out a programme of work that includes the assessment of the Licensee's submission by a fault analysis specialist inspector and inspection of proposed changes to ensure they are consistent with the Licensee's arrangements and regulatory standards.

For this assessment, effort has been concentrated on the assessment of the fault studies aspects of the Safety Case. The Safety Case supports two amendments of the Operating Rules for definition of the penalties, applied on the T2op reactor protection set-point:

- To remove the T2op penalty related to reactor power below 1500 MWth.
- To change the method for definition of the T2op penalty related to radial power distribution in the reactor (Rmin) – from step-wise application of tabulated values to a combination of two smooth curves.

The assessment considers the relatively low risk involved in the proposed changes, the historical evolution of the T2op penalties at Wylfa and the demonstrated inherent safety margins of the process applied for T2op definition.

Matters arising from ONR's work
No unresolved issues remain from ONR's assessment and inspection work.

Conclusions
To conclude, I am broadly satisfied with the claims, arguments and evidence laid down within the Nuclear Safety Committee (NSC) paper "Generation Extension Maximisation – Review of the Adjustments to the T2op Temperature Limit and Proposal to Amend the Operating Rules".

Recommendations
The project assessment report recommends that;

- The Superintending Inspector for the Magnox and Restoration Sites sub-programme accepts the technical and regulatory judgements in the report;
- The Superintending Inspector for the Magnox and Restoration Sites sub-programme approves the report for publication after redaction as appropriate; and
- the Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme grants the Approval to amend the Wylfa Operating Rule relating to the T2op Temperature Limit.

LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
HOW2	(Office for Nuclear Regulation) Business Management System
HSE	The Health and Safety Executive
INSA	Independent Nuclear Safety Assessment
NSC	Nuclear Safety Committee
ONR	Office for Nuclear Regulation
SAP	Safety Assessment Principle(s)
TAG	Technical Assessment Guide (ONR)

OFFICIAL

TABLE OF CONTENTS

1 PERMISSION REQUESTED

1. The Wylfa nuclear site licence holder Magnox Ltd (the Licensee) has proposed to amend the station Operating Rules for the definition of a reactor protection set-point (T2op) (Reference 1). The proposal aims to facilitate the operation of Wylfa power station Reactor 1 until the final shut-down on 31 December 2015 or when fuel irradiation of 34.1 GWd/tU is achieved – whichever comes first. The amendments will bring commercial and safety benefits by allowing Wylfa Reactor 1 to operate under the design arrangements after power decreases below 1500 MWth.

2. The Licensee has requested ONR's 'Approval' to these amendments under Licence Condition (LC) 23(5) of the nuclear site licence number 58A (Reference 2).

2 BACKGROUND

3. Wylfa Power Station (Wylfa) has two reactors with graphite cores, each containing 6156 vertical fuel channels. Another 200 channels allow control rods to enter the core.

4. Reactor 2 (R2) is in cold shutdown state, in air. Reactor 1 (R1) operates at about 1600 MWth power, using partially burnt up nuclear fuel from Reactor 2. The absence of fresh fuel limits the available reactivity and imposes the need for operation at low (below 1500 MWth) power.

5. This report presents ONR's consideration of the Licensee (Magnox Ltd) proposal to amend the Wylfa Operating Rule for definition of the reactor protection set-point T2op which limits the maximal measured channel gas outlet temperature. The proposal is supported by the Category 1 safety case (Reference 1) – further referred to as "the Safety Case" - and by referenced documents.

6. The proposal aims to facilitate the R1 operation at low power until the final reactor shut-down on 31 December 2015 or when the mean fuel irradiation limit of 34.1 GWd/tU is achieved – whichever comes first.

7. At least once per each 24 hours of R1 operation the PANTHER code is run with the updated PREDICT2 input to calculate the maximal channel gas outlet temperature that provides safe reactor operation under the current conditions. The reactor protection set-point value of T2op is then defined by consecutive application of penalties (ΔT2op) on the calculated maximal safe channel gas outlet temperature. According to the current Operating Rule a separate penalty is applied for each of the following factors:

   - Inlet gas temperature (T1)
   - Number and location of empty[1] fuel channels
   - Availability of thermo-couples
   - Reactor power below 1500 MWth or non-equilibrium xenon (Xe-135) concentration in the reactor
   - Unevenness of the radial power distribution in the core (Rmin)

8. The proposed Operating Rule amendment will exclude the 1500 MWth condition on reactor power and will change the method for evaluation of Rmin impact on ΔT2op from a four steps table to a set of two smooth functions of the type ΔT2op = f(Rmin).

[1] According to Wylfa operating rules glossary "empty" is any normal fuel channel containing less than eight fuel elements.

9. The current Operating Rule was established when the reactor power at normal operation was about 2000 MWth and the currently obsolete computer code KINAX was used to calculate T2op. The proposal for change is based on two main reasons:

- R1 power is expected to decrease below 1500 MWth in 2015 due to the absence of fresh Magnox fuel.
- The regular PANTHER calculations with updated PREDICT2 input provide a conservative T2op prediction without the need to add further margins.

10. The proposal fits in the long-term strategy of the Licensee to achieve maximal utilisation of the available Magnox fuel at Wylfa (Reference 3). It will bring commercial benefits by improving the plant output. The modification will also provide operational safety benefits by allowing R1 to remain in its current operation mode (four boilers in operation) despite the expected power decrease.

11. The Safety Case presents arguments and evidence that the requested modifications will not affect the overall plant safety during normal operation or accident conditions, and that the nuclear and radiological risk for the plant workers and for the public will remain As Low as Reasonably Achievable (ALARP).

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

12. ONR has carried out a programme of work that includes the assessment of the Licensee's submission by a fault analysis specialist inspector (Reference 13) and inspection of proposed changes to ensure they are consistent with the Licensee's arrangements and regulatory standards (Reference 4). The response to Magnox Ltd's request has been undertaken in accordance with relevant ONR Guidance (Reference 12).

3.1 INSPECTION

13. The licensee's arrangements requires an Independent Nuclear Safety Assessment (INSA) to be undertaken for changes to Approved Operating Rules followed by presentation to the Nuclear Safety Committee (NSC) for Endorsement.

14. The record of the INSA has been reviewed and provides assurance that the Licensee has complied with its arrangements. The INSA officer provided agreement to the proposed amendments as described in the submission (Reference 5).

15. The minutes of the Magnox Ltd NSC meeting held on 30/9/14 have been reviewed and considered to provide assurance of further independent challenge to the submission (Reference 6). The NSC advised the Chairman to endorse the proposed Operating Rules.

16. The licensee submission is consistent with the site arrangements for amendments to Operating Rules (Reference 4).

17. Magnox Ltd has confirmed that commitments identified in the submission have been progressed (Reference 7), including:

- production of the modification to make the changes to the Wylfa reactor temperature assessment programme (RRCAL) (Reference 8 and 9)
- Identification of relevant procedures to be updated (Reference 7)
- Provision of suitable familiarisation training (Reference 10)

3.2 ASSESSMENT

18. For this assessment, effort has been concentrated on the assessment of the fault studies aspects of the Safety Case. The Safety Case supports two amendments of the Operating Rules for definition of the penalties, applied on the T2op reactor protection set-point:

- To remove the T2op penalty related to reactor power below 1500 MWth.
- To change the method for definition of the T2op penalty related to radial power distribution in the reactor (Rmin) – from step-wise application of tabulated values to a combination of two smooth curves.

19. The assessment considers the relatively low risk involved in the proposed changes, the historical evolution of the T2op penalties at Wylfa and the demonstrated inherent safety margins of the process applied for T2op definition.

20. The assessment is undertaken in line with the relevant ONR SAPs and TAG requirements and identifies satisfactory conformance of the fault-studies related parts of the Safety Case with ONR's guidance.

21. Having sampled the Safety Case and one of its main reference documents, the ONR Fault Analysis Specialist Inspector concludes that from fault studies point of view the presented claims, arguments and evidence provide sufficient support to the proposed amendments to station Operating Rules as well as a reasonable ALARP justification.

22. The ONR fault studies assessment has not identified any observations that could preclude the Licensee implementing the proposed amendments of the station Operating Rules.

4 MATTERS ARISING FROM ONR'S WORK

23. There are no unresolved issues remaining from ONR's assessment and inspection work.

5 CONCLUSIONS

24. This report presents the findings of ONR's consideration of Magnox Ltd's request for Approval of an amendment to the Wylfa Operating Rules resulting from a proposed adjustment to the T2op Temperature Limit.

25. To conclude, I am broadly satisfied with the claims, arguments and evidence laid down within the NSC paper "Generation Extension Maximisation – Review of the Adjustments to the T2op Temperature Limit and Proposal to Amend the Operating Rules".

6 RECOMMENDATIONS

26. The project assessment report recommends that;

- The Superintending Inspector for the Magnox and Restoration Sites sub-programme accepts the technical and regulatory judgements in the report;
- The Superintending Inspector for the Magnox and Restoration Sites sub-programme approve the report for publication after redaction as appropriate; and

- the Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme grants the Approval (Reference 11) to amend the Wylfa Operating Rule relating to the T2op Temperature Limit.

7 REFERENCES

1. NP/SC 5176 Revision 1 Addendum 3 Revision 1, "Generation Extension Maximisation – Review of the Adjustments to the T2op Temperature Limit and Proposal to Amend the Operating Rules". TRIM 2014/433524
2. Letter WYF 52436N, dated 12 November 2014, Magnox Ltd application for Approval to Amend Wylfa Operating Rules following review of T2op temperature limit, TRIM Ref: 2014/419177
3. NP/SC 4987 Addendum 2 "Wylfa site – strategy for generation beyond 2010", September 2009, TRIM: 2009/381388
4. Magnox Ltd, Wylfa - Management Control Procedure No 021 Part 012, WAY/MCP/021/012 Issue 26. Control of amendment to or suspension of operating rules, RSOIs, amendment of operating instructions and special temporary instructions. TRIM Ref: 2015/156763.
5. Final INSA Statement, "GEM – Review of the adjustments to the T2op temperature limit and proposal to amend operating rules – Issue 2", [redacted] ECM No: 97225. TRIM Ref: 2014/408210.
6. Minutes of the Joint Meeting of the Magnox Ltd Oldbury, Sizewell A and Wylfa Nuclear Safety Committees held on Tuesday 30 September 2014 at Oldbury Technical Centre. TRIM Ref: 2014/383217
7. Email from [redacted] (Wylfa) to [redacted] (ONR), dated 26 March 2015, Magnox Ltd, Wylfa - RE: NP/SC 5176 Rev 1 Add 3 Rev 1 - Adjustments to the T2op Temperature Limit - Response from Wylfa to request for additional information. TRIM Ref: 2015/151723.
8. WYA-2-299-5231 Add. 16, RRCAL Adjustments to the T2op Temperature Limit for Generation Extension Maximisation (GEM) TRIM Ref: 2015/153058.
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10. Familiarisation training in support of changes to T2op Rmin and 1500MWth. TRIM Ref: 2015/156788.
11. Licence Instrument (LI) 563 - ONR Approval under LC23(5) of an Amendment to Table 1 (T2op temperature limit) of the Wylfa Operating Rules - May 2015. TRIM Ref: 2015/156567.
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13. *ONR Assessment Report ONR*-CNRP-AR-14-107, "Proposal to amend the operating rules regarding T2op temperature limit", TRIM Ref: 2015/122903.