



Transition from Generation to Defuelling Operations

**Withdrawal of Operating Rule Approvals to Enable Implementation of the Post
Generation Defuelling Safety Case**

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EXECUTIVE SUMMARY

Withdrawal of Operating Rule Approvals to Enable Implementation of the Post Generation Defuelling Safety Case

This report presents the findings of the Office for Nuclear regulation's (ONR) consideration of Magnox Ltd's request for Approval of an amendment to the Wylfa Operating Rules resulting from transition from generation to defuelling.

Permission Requested

Magnox Ltd, the licensee for the Wylfa nuclear site, has requested ONR's 'Approval' under Licence Condition (LC) 23(5) of Schedule 2 attached to Nuclear Site Licence number 58A of amendments or alterations to the Wylfa Power Station Operating Rules.

Background

Both reactors at Wylfa are now in a depressurised, cold shutdown condition in air. The reactors have been modified to prevent re-criticality and to ensure that a shutdown margin can be maintained during normal defuelling operation and fault conditions. Reactor 2 has been steadily defuelled in support of Reactor 1, which ceased operation at the end of December 2015, and is now being passively cooled through natural circulation. Reactor 1 is currently being actively cooled and will change to passive cooling during the post generation defuelling period of operation. Both reactors present a lower nuclear safety risk and hazard compared with the generation phase of operation, and these risks and hazards will continue to reduce as the reactors are defuelled.

Magnox Ltd has submitted the Post Generation Defuelling Safety Case and supporting documentation that supports amendments to the generation Operating Rules such that they are suitable for defuelling of the two reactors. The proposed defuelling Operating Rules are a much reduced, and simplified, set of three Operating Rules for the defuelling phase of operations that cover the following areas:

- Criticality – requiring only one control rod to be withdrawn at any time, absorber bar removal is prohibited, defuelling and criticality control outside the reactor in accordance with Station Operating Instructions (SOIs).
- Fuel and Core – if indicated reactor core temperature exceeds 100°C then urgent action shall be taken to reduce the temperature. The maximum core temperature shall not exceed 180°C.
- Minimum Safety Related Plant (MSRP) – to be as specified in SOIs.

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

ONR has carried out a programme of work that has included a number of detailed assessments of key aspects of the safety submissions, additional assessments of modifications being undertaken to support the implementation of the safety case and inspection of the implementation of modifications and plant configuration for defuelling.

Detailed assessments of the safety case have been undertaken in the following areas:

- Fault Studies
- Mechanical Engineering
- Chemistry
- Civil Engineering and External Hazards
- Organisational Capability
- Structural Integrity

Further assessment/inspection of plant modifications was undertaken in the following areas

- Electrical, control and instrumentation
- Internal hazards
- Prevention of re-criticality

ONR also undertook inspections of changes and improvements to maintenance and operating instructions to ensure that the Post Generating Defuelling Safety Case would be adequately implemented.

The regulatory interventions undertaken by ONR inspectors did not identify any issues that would prevent ONR permissioning the licensee's proposed changes to Wylfa's Operating Rules.

Matters arising from ONR's work

A number of recommendations were made from the fault studies and external hazard assessments for progressing following the transition to defuelling. These recommendations have been captured as actions under an ONR regulatory issue and shared with Magnox Ltd for consideration.

During the implementation of elements of the Post Generation Defuelling Safety Case, Magnox Ltd identified some issues that have resulted in a need to continue on the reliance of gas turbines to provide essential electrical supplies during the initial phases of defuelling. Magnox Ltd will produce Stage Submission 1 safety case to the Paper of Intent proposing plant configuration changes for defuelling that will justify further amendment to the SOIs. The proposed amendment will remove the requirement for gas turbines. This can happen once the work has been completed to justify that the electrical overlay system diesel generators can adequately back up the essential electrical supply systems. A copy of this submission will be provided to ONR and a suitable level of permissioning agreed with and provided by ONR before removing the gas turbines from service. Magnox Ltd has recorded this regulatory requirement on the Wylfa Regulatory Schedule.

Magnox Ltd has formally requested that ONR grants Approval under LC 23(5) of the proposed amendments or alterations to the Wylfa ORs. However, during the period of considering this request ONR has continued to refine its approach to ensure proportionate regulation of sites where hazards and risks are reducing. Consequently, it is proposed that ONR should not approve the amendments but rather withdraw the extant Approval of the ORs and allow Magnox Ltd to implement its revised ORs for defuelling without continued regulatory approval under Licence Condition primary powers.

ONR can achieve the appropriate level of regulation and maintain a regulatory footprint of Wylfa Operating Rules and Operating Instructions, post operation, through the use of flexible permissioning documented in the site arrangements.

Conclusions

This report presents the findings of ONR's consideration of Magnox Ltd's request for Approval under LC 23(5) of an amendment to the Wylfa Operating Rules resulting from transition from generation to defuelling.

ONR specialist inspectors have assessed key aspects of the licensee's safety case. There were no issues identified that would prevent ONR permissioning the licensee's request to amend or alter its Operating Rules.

I consider that the more appropriate regulatory action to take in this case is to permission the withdrawal of Wylfa's approved Operating Rules under LC1 rather than issue Approval under LC23 to amend or alter them.

ONR can achieve the appropriate level of regulation of Wylfa's Operating Rules, post operation, using flexible permissioning.

To conclude, I am satisfied with the claims, arguments and evidence laid down within the PGDSC and that it represents an adequate safety case for defuelling at Wylfa.

Recommendations

The Project Assessment Report recommends that;

- The Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme accepts the technical and regulatory judgements in this report;
- The Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme approve this report for publication after redaction as appropriate; and
- the Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme grants Licence Instrument 569, Withdrawal, of Approval of the Wylfa Operating Rules.

LIST OF ABBREVIATIONS

ACPM	AC pony motors
ALARP	As low as reasonably practicable
BUFS	Back-up feed system
BSL	Basic Safety level (in SAPs)
BSO	Basic Safety Objective (in SAPs)
CNS	Civil Nuclear Security (ONR)
DG	Diesel generators
DSC	Dry storage cells
EBFP	Emergency boiler feed pumps
EESS	Essential emergency supply systems
EIMT	Examination, inspection, maintenance and testing
EOS	Electrical overlay system
FFA	Fuel flask filling area
GT	Gas turbines
HOW2	(Office for Nuclear Regulation) Business Management System
HSE	The Health and Safety Executive
LC	Licence Condition
IAEA	The International Atomic Energy Agency
MoC	Management of change
MSRP	Minimum safety related plant
INSA	Independent nuclear safety assessment
NSC	Nuclear safety committee
NDA	Nuclear Decommissioning Authority
ONR	Office for Nuclear Regulation
OR	Operating rule
OSIP	Operational safety improvement programme
PFC	Post-fault cooling
PGD	Post-generation defuelling
PGDSC	Post-generation defuelling safety case
PIOI	Plant item operating instruction
PTC	Post-trip cooling
PSR	Periodic safety review
PCERP	Pre-construction Environment Report
PCSR	Pre-construction Safety Report
PSA	Probabilistic Safety Analysis
PSR	Preliminary Safety Report
RGP	Relevant Good Practice
SAP	Safety Assessment Principle(s)
SFAIRP	So far as is reasonably practicable
SBI	System based inspection
SOI	Station operating instruction
SSC	Structure, System and Component
TAG	Technical Assessment Guide (ONR)
TFS	Tertiary feed system
TIG	Technical Inspection Guide (ONR)
WANO	World Association of Nuclear Operators

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1 PERMISSION REQUESTED

1. Magnox Limited, the licensee of Wylfa, has requested the Office for Nuclear Regulation's (ONR) 'Approval' under Licence Condition 23(5) of Schedule 2 attached to Nuclear Site Licence number 58A of amendments or alterations to the Wylfa Power Station Operating Rules (OR) (Reference 1).

2 BACKGROUND

2. Both reactors at Wylfa are now in a depressurised, cold shutdown condition in air. The reactors have been modified to prevent re-criticality and to ensure that a shutdown margin can be maintained during normal defuelling operation and fault conditions. Reactor 2 has been steadily defuelled in support of Reactor 1, which ceased operation at the end of December 2015, and is now being passively cooled through natural circulation. Reactor 1 is currently being actively cooled and will change to passive cooling during the post generation defuelling period of operation. Both reactors present a lower nuclear safety risk and hazard compared with the generation phase of operation, and these risks and hazards will continue to reduce as the reactors are defuelled.
3. Since Reactor 1 ceased generating no further defuelling has been undertaken. Reactor 1 is 100% fuelled and Reactor 2 is 65.5% fuelled. The total number of fuel elements at the end of April 2016 was 86163, this will have reduced slightly since then as a result of flask exports to Sellafield. The current site proposals for defuelling indicate that the site will be fuel-free by the end of December 2018.
4. Magnox Ltd provided ONR with NP/SC 4899 Rev 1 (Reference 2), the safety case for fuel handling during defuelling and NP/SC 4899 Addendum 1 Rev 3 (Reference 3), the post generation and defuelling safety case (PGDSC). These were provided approximately 12 months in advance of the request for Approval of amendments or alterations to the ORs (Reference 4) to enable early engagement between Magnox Ltd and ONR on any potential issues. Magnox Ltd provided a further update to the proposed ORs as part of a submission made in July 2015 to delete an operating rule related to the operation of Dry store Cell 4 (Reference 5), these represented the final state of the ORs for defuelling operations. Given the time between drafting the documentation and undertaking the modifications to implement the safety case, Magnox Ltd undertook a revalidation of the safety case (Reference 6) to confirm the continued validity and where necessary revise proposed operating instructions. Each of the submissions provided were subject to Independent Nuclear Safety Assessment (INSA) as required by the licensee's arrangements (References 7, 8 and 9) and reviewed by its Nuclear Safety Committee (NSC) (References 10, 11 and 12).
5. Magnox Ltd has requested ONR's Approval to amend the current suite of ORs to a much reduced, and simplified, set of three ORs for the defuelling phase of operations that cover the following areas:
 - Criticality – requiring only one control rod to be withdrawn at any time, absorber bar removal is prohibited, defuelling and criticality control outside the reactor in accordance with Station Operating Instructions (SOIs).
 - Fuel and Core – if indicated reactor core temperature exceeds 100°C then urgent action to be taken to reduce the temperature. The maximum core temperature shall not exceed 180°C.
 - Minimum Safety Related Plant (MSRP) – to be as specified in SOIs.

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

6. ONR has carried out a programme of work that has included a number of detailed assessments of key aspects of the safety submissions, additional assessments of sampled modifications being undertaken to support the implementation of the safety case. Inspectors also sampled the on-site implementation of modifications and plant configuration for defuelling.

3.1 ASSESSMENT OF THE DEFUELLING SAFETY CASE

7. Detailed assessments of the safety case have been undertaken in the following areas:
 - Fault Studies (Reference 13)
 - Mechanical Engineering (Reference 14)
 - Chemistry (Reference 15)
 - Civil Engineering and External Hazards (Reference 16)
 - Organisational Capability (Reference 17)
 - Structural Integrity (Reference 18)

3.1.1 FAULT STUDIES

8. The revised fault schedule for the PGDSC has identified the potential worst case reactor faults during defuelling as “return to criticality” and “loss of cooling”. The safety case claims that the implemented hardware modifications prevent a return to criticality and provide sufficient defence in depth against loss of cooling in both reactors.
9. The subcritical state and decay heat level of power clearly reduce the risk in comparison with operation at power. On the other hand, the magnox fuel cladding is susceptible to ignition in moist air if exposed to temperatures above 565°C. Hence changing the reactors’ atmosphere from CO₂ to air introduces the hazard for a reactor fire that could lead to a very large off-site release. Reliable core cooling is generally regarded as the optimal preventive measure for reducing the likelihood of this hazard to an acceptably low level.
10. The fault studies assessment focussed on the arrangements for response to loss of cooling and concluded:
 - From a fault studies perspective the safety case is compliant with the applicable ONR standards and guidance.
 - The proposed limits and conditions for defuelling are consistent with the safety case in terms of defence against loss of cooling faults.
11. The specialist inspector is content that from fault studies point of view the safety case provides sufficient support to the proposed modifications in the station ORs.

3.1.2 MECHANICAL ENGINEERING

12. This assessment sampled the fuel flask filling area (FFA) active ventilation system, the reactor core temperature control system and fuel handling arrangements for defuelling. It was conducted through a review of the post generation and defuelling safety case and its supporting documents, together with site visits and meetings with the licensee to inform ONR’s understanding of the Wylfa power station plant, equipment and operations.
13. The assessment concluded that:
 - The FFA active ventilation system will prevent significant off site releases throughout the defuelling programme,

- The necessary safe limits and conditions for defuelling operations have been determined and appropriate ORs and Reference SOIs identified to ensure adequate plant and equipment availability,
 - The existing fuel handling arrangements are suitable and sufficient to defuel the Wylfa nuclear power station safely
14. The specialist inspector supports the amendment to Wylfa power station's ORs arising from the proposed PGDSC.

3.1.3 CHEMISTRY

15. At-power, the fundamental purpose of the chosen chemistry regime is to minimise the risks of corrosion to a wide variety of materials. During the post-generation and defuelling phases, the need for stringent controls can be somewhat lessened due to the lower hazards associated with the reactor no longer being at-power, but the same fundamental requirements are still required – the minimisation of corrosive processes, which could lead to significant material degradation.
16. The two key areas in which chemistry has a key impact are the primary and secondary circuits. The PGDSC submission describes the limits and conditions for the control of moisture and temperature within the primary circuit, and how these will be controlled, which ONR considers to be appropriate. The water chemistry specifications of the secondary circuit and reserve feed systems are also described, and the requirement for this plant is included within a proposed new OR, to mitigate against loss of coolant faults. The specialist inspector is content with these water chemistry specifications, and the level at which they feature within the overall hierarchy of control.
17. The inspector considers that the licensee has produced an adequate safety case, from a chemistry perspective. He supports issuing a license instrument to allow removal of the current ORs (regarding operation of the plant at-power) and the introduction of the proposed ORs, (temperature of the reactor core, and minimum safety related plant).

3.1.4 CIVIL ENGINEERING AND EXTERNAL HAZARDS

18. A civil engineering and external hazards specialist inspector has assessed the licensee's PGDSC. The assessment has been supported by a site System Based Inspection (SBI) at Wylfa that focused on the dry storage cells (DSCs) and fuel route, combined with Level 4 technical meetings and subsequent discussions with Magnox Civil Engineering and External Hazards specialists
19. The assessment has sampled elements of the fuel route, fuel handling plant and DSC. It has reviewed the recent Periodic Safety Review (PSR) findings and sampled two of these pertinent to the PGDSC. These related to the substantiation of the flask crane and pile cap crane and their supporting structures. For the pile cap crane, the recent analysis submitted by the licensee has been reviewed and the specialist inspector is content that the conclusions from this do not affect the claims made by the PGDSC. Based on the inspector's review of the PGDSC, PSR, and SBI, he considers that the site's arrangements and general condition of the plant and fuel route support the claims being made by the PGDSC.
20. With regard to the Pre-stressed Concrete Vessel (PCV) integrity and the proposed OR2.1 and SOI temperature limits, the inspector has sampled the supporting references and is content that the approaches taken meet the intent of the SAPs, and that the claims of integrity are adequately substantiated and build on the licensee's experience from other sites that have been through this similar transition.
21. For External Hazards, as the existing safety case is referred to, the inspector has reviewed the recent PSR and examined the relevant findings raised, their closure, and

the overall conclusions. He is content that the PGDSC is robust to external hazards. The inspector has also reviewed the claimed MSRP and is satisfied that the MSRP required by OR 3 as detailed in the supporting SOIs is robust to external hazards, and the intent of the SAPs has been met.

22. In conclusion for civil engineering and external hazards, the inspector is satisfied that for defuelling operations the PGDSC has demonstrated a risk ALARP position. He considers that the new proposed OR 2.1 and 3 and their supporting SOIs are adequate, and that these new limits are consistent with the PGDSC and supports permissioning for the site transition to defuelling.

3.1.5 ORGANISATIONAL CAPABILITY

23. As part of the transition to defuelling operations, Magnox Ltd has produced a Management of Change (MoC) submission that modifies the organisational structure to be aligned with the requirements of the PGDSC (Reference 19).
24. Wylfa is the last Magnox Nuclear Power Station to move from generation to defuelling. This means that there is significant experience and knowledge within Magnox Limited on the likely workload and risks of moving from generation to defuelling. The MoC, which includes a reduction in the headcount of the site, is taking place within the context of other significant changes to the Magnox Limited's operating model. In general though, the approach taken by Magnox Limited is to minimise the impact of these corporate changes at Wylfa until defuelling is completed, which ONR considers appropriate.
25. The licensee's case for the proposed organisational change that accompanies the move to defuelling is largely based upon the argument that hazards on site will have significantly reduced and a significant amount of plant will cease operation, resulting in a reduction in workload by 45 to 50%. The case identifies a number of risks and has identified a number of mitigating controls. The mitigation includes the following:
- The change will not start until the fuel in the reactor has cooled for a minimum of 100 days.
 - Release of staff will be carried out in phases and requires confirmation that sufficient progress has been made on key enablers, such as removing equipment from service, before they can be implemented.
 - If there is a significant shortfall in performance the site can suspend defuelling operations, reducing workload and nuclear risks.
26. The specialist inspector's assessment of the MoC included early engagement on site, discussion with licensee managers and safety representatives as the plans and documentation developed and review of documents finally submitted. The inspector concludes that:
- the change was adequately described and assessed in the documentation;
 - Wylfa management were able to articulate the basis of and justification for the changes including the reduced staffing levels;
 - the risks had been adequately assessed and appropriate mitigation has been identified;
 - controls were in place to ensure that necessary mitigation and enabling activities were implemented before the change occurs.
27. The MoC submission meets relevant good practice as set out in the Nuclear Industry Code of Practice "Nuclear baseline and the Management of Organisational Change". Examples include the use of an overarching change proposal, appropriate

classification of the hazard, ownership by managers, involvement of staff in the development and enabling actions linked to the phases of implementation.

3.1.6 STRUCTURAL INTEGRITY

28. When the revised PGDSC ORs are implemented the currently defined reactor cooling states will be replaced by three new phases to reflect the reducing reactor cooling requirements. The reactors will be in air at atmospheric pressure throughout the three phases, which are:
- Forced circulation: Intermittent forced air circulation and boiler water circulation.
 - Natural circulation: Cooling will be provided by natural circulation of air through the reactor core and intermittent circulation of boiler water.
 - Passive cooling: heat-loss through the reactor vessel will be sufficient without any requirement for active cooling.
29. This assessment focused primarily on sampling the PGDSC and supporting documentation pertaining to the structural integrity of systems, structures and components (SSC) that are required to fulfil a nuclear safety function.
30. The structural integrity specialist inspector is satisfied that the licensee has adequately considered and assured the structural integrity of the SSC sampled to support the Wylfa PGDSC.
31. The inspector sampled the proposed OR 2, which specifies that urgent action shall be taken to reduce temperatures in the event that the maximum reactor core temperature exceeds 100°C (rule 2.1) and limits the core temperature to less than 180°C (rule 2.2). ONR considers that the licensee has provided adequate substantiation that operating rule 2 does not challenge the integrity of the primary circuit's metallic SSCs.
32. The inspector is satisfied that, from a structural integrity perspective, the evidence sampled adequately supports the licensee's PGDSC. Additionally, from a structural integrity view, the inspector supports the amendments to Wylfa's current ORs.

3.2 ASSESSMENT/INSPECTION OF MODIFICATIONS

33. Further assessment/inspection of plant modifications was undertaken in the following areas
- Electrical, Control and Instrumentation (Reference 20)
 - Internal Hazards (Reference 21)
 - Prevention of Re-Criticality (Reference 22)

3.2.1 ELECTRICAL, CONTROL AND INSTRUMENTATION (EC&I)

34. EC&I specialist inspectors undertook an inspection of the progress with the EC&I aspects of the PGDSC. This followed the final shutdown of Reactor 1. The purpose of the inspection sampled was to inspect EC&I aspects of preparations for transition to a Post Generation and Defuelling (PGD) phase of operation and was intended to inform a judgement on licensee's readiness to implement the proposed ORs for defuelling.
35. During this intervention a regulatory issue (#4349) was raised which required Magnox to undertake further work before we were able to recommend consent to commence defuelling. This additional work included:
- Magnox to provide the SOI for essential indications and safety-related electrical supply systems (WYA/SOI/N1 Plant Supervision and Operations) when it has been through the due process.

- Magnox to consider adding an additional check to PIMI 140/094, relating to the T1 measurements to provide a tolerance of T1 measurements at the plenum location.
- Magnox to provide a copy of the minutes of the Testing and Commissioning Panel following the site acceptance tests carried out on the fuel records system.
- Magnox to review the availability of resources to ensure adequate arrangements for the repair of analogue equipment on plant are in place.

Magnox Ltd provided a satisfactory response to the actions contained in regulatory issue #4349 and it was closed with supporting basis for closure from ONR specialist inspectors (Reference 23).

36. The inspectors have not identified any electrical, control and instrumentation issues that should prevent permission to commence the defuelling operations at Wylfa (Reference 24 and 25).

3.2.2 INTERNAL HAZARDS

37. During the defuelling phase of operations the demand on MSRP reduces. As such, the Emergency Boiler Feed Pumps (EBFP's), which are currently claimed for Post Trip Cooling (PTC) are not going to be claimed for the defuelling stage. The defuelling Post Fault Cooling (PFC) claim is for any two pumps from the Tertiary Feed System (TFS) or Back Up Feed System (BUFS). In addition, there is a requirement for forced circulation supplied by the Electrical Overlay System (EOS) backed-up AC Pony Motors (ACPMs) as an ALARP measure.
38. In support of the revised claims, Magnox Ltd carried out a fire risk assessment to ensure adequate protection of the claimed MSRP (BUFS, TFS & EOS) during defuelling. The risk assessment identified a number of shortfalls relating to the existing fire protection precautions (e.g. shortfalls relating to maintenance of fire barriers, fire resistance of structural steelwork of the BUFS and lack of automatic fire suppression in the BUFS & TFS) that resulted in a number of recommendations for improvements.
39. Inspection by an internal hazards specialist inspector provided evidence that the approach Magnox Ltd is adopting to address the identified fire protection shortfalls is adequate to meet the requirements of the defuelling safety case. In response to the recommendations a number of improvements have been addressed in advance of the transition to defuelling however some improvements will be undertaken after defuelling commences.
40. The inspector is content that implementation of the remaining fire improvements (automatic fire suppression system) following entry into defuelling is acceptable on the basis that in the event of complete burn out of the BUFS or TFS pumphouse, sufficient time (in excess of 48 hours for Reactor 1 & many days for Reactor 2) and alternative facilities (supplementary diesel fire pump which has been demonstrated as part of emergency training exercise) are available to provide the required boiler feed to the reactors, if necessary.

3.2.3 PREVENTION OF RE-CRITICALITY

41. A criticality specialist inspector has reviewed the safety case Magnox Ltd has made for the maintenance of sub-criticality margins during the defuelling operations to be conducted on the shut-down reactors. Whilst there were a number of questions arising for clarification the inspector is content that the licensee has made a sound case that it will adequately control any residual risk of reactor re-criticality during the Wylfa R1 and R2 reactor defuel programme and that all questions were adequately addressed.

42. Additionally, I inspected the implementation of modifications for the prevention of re-criticality that included modifications to prevent motorised control rod withdrawal and limit manual control rod withdrawal and the isolation of CO₂ supplies. I concluded that Magnox Ltd provided adequate evidence to demonstrate robust implementation of the PGDSC and those modifications were being delivered to a good standard (Reference 26).

3.3 INSPECTION OF OPERATING/MAINTENANCE INSTRUCTIONS

43. I undertook inspections, with a human factors specialist inspector, of changes and improvements to maintenance and operating instructions have been undertaken (Reference 26).
44. The inspection of operating instructions focused on the Wylfa Operational Safety Improvement Programme (OSIP) developed by Magnox Ltd in response to a number of incidents that occurred early in 2015 and highlighted weaknesses in conduct of operations. The inspection identified that:
- There is evident commitment to improving procedures and the overall conduct of operations, Magnox Ltd has chosen to make significant changes rather than attempt to take a 'minimalist' approach (e.g. complete revision of the SOIs for defuelling)
 - There has been a review and improvement of the 28 day log – this includes enhanced supervisor checks embedded in the procedure to ensure plant configuration compliance.
 - 142 fuel route Plant Item Operating Instructions (PIOIs) have been updated for defuelling operations.
 - There has been roll-out of a WANO based Operations Fundamentals training course to all operations staff which has been well received
 - The procedure revisions have used learning gained from the Fukushima work on procedure format and presentation – and from Oldbury experiences.
45. The inspection of maintenance instructions focused on the Wylfa maintenance improvement programme and Magnox Ltd's response to ONR enforcement letter WYF71019R, issued 12 November 2015 (Reference 27). The inspection focussed on the adequacy of procedural quality, use and conduct of maintenance operations. The inspection identified that:
- There is evident commitment by the maintenance department to improving procedures and overall conduct of maintenance.
 - Magnox Ltd has introduced an effective prioritised process of maintenance instruction review and revision at Wylfa.
 - The maintenance instruction review has taken cognisance of human factors guidance developed by Magnox Ltd in recent years
 - There has been and is good engagement with maintenance personnel on both the procedures and wider conduct of maintenance.
46. Overall we concluded that Magnox Ltd has undertaken a satisfactory programme for revising its operational arrangements and updating maintenance instructions in readiness for defuelling. The programmes of work undertaken have positively addressed the human factors issues revealed by the site events instigating the development of an OSIP and improving the overall conduct of maintenance. I concluded that this work puts the site in an acceptable position for the start of defuelling.

4 MATTERS ARISING FROM ONR'S WORK

4.1 FAULT STUDIES

47. The fault studies assessment recommended that the following matters should progressed by ONR following commencement of defuelling:
- The Project Inspector to discuss with the site the introduction of an additional clause into the relevant SOI so that the defuelling operations are stopped if the available protections are below the minimum requirement.
 - The Project Inspector to discuss with the site the current applicability and relevance of the proposed OR2.2.
 - The nominated site inspector should follow up the licensee's commitment to provide ONR with appropriate safety submissions for the transitions between the different regimes of core cooling during the defuelling process.
48. The first of these recommendations has been addressed already and the relevant SOI has been updated to include the proposed clause (Reference 28).
49. The other recommendations have been captured as actions in a Level 4 Regulatory Issue (#4472).

4.2 EXTERNAL HAZARDS

50. For the pile cap crane and flask crane, an external hazards specialist inspector reviewed the recent analysis submitted by the licensee. He was content that the conclusions from this do not affect the claims made by the PGDSC. However, the analyses presented did highlight that some components of the load path for these cranes do not have available margin when assessed against the relevant design codes for the design basis seismic event. Therefore, the assessment recommends that the licensee reviews its LC 28 arrangements with respect to the pile cap crane and flask crane and their supporting structures to ensure that the frequency and scope appropriately control degradation of critical elements of the load path.
51. The risk to Wylfa from external hazards is primarily from a seismic event and there is on-going work deriving design basis external hazards to modern standards as part of the adjacent new build site. The assessment recommends that the licensee and the ONR nominated site inspector take appropriate account of the developing activities and assessment work for the adjacent new build site, such that the Wylfa external hazard safety cases remain adequate.
52. These two recommendations have been added as actions to Issue #4472, to be addressed following commencement of defuelling operations.

4.3 ELECTRICAL

53. During the implementation of elements of the PGDSC, Magnox Ltd identified some issues that have resulted in a need to continue on the reliance of gas turbines (GT) to provide essential electrical supplies during the initial phases of defuelling.
54. The essential electrical supplies system (EESS) protection is not optimal if supplied from one electrical overlay system (EOS) diesel generator (DG). There is the potential that protection will not operate under some, very low probability, fault conditions. Hence Magnox Ltd has commissioned additional work to provide recommendations to optimise the EESS protection. Unfortunately, a draft EESS protection optimisation report was not be available until mid-March 2016. Following receipt of the report, Magnox Ltd needed time to consider the recommendations, justify the implementation of those considered ALARP and implement them before it carries out the EOS DG demonstration. Consequently, justifying that the EOS can back up the EESS, in order

to justify standing down the GTs, had the potential to delay implementation of the PGDSC ORs and consequently the start of bulk defuelling.

55. Magnox Ltd has, as a result made a decision to retain the claims on GTs for the first few months of defuelling. Magnox Ltd will produce Stage Submission 1 safety case to the Paper of Intent proposing plant configuration changes for the PGD phase (WYA/2/070/5388 Add.0) that will justify further amendment to the PGD SOIs to remove the requirement for GTs. This can happen once the work has been completed to justify that the EOS DGs can adequately back up the EESS. A copy of this submission will be provided to ONR and a suitable level of permissioning agreed with and provided by ONR before removing the GTs from service. Magnox Ltd has recorded this regulatory requirement on the Wylfa Regulatory Schedule.
56. In addition, ONR requested that the licensee undertakes an impact assessment on the proposed MoC to ensure adequate resources were available to support continued maintenance of the GTs in the defuelling organisational structure (Reference 29). I consider the resulting assessment is adequate and confirms no undue stress on the defuelling organisation as a result of the change in strategy.

4.4 PERMISSIONING

57. Magnox Ltd has formally requested that ONR grants Approval of the proposed amendments or alterations to the Wylfa ORs under Licence Condition (LC) 23(5). However, during the period of considering this request ONR has continued to refine its approach to ensuring proportionate regulation of sites where hazards and risks are reducing.
58. Consequently, I propose that a more appropriate approach is for ONR to permission the withdrawal of the OR originally approved under LC 23(4) (Reference 34) rather than Approve their alteration or amendment under LC 23(5). The withdrawal of the LC 24(4) Approval would be via LC 1(3)(a). I have considered the following points in forming my view:
- The transition to defuelling represents a significant reduction in risk and hazard following the first 100 days shutdown. This is followed by a progressive reduction in risk and hazard as fuel is removed from the reactors and transferred to Sellafield for reprocessing.
 - The proposed ORs are the same as those implemented at Oldbury during safe and successful defuelling, and these were not subject to any further changes during its period of defuelling.
 - The safe and successful defuelling of nine Magnox reactor sites by Magnox Ltd which has provided the maturity of the licensee's arrangements for these operations.
 - In considering Wylfa ORs against the hierarchy set out in ONR's relevant TAG (Reference 30), the ORs have moved from the tier 2/3 levels down to the tier 1/2, such that they are now considered predominantly Low Hazard Operating Rules. The TAG advises that ONR will not normally Approve ORs unless they fall broadly within tier 3.
 - The comprehensive assessments and inspections undertaken by ONR in response to Magnox Ltd's request concluding that the proposed ORs and SOIs are adequate for defuelling operations.
 - The evidence from ONR inspections that the licensee's arrangements for change control of ORs and SOIs are sufficient to ensure appropriate regulatory engagement in advance of any proposed changes by embedding flexible permissioning within them (Reference 31).
 - Given the thorough scrutiny of the safety case, as part of this assessment and its proposed implementation, there will be a reduced regulatory burden on the

licensee from ONR not having to undertake assessment of any request for Withdrawal of Approval at the end of defuelling.

- Changes within ONR's Operating Sites Programme with regard to Licence Condition 23 resulting in the removal of Approval of individual limits and conditions and focussing the regulatory footprint on licensee protocols and arrangements to enable use of a flexible permissioning based on safety significance of any changes (Reference 32).
- Should the potential arise for minor amendments to the ORs, the continued requirement for Approval under primary powers could introduce delays in the hazard reduction programme and increase risk of not completing reprocessing Magnox fuel through the Sellafield reprocessing facilities.

59. Based on the above points I conclude that withdrawing ONR approval will ensure that ONR:

- remains proportionate in its approach, enabling ongoing hazard-reduction at Wylfa and meets statutory obligations under the Regulators' Code (Reference 35).
- Comply with its own internal guidance within TAGs, TIGs etc
- Deliver efficient and effective regulation through a flexible permissioning approach.

5 CONCLUSIONS

60. 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 transition from generation to defuelling.

61. ONR specialist inspectors have assessed key aspects of the licensee's safety case. There were no issues identified that would prevent ONR permissioning the licensee's request to amend or alter its Operating Rules.

62. I consider that the more appropriate regulatory action to take in this case is to permission the withdrawal of Wylfa's approved Operating Rules under LC1 rather than issue Approval under primary powers to amend or alter them.

63. ONR can achieve the appropriate level of regulation of Wylfa's Operating Rules, post operation, using flexible permissioning.

64. To conclude, I am satisfied with the claims, arguments and evidence laid down within the PGDSC and that it represents an adequate safety case for defuelling at Wylfa.

6 RECOMMENDATIONS

65. The Project Assessment Report recommends that;

- The Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme accepts the technical and regulatory judgements in this report;
- The Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme approve this report for publication after redaction as appropriate; and
- the Deputy Chief Nuclear Inspector for the Decommissioning, Fuel and Waste Programme grants Licence Instrument 569, Withdrawal (Reference 33), of Approval of the Wylfa Operating Rules.

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