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**HALES – Evaporator D
Transition to Normal Operations**

Project Assessment Report ONR-SDFW-PAR-18-026
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EXECUTIVE SUMMARY

Permission Requested

In accordance with its arrangements under Licence Condition (LC) 22(1), “Modification or experiment on existing plant”, of Schedule 2 of site licence 103, Sellafield Limited (SL), the licensee, has requested (Ref. 1) the Office for Nuclear Regulation’s (ONR) “Agreement” to implement revised evaporator usage management arrangements and transition Evaporator D safety Case from pre-active to operational status in the Highly Active Liquor Evaporation and Storage (HALES) facility (Ref. 2).

Background

The HALES facility supports both Thermal Oxide Reprocessing Plant (THORP) operations and Magnox reprocessing operations at Sellafield by receiving Highly Active Raffinate (HAR) and concentrating it through evaporation. The result is concentrated liquor known as Highly Active Liquor (HAL). The HAL is held in interim storage within HALES in Highly Active Storage Tanks (HASTs) prior to it being transferred to another facility, the Waste Vitrification Plant (WVP), where it is processed into glass blocks suitable for long term storage.

In the late 2000’s Sellafield Limited identified that it would face a shortage of Highly Active (HA) evaporative capacity as Evaporators A, B and C were approaching their end of life corrosion limits. This would limit Sellafield Limited’s reprocessing and decommissioning operations so it decided to construct a new evaporator, Evaporator D, to provide the additional evaporative capacity to secure these operations. Sellafield Limited started construction of Evaporator D in 2009 as an extension to its existing HALES facility which contains Evaporators A, B and C.

ONR has been regulating the licensee’s design, construction and commissioning of Evaporator D (Ref. 3). ONR has implemented formal regulatory hold points associated with construction (Refs 4, 5 and 6), inactive safety commissioning (Ref. 7), active connections (Ref. 8), and active commissioning (Ref. 9) which have been assessed and released. This report assesses the final regulatory hold point on Evaporator D entering normal operations.

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

ONR has carried out a programme of work utilising specialist inspectors in Human Factors (HF) and Control and Instrumentation (C&I) to assess Sellafield Limited’s proposal and supporting safety case. In these activities ONR has:

- Reviewed the outstanding Regulatory Issues (RIs) raised during the Active Commissioning permission in November 2017;
- Reviewed the Active Commissioning Safety Report (ACSR);
- Reviewed a number of the reports produced by Sellafield Limited’s Independent Nuclear Safety Assessment (INSA) team and Internal Regulators;
- Reviewed Sellafield Limited’s proposals for monitoring and usage reporting of its HA Evaporators;
- Held meetings and discussions to feed back our assessment findings and allow Sellafield Limited to present new and/or revised evidence and proposals;
- Undertaken a readiness review to confirm HF implementation.

Matters arising from ONR's work

ONR HF assessment has considered Sellafield Limited’s revised managerial arrangements for Evaporator D transition from active commissioning to normal operations. The inspector focuses on the RIs raised during ONR’s assessment of the Evaporator D Pre-Active

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Commissioning Safety Report (PACSR), in particular, the training arrangement relating to off normal conditions, integrated use of operational documentation and incorporation of learning. The HF inspector is satisfied that Sellafield Limited has taken a structured approach to close out the outstanding HF issues identified at PACSR, and relevant HF learning has been incorporated into the operational process.

The C&I inspector has considered the resolution of the C&I Issue raised during the PACSR and is satisfied with the outcome.

I have considered the active commissioning findings and the revised Evaporator usage management arrangement following Evaporator D transition to normal operations. I am content that the safety case has demonstrated operational maturity in people, plant and process such that Evaporator D is ready to move into normal operations. I consider the proposed evaporator usage management arrangements adequate for the normal operations of Evaporator D and in line with ONR regulatory expectations.

All inspectors who have undertaken the assessment of the safety case support ONR issuing a licence instrument to permit Evaporator D transition from active commissioning to normal operations.

Conclusions

I consider that Sellafield Limited has demonstrated operational maturity in people, plant and process such that Evaporator D is ready to move into normal operations, and the proposed evaporator usage management arrangements are adequate for future operations.

Recommendations

I recommend that ONR issues Licence Instrument (LI) 518 giving agreement to Sellafield Limited to commence normal operations of Evaporator D and implement the revised evaporator usage management arrangements.

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LIST OF ABBREVIATIONS

ALARP	As low as reasonably practicable
C&I	Control and Instrumentation
CNS	Civil Nuclear Security (ONR)
EA	Environment Agency
Evap D	Evaporator D
FOBS	Fault Observation
HA	Highly Active
HAL	Highly Active Liquor
HALES	Highly Active Liquor Evaporation and Storage
HAR	Highly Active Raffinate
HASTs	Highly Active Storage Tank
HAZAN	Hazard Analysis
HF	Human Factors
HFIP	Human Factors Integration Plan
HOW2	(Office for Nuclear Regulation) Business Management System
HSE	Health and Safety Executive
IAEA	International Atomic Energy Agency
IN	Improvement Notice
INSA	Independent Nuclear Safety Assessment
LC	Licence Condition
LI	Licence Instrument
LTQR	Lifetime Quality Records
MSC	Management Safety Committee
NSC	Nuclear Safety Committee
ONR	Office for Nuclear Regulation
PACSR	Pre Active Commissioning Safety Report
PAR	Project Assessment Report (ONR)
PICSR	Pre Inactive Safety Commissioning Report
PMP	Plant Modification Proposal
POCO	Post Operational Clean Out
RGP	Relevant Good Practice
SAMS	Severe Accident Management Strategy
SAP	Safety Assessment Principle(s)
SCIP	Safety Case Implementation Plan
SL	Sellafield Limited
TAG	Technical Assessment Guide (ONR)
TCA	Temporary Commissioning Aids

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THORP THERmal Oxide Reprocessing Plant
WVP Waste Vitrification Plant

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1 PERMISSION REQUESTED

1. In accordance with its arrangements under Licence Condition (LC) 22(1), "Modification or experiment on existing plant", of Schedule 2 of site licence 103, Sellafield Limited (SL), the licensee, has requested (Ref 1) the Office for Nuclear Regulation's (ONR) "agreement" to commence normal operation of Evaporator D in the Highly Active Liquor Evaporation and Storage (HALES) facility, in accordance with a Category B Plant Modification Proposal (PMP). The following safety case documentation was submitted for consideration by ONR:
 - PMP to implement revised Evaporator Usage Management Arrangement and Transition D Safety Case from Pre-active to Operational Status (Ref. 2);
 - Active Safety Commissioning Report for Endorsement to Operate (Ref. 12);
 - MSC Paper Seeking NSC Endorsement to Operate Evaporator D (Ref. 13);
 - Proposal for Reporting Arrangement on the Usage of HA Evaporators following Evaporator D transition to normal operations (Ref. 14);
 - MSC Acceptance for NSC submission (Ref. 15);
 - NSC Endorsement (Ref. 16).
2. The Licensee's proposal for reporting of the usage of HA evaporators replaces the current arrangements detailed in LI836 (Ref. 17) and is assessed as part of this Project Assessment Report (PAR).
3. This PAR has been written to present the basis for the permissioning decision made by ONR, of which the scope is captured in the Sellafield Sub-Division task sheet (Ref. 18).
4. This report has been prepared in accordance with the requirements of HOW2 (Ref. 19).

2 BACKGROUND

2.1 FACILITY INFORMATION

5. The HALES facility broadly consists of two areas: Evaporation and Storage. The Evaporation element consists of three evaporators A, B and C with a fourth evaporator, D, currently completing active commissioning. The Storage element comprises of a number of High Activity Storage Tanks (HASTs) divided into 'old side' (essentially quiescent) and 'new side' (in active operations). Parts of the HALES facility were constructed in the 1950's and have since been extended and modified over subsequent years and so comprise different generations of HASTs and evaporators.
6. HALES supports both Thermal Oxide Reprocessing Plant (THORP) operations and Magnox reprocessing operations by receiving Highly Active Raffinate (HAR) into buffer storage. The volume of HAR is reduced through evaporation (low temperature boiling at sub-atmospheric pressure), resulting in a concentrated liquor known as Highly Active Liquor (HAL). The HAL is held in interim storage within the HASTs prior to it being transferred to the Waste Vitrification Plant (WVP), where it is incorporated in glass within a high integrity welded stainless steel container suitable for long term storage and disposal.
7. In the late 2000's SL identified that it would face a shortage of Highly Active (HA) evaporative capacity as Evaporators A, B and C were approaching their end of life corrosion limits. This would limit SL's reprocessing and decommissioning operations so it decided to construct a new evaporator, Evaporator D, to provide the additional evaporative capacity to secure these operations.

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8. ONR has been regulating the licensee's design, construction and commissioning of Evaporator D (Ref. 3). ONR has implemented formal regulatory hold points associated with Construction (Refs 4, 5 and 6), Inactive safety commissioning (Ref. 7), active connections (Ref. 8), and active commissioning (Ref. 9) which have been assessed and permissioned. This report assesses the final regulatory hold point on Evaporator D entering normal operations.
9. During the construction and commissioning of Evaporator D ONR has undertaken continued monitoring of the remnant life and usage of Evaporators A, B, & C by review of the licensee's quarterly usage reports, inspection data and meetings as part of the licensee's arrangements implemented under LI836 (Ref. 17). These interventions have demonstrated that the licensee is adequately managing its evaporative capacity to secure completion of the Magnox Reprocessing mission. I have been monitoring the licensee's progress through monthly regulatory engagements and I am content that licensee has taken all reasonable steps to deliver Evaporator D as soon as practicable.
10. Evaporator D receives HA liquor feed from HALES, THORP, MAGNOX and WVP facilities. It also receives Post Operational Close Out (POCO) liquors. Evaporator D is essential to the site POCO programme and is planned to operate until the end of POCO in 2030.

2.2 LICENSEE'S PROPOSAL

11. SL is proposing to transition Evaporator D from active commissioning to normal operations. In line with regulatory expectations (Ref. 20) when Evaporator D enters normal operations, SL is proposing to retire Evaporator A and B from front line duty and retain Evaporator C as contingency until Magnox Reprocessing is completed (currently scheduled for 2020/21). As a result the current usage reporting arrangements implemented under LI836 (Ref. 17) are no longer appropriate.
12. In support of these activities SL has submitted the safety case documentation cited in Section 1 of this report to ONR.
13. The PMP (Ref. 2) demonstrates that active commissioning has been completed successfully and Evaporator D is ready to move into normal operations; it also proposes a new inspection and usage reporting mechanism for Evaporators A,B, C & D to replace the current arrangements under LI836.
14. SL confirms that the operational ramp-up of six evaporator batches has been successfully concluded, highlighting a relatively small number of plant changes which have been implemented and re-tested, resulting in consistent completion of several batches containing both oxide and Magnox liquors. SL concludes that the last three batches have demonstrated predictable performance commensurate with the expectations for a normal operational plant.
15. SL proposes that Evaporator D will become the duty HA Evaporator with Evaporators A & B withdrawn from operational duty and Evaporator C moved to standby status until MOP completion. SL will produce an annual evaporator usage report for Evaporator D with usage of Evaporator A, B or C reported only by exception.
16. NSC has issued Endorsement to Operator (EoT) for Evaporator D to move to normal operations (Ref. 16).
17. I note that SL has subjected the suite of safety case documents to a prescribed checking and approval process in accordance with its arrangements made under the licence conditions. I am satisfied that SL's due process has been followed and that the safety case documentation was accepted at the relevant Management Safety

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Committees (MSC) (Ref. 15) and Endorsed by the Nuclear Safety Committee (NSC) (Ref. 16).

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

18. The licensee's request for permission can be split into two aspects. Firstly to transition evaporator D from active commissioning to normal operations, which essentially means withdrawing the additional controls in place in a commissioning environment as these are no longer necessary. Therefore the focus of ONR's assessment is to ensure that plant, people and processes important to safety have been developed, tested and implemented adequately and demonstrated to function as claimed in the safety case.
19. The second aspect is to update its monitoring and usage reporting strategy for Evaporators A-D. The reporting arrangement for Evaporators A to C were originally agreed under LI836; however, with the Evaporator D entering normal operations SL no longer plans to utilise its older evaporators making the extant arrangements inappropriate, hence the licensee has developed a new strategy for monitoring and reporting the usage of its evaporators. ONR's assessment of this focuses on the justification for reducing the usage reporting on the old evaporators, the arrangements for using Evaporators A-C, and assessing the adequacy of the licensee's proposals for monitoring the remnant life on Evaporator D.
20. In accordance with ONR's regulatory strategy and scope defined in the Sellafield Objective 4 Task Sheet (Ref. 18) related to this project, ONR carried out a programme of work utilising specialist inspector Human Factors, and Control and Instrumentation, to review SL's proposal and supporting safety case. In these activities we have:
 - Performed assessments of SL's suite of safety case documents supporting the modification
 - Reviewed the Active Commissioning Safety Report (ACSR) (Ref. 21)
 - Reviewed a number of the reports produced by SL's INSA team and Internal Regulators
 - Held meetings and discussions to feed back our assessment findings and allow SL to present new and/or revised evidence and proposals.
 - Undertaken a readiness inspection to confirm implementation.
21. In line with ONR's permissioning process, further supporting documentation was requested by ONR and is referred to where appropriate within this PAR.

3.1 CONSULTATION WITH OTHER AGENCIES AND DEPARTMENTS

22. I have consulted the Environment Agency (EA), which confirmed that it has no objection to the issuing of a licence instrument in this matter (Ref 26).
23. I have consulted ONR Civil Nuclear Security (CNS), which confirmed that it has no objection to the issuing of a licence instrument in this matter (Ref 27).
24. The nature of this proposal does not relate to the transport or safeguarding of nuclear material, therefore I have not consulted with ONR's inspectors within these areas.

4 MATTERS ARISING FROM ONR'S WORK

25. As part of the previous permissions (Refs. 7 & 9) ONR assessed the licensee's as built design and safety case in detail and reviewed its commissioning strategy and tests. These assessments concluded that the as built design was adequate; its safety commissioning strategy met Relevant Good Practice (RGP) and ONR granted permission to start active commissioning. Therefore the focus of ONR's assessment

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for this permission has been the close-out of the Regulatory Issues raised during the assessment of pre-Active Commissioning Safety Report (PACSR), the close-out of the PMPs raised during the active commissioning phase, and assessing the licensee's strategy for managing and reporting HA evaporative capacity going forwards. The findings of ONRs assessment is detailed below.

4.1 TRANSITION TO NORMAL OPERATIONS

26. I note that the scope of the active safety commissioning tests comprises a total of 15 commissioning and proof test, and also 8 route tests between facilities. I am content that the active commissioning has been successful and no significant issues are identified (Ref. 21).
27. I have reviewed the findings from operational ramp-up (Ref. 12) which demonstrate that Evaporator D has successfully completed the last three consecutive active batches. I consider that the repeatable and consistently successful operations of Evaporator D provide confidence in its readiness for transition to normal operations.
28. I have also reviewed the shielding and radiological protection report (Ref. 35), where the extensive HP&S survey demonstrates no contamination or dose rates above the minimum detectable level for the instruments, and the activity in air measurement showed airborne activity concentrations far below the levels associated with a C0 area. I am content that the Evaporator D building and shielding is operating as expected for radiological protection.
29. I note that Nuclear Independent Oversight (NIO) conducted a High Hazard Activity Readiness Review (HHARR) on Evaporator D transition to full operational status (Ref. 22). The review has not identified any significant (Category A) issues; however, it presented 19 Category B and 1 Category C findings which HALES has to address before moving into normal operations. NIO has now confirmed that all these findings have been closed out satisfactorily (Ref. 23).
30. I note there are currently 27 active Category C/D PMPs from the active commissioning phase and the construction phase. At the time of writing, 7 of these have been closed. The remaining PMPs are in the process of being implemented with SL aiming to close 12 including all of the construction PMPs by the end of 2018 and the rest 8 by May 2019 (Ref. 31).
31. In the tri-partite meeting in Oct 2018 (Ref. 34), I made it clear that ONR expects, prior to Evaporator D transition to normal operations, HALES to close out all the PMPs from the construction phase and reduce the number of PMPs arising from active commissioning to a single digit to ensure a sufficient level of configuration control for future normal operations (Ref. 34). However, I consider SL's proposed target closure dates of the PMPs reasonable for the expectation. In order to ensure these dates are realised, I consider it proportionate for the ONR Site Inspector to raise a Level 4 Regulatory Issue to track the aforementioned PMPs to a satisfactory closure to the above dates; as a result, RI 6817 has been raised.

ONR Human Factors (HF) Assessment

32. The HF assessment (Ref. 10) focuses on:
 - Completion of the HF work identified as outstanding at the time of ONRs assessment of the Evaporator D Pre-Active Commissioning Safety Report (PACSR, Ref. 28). As part of this, to confirm satisfactory progress and closure of the following associated RIs:
 - RI 5841 on Workload and Environmental aspects within the Evaporator D control room;

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- RI 5840 on Training for off normal and fault conditions.
 - Learning from experience of active commissioning, to evaluate whether from a HF perspective SL is able to effectively demonstrate maturity in its people, plant and process to support commencement of operations.
- 33. The HF inspector finds that evidence presented in the Licensee's submission demonstrates that the HF Suitably Qualified & Experienced Person (SQEP) resource has been provided throughout active commissioning both to complete a planned programme of work and to provide advice and guidance on emergent issues that have arisen during commissioning. The inspector finds that SL has taken a systematic and structured approach to management and close out of HF issues through effective management of a HF Issues Register, which the inspector has sampled and is content that it has received appropriate HF scrutiny with evidence supporting the position reached. Whilst the inspector finds that a small number of HF issues are still ongoing, she considered that they should not prevent transition to operations, and is satisfied that SL have appropriate processes in place to address them going forward (Ref. 10).
- 34. Regarding the workload and environmental aspects (linked to RI 5841) the HF inspector confirms in her readiness inspection (Ref. 29) that these have been addressed through a series of structured interviews and control room observations, which showed a broadly positive picture.
- 35. Regarding training for off normal and fault conditions (linked to RI 5840), The HF inspector finds that SL has built on the early pilots that they undertook, and has developed this into structured coaching sessions for the Duly Authorised Persons (DAPs). This involves desk top exercises based on a series of off normal and fault scenarios and focuses on promoting a structured approach to problem solving and decision making.
- 36. The HF inspector judges that sufficient progress has been made in addressing both RIs (5840 and 5841) and confirmed that these regulatory issues are now closed.
- 37. Lastly, the HF inspector considers learning from experience, in particular, learning in relation to the HF aspect of the active commissioning. She finds that learning is gained from each of the six evaporator batches undertaken as part of active commissioning, which has informed modifications to plant and procedures for subsequent batches. This includes some minor modifications to operational safety measures and the introduction of one additional measure which the inspector confirmed has been appropriately substantiated by SLs HF SQEPs. The HF inspector has also sampled a number of decision records relating to Operational Decision Making (ODM) and Conservative Decision Making (CDM) which were held to address emerging issues during active commissioning. The inspector considers the arrangement adequate.
- 38. Overall the HF inspector considers that SL has taken a structured and systematic approach to resolution of HF issues and outstanding actions identified during active commissioning. Together with a pro-active approach to learning from experience, the HF inspector is content that from a human factors perspective, the evidence presented by SL supports ONR granting permission for Evaporator D transition from active commissioning to normal operations.

C&I Issue

- 39. As part of the C&I assessment of the evaporator D pre-active commissioning safety report (Ref. 30), the C&I inspector found generic deficiencies in the design substantiations for all the smart devices used for safety protection systems, on which he raised the Level 3 Regulatory Issue (RI) 5383. At the time, although he considered

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it disproportionate to withhold permissioning for active commissioning, he recommended that this shortfall needed to be resolved prior to Evaporator D entering normal operations.

40. RI 5383 requires SL to:
- 1) determine the hardware and firmware version numbers of every smart device used in safety mechanisms, and show that these are within the scope of their corresponding device justification documents;
 - 2) supply missing justification documents;
 - 3) revise each of the relevant design substantiation documents to address common shortfalls in
 - breadth of compensatory measures and independent confidence building measures applied;
 - supporting documentation for each technique;
 - definition of safety functions covered;
 - clarity and supporting documentation relating to reviews of version changes;
 - use of existing proof test results when updating the justification.
41. The C&I inspector is now content that SL has implemented all that is required for Actions 1) & 2) but considers two aspects of Action 3) still outstanding (Ref. 11). However, noting SL has a plan in place for their completion he judges it disproportionate for ONR to delay permissioning for Evaporator D entering normal operations (Ref. 11).
42. In conclusion, the C&I inspector supports ONR granting permission for Evaporator D transition from active commissioning to normal operations.

4.2 HA EVAPORATOR USAGE REPORTING

43. SL proposes the following HA evaporator usage arrangement:
- Evaporator D shall be operated as duty HA evaporator;
 - Evaporator C will be held as standby Evaporator and be maintained to a fully operational standard and routinely demonstrated as available until the completion of the MOP, following which it will be withdrawn from operational duty pending any further POCO that is required;
 - Evaporators A & B will be withdrawn from operational duty pending POCO;
 - Routine usage reporting to ONR will be conducted for Evaporator D only, all other evaporators will be by exception;
 - Routine through life inspections will be conducted on Evaporator D;
 - No further routine ultrasonic coil inspections to be conducted on Evaporator C; further inspections only in the event of requirement for unexpected prolonged period of operation;
 - No further ultrasonic inspections will be conducted on Evaporators A or B coil;
 - Washouts of the evaporators will be progressed with an aim to complete washouts of all three evaporators prior to the completion of the MOP.

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44. I consider the above arrangement reasonable as it is in line with ONR's regulatory expectations following Evaporator D entering normal operations (Ref. 20).
45. SL proposes the following reporting arrangement:
- Replacement of quarterly routine evaporator usage reporting with annual routine reporting of Evaporator D usage with all other evaporators reported by exception.
46. I note that the evaporator usage reporting is currently undertaken quarterly in line with LI 836 (Ref. 17) for Evaporator C with additional reporting arrangements for Evaporators A & B introduced subsequently to cover the wider Evaporator fleet. As Evaporators A to C are to be retired from operational duty and Evaporator D becomes the duty HA evaporator, I consider that to continue the quarterly usage reporting of Evaporators A to C would be disproportionate and not provide any valuable information on SL's evaporative capacity management.
47. The annual reporting of Evaporator D usage would detail usage of Evaporator D over the previous 12 month period and planned usage over the coming 12 months, and provide an overview of current predicted corrosion rates, predicted minimum thickness and the remnant life. I consider the proposed annual reporting arrangement for Evaporator D adequate for the normal operations of a new evaporator with a 25 year design life (Ref. 24).
48. SL proposes that the first planned coil inspection on Evaporator D will be carried out after 2 years of operations and the first base inspection after 4 years; the periodicity of subsequent through life inspection will be informed by the results of inspections and adjusted accordingly throughout the life of Evaporator D. I note that the coils have a minimum start-of-life thickness of 11.4mm and an end-of-life thickness of 5mm; for the base, a minimum start-of-life thickness of 36.76mm and an end-of-life thickness of 24mm (Ref. 25). As THORP stops reprocessing AGR fuel by the end of November 2018, the volume of oxide HAR will reduce significantly over the next few months leaving Magnox HAR the main user of Evaporator D, followed by the POCO HAR. SL currently understands that the corrosion rate of the POCO HAR is in line with the Magnox rate and likely lower as POCO progresses (Ref. 32). Taking into account the operational experience of Evaporators A to C which suggests a bounding corrosion rate of Magnox HAR of 0.18mm/yr for the coils and 0.37mm/yr for the base (Ref. 32), I consider the proposed inspection regime adequate for the normal operations of Evaporator D.

5 CONCLUSIONS

49. This report presents the findings of ONR's assessment of the safety case associated with the licensee's request to transition from active commissioning of Evaporator D to normal operations and to implement the revised evaporator usage management arrangements in the HALES facility on the Sellafield site.
50. I have reviewed the licensee's ASCR and am content that all commissioning test, proof test and route tests between facilities had been successfully completed with no significant issues identified.
51. I have reviewed the findings from operational ramp-up which demonstrated that Evaporator D has performed satisfactorily over the last three consecutive active batches. I consider that the repeatable and consistently successful operations of Evaporator D provide confidence in its readiness for transition to normal operations.
52. I have reviewed the shielding and radiological protection findings where the extensive HP&S survey demonstrated no contamination or dose rates above the minimum detectable level for the instruments, and the activity in air measurement showed

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airborne activity concentrations far below the levels associated with a C0 area. I am content that the Evaporator D building and shielding is operating as expected for radiological protection.

53. I note there are currently 27 active Category C/D PMPs from the active commissioning phase and the construction phase. At the time of writing, 7 of these have been closed. The remaining PMPs are in the process of being implemented with SL aiming to close 12 by the end of 2018 and the rest 8 by May 2019 (Ref. 31). I consider SL's target closure dates of the PMPs reasonable and will ensure a sufficient level of configuration control for future normal operations. ONR Site Inspector has raised a Level 4 Regulatory Issue (RI) 6817 to monitor the close-out of the PMPs and ensure the target dates are met.
54. ONR HF inspector considers that SL has taken a structured and systematic approach to resolution of HF issues and outstanding actions identified during active commissioning, and recognises that SL takes a pro-active approach to learning from experience. The HF inspector is content that from a human factors perspective, the evidence presented by SL supports ONR granting permission for Evaporator D transition from active commissioning to normal operations.
55. ONR C&I inspector considers the closure of the Regulatory Issue 5383 raised from the assessment of active commissioning and is content that it has been addressed adequately to enable Evaporator D to enter normal operations.
56. NIO confirms that the findings from their HHARR have all been addressed satisfactorily and has no objection to Evaporator D transition to normal operations.
57. Regarding the revised HA Evaporator usage and reporting arrangement following Evaporator D entering normal operations, I consider that it is in line with ONR regulatory expectations and the annual reporting of Evaporator D usage proportionate with the normal operations of a new evaporator.
58. I note that the Evaporator D coils have a minimum start-of-life thickness of 11.4mm and an end-of-life thickness of 5mm; for the base, a minimum start-of-life thickness of 36.76mm and an end-of-life thickness of 24mm. Given the operational experience of Evap A to C suggesting a bounding corrosion rate of 0.18mm/yr for the coils and 0.37mm/yr for the base, I consider the proposed inspection regime of 2-yearly inspection on the coils and 4-yearly inspection on the base adequate for the normal operations of Evaporator D.
59. I have consulted ONR civil nuclear security and the Environment Agency who have no objections to ONR agreeing to the licensee's proposal.
60. Based on the above, I consider that SL has demonstrated operational maturity in people, plant and process such that Evaporator D is ready to move into normal operations, and the proposed evaporator usage reporting arrangement adequate for normal operations going forward.

6 RECOMMENDATIONS

61. I recommend that ONR issues LI 518 (Ref. 33) giving agreement to Sellafield Limited to commence normal operations of Evaporator D and implement the revised evaporator usage management arrangements.

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7 REFERENCES

1. Letter for PMP HALES [REDACTED] 1617 (TRIM 2018/291921)
2. PMP [REDACTED] 1617: To implement revised evaporator usage management arrangements and transition evaporator D safety case from Pre-active to Operational status (TRIM 2018/291923)
3. Sellafeld program Task Sheet objective 4 (TRIM 2016/32941)
4. Licence Instrument for gantry erection & dismantling (TRIM 2011/71643)
5. Licence Instrument – Agreement to use of self-erecting cranes at Evaporator D (TRIM 2009/440932)
6. Agreement to commence construction of the Raft for [REDACTED] Evaporator D PAR 030/09 (TRIM 2009/177580)
7. Decision record for Evaporator D inactive safety commissioning (TRIM 2015/115855)
8. Decision record for Evaporator D active connections (TRIM 2016/81459)
9. Project assessment report for Evaporator D active commissioning (TRIM 2017/387806)
10. ONR-SDFW-AR-18-054 - Human Factors Assessment of Evaporator D Endorsement to Operate - September 2018 - [REDACTED] (TRIM 2018/299485)
11. C&I confirmation on support of ONR permission (TRIM 2018/351226)
12. Active Safety Commissioning Report for Endorsement to Operate (TRIM 2018/291919)
13. MSC Endorsement to Operate Evaporator D (TRIM 2018/291911)
14. Proposal for Reporting Arrangement on the Usage of HA Evaporators following Evaporator D transition to normal operations (TRIM 2018/291917)
15. MSC Minutes (TRIM 2018/291910)
16. NSC Minutes (TRIM 2018/291925)
17. SEL77326 - LI 836 - Sellafeld Ltd - Agreement to commence Modification to an existing plant - implementation of revised managerial controls to monitor and report evaporator C heating/cooling component usage, within current safety case limits (TRIM 2012/252065)
18. ONR-SDFW-ProjDel-TS-2018/19 - Obj 4 Reduction of Hazard from Highly Active Liquors (TRIM 2017/317247)

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19. ONR HOW2 Guide - Purpose and Scope of Permissioning - NS-PER-GD-014 Revision 4. July 2014. <http://www.onr.org.uk/operational/assessment/index.htm>
20. SEL77561N - Letter to Sellafield Ltd - Waste Encapsulation & Disposition Directorate (WEDD) - ONR's Regulatory Judgement With Respect to Evaporator 'C', Continued Operations - 19 October 2015 (TRIM 2015/389753)
21. Active commissioning safety report ACSR (TRIM 2018/300300)
22. NIO high hazard activity readiness review (HHARR) (TRIM 2018/299546)
23. NIO confirm closure of all findings (TRIM 2018/362646)
24. Evap D vessel design justification report (TRIM 2018/359442)
25. NNL 13951 - Issue 2 - HA Evaporator D Base Thickness Fingerprint (TRIM 2018/359444)
26. EA confirmation: no objection to Evaporator D transition to normal operations (TRIM 2018/339939)
27. CNS confirmation: no objection to Evaporator D transition to normal operations (TRIM 2018/301764)
28. ONR-SEL-AR-027, Rev 0, Human Factors Assessment of Evaporator D Pre-Installation Commissioning Report (TRIM 2014/464635)
29. ONR-SDFW-CR-18-052 - Human Factors Aspects of Evaporator D Transition to Operations (TRIM 2018/294412)
30. C&I assessment report for Evap D active commissioning (TRIM 2017/402362)
31. Evap D Commissioning PMPs Status 30.10.2018 (TRIM 2018/354832)
32. Evap D vessel thickness and understanding of corrosion rates (TRIM 2018/357324)
33. Official - ONR-SDFW- Letter Out - Licence Instrument - Sellafield Site - Site Licence 103 - LI 518 - HALES - Agreement to Evap D transition to normal operations (TRIM 2018/361359)
34. CR ONR-SDFW-CR-18-609 - Sellafield - SL event trending to inform process improvement, LV0001 readiness discussion and Evap D tripartite - 10 October 2018 (TRIM 2018/330553)
35. Evap D - Radiological Protection Commissioning (TRIM 2018/365482)