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| **GDA Regulatory Observation** |
| **REGULATOR TO COMPLETE** |
| **RO unique no.:** | RO-RRSMR-003 |
| **Revision:** | 1 |
| **Date sent:** | 14/08/2024 |
| **Acknowledgement required by:** | 05/09/2024 |
| **Resolution Plan Agreement Required by:** | 03/10/2024 |
| **Record Reference:** | ONRW-2126615823-4083 |
| **Related RQ / RO No. and CM9 Ref:** (if any)**:** | RQ-01081 and RQ-01168 |
| **Observation title:** | Design Basis Maintenance Assumptions and Redundancy Requirements for Class 2 Safety Measures |
| **Lead technical topic:**Fault Studies | **Related technical topic(s):**Mechanical EngineeringElectrical Engineering |
| **REGULATORY OBSERVATION:** |
| **Background**It is well established relevant good practice, in Design Basis Analysis (DBA), to assume the most limiting random single failure, together with losses consequential to the initiating event and the worst normally permitted plant configuration (including unavailability due to planned maintenance, test or repair). As such the DBA supports a demonstration that there are sufficient independent and redundant means to deliver safety functions.Therefore, as part of the Generic Design Assessment (GDA), the Requesting Party (RP) is required to provide DBA which appropriately includes the unavailability of Structures, Systems and Components (SSC) due to planned maintenance, test or repair. Such analysis is required in order to demonstrate:* the adequacy of the generic Rolls-Royce SMR design, in particular regarding the relationship between equipment redundancy and maintenance;
* that the scheduling of planned maintenance test or repair has been informed by, and appropriately included within, the safety analysis and engineering; and
* that operating rules identified within the safety case account for planned maintenance, test or repair as appropriate.

Maintenance requirements identified during GDA will be a key input for any future licensee defining arrangements to ensure the on-going safe operation of the facility. ONR is therefore seeking to build confidence that the RP’s assumptions for planned maintenance, test or repair in the DBA meet UK regulatory expectations and are consistent with the relevant SSC’s design and engineering requirements.The submissions received to date (Refs. [1] and [2]) do not provide sufficient confidence in this regard as they appear to present an inconsistent approach and only cover operating Modes 1 and 2. Notably, following assessment in Step 2 and through Regulatory Queries (Refs. [3] and [4]), ONR has found that the RP has not provided sufficient detail regarding the DBA rules which cover assumptions of unavailability due to planned maintenance for all modes of operation. Furthermore, whilst it is clear the RP’s design principles for Class 1 SSCs require sufficient redundancy for planned maintenance activities (Ref. [5]), this is not the case for Class 2 SSCs and further clarity is required regarding when planned maintenance of Class 2 SSCs will be performed.**Relevant Legislation, Standards and Guidance**The guidance provided in this RO is based on ONR's Safety Assessment Principles (SAPs) (Ref. [6]) and Technical Assessment Guide (TAG) NS-TAST-GD-006 Issue 5.1 (Ref. [7]), which highlight the need to identify maintenance activities, and ensure that they are represented appropriately within the safety analysis. These expectations are captured within the following relevant SAPs; FA.6, EMT.1, EMT.2, EMT. 5-7, ESS.2 and ESS.23. **Regulatory Expectations**From a deterministic fault studies perspective, it is ONR’s expectation (SAP FA.6) that the RP’s design basis fault sequences should include, as appropriate:* The worst normally permitted configuration of equipment outages for maintenance; and
* The most onerous initial operating state within the inherent capacity of the facility permitted by the operating rules.

Therefore, facilities should include design provision for faults occurring in all planned operating modes and configurations, even if such a position would only exist for a short period of time or occur infrequently during the operational life of the facility (Ref. [7]). The effectiveness of this provision should be demonstrated through suitable DBA. Based on the guidance outlined in SAP FA.6 (para 631) (Ref. [6]) and NS-TAST-GD-006 Issue 5.1 (Ref. [7]), ONR expects that the DBA includes appropriate consideration of equipment unavailability due to planned maintenance, test or repair activities. This should include relevant supporting systems (such as standby and alternate AC power sources for example) for both the principal and diverse means of protection. This expectation applies to all operational modes and the analysis of spent fuel pool cooling faults, and faults during refuelling, as well as at power reactor faults. **References**[1] Rolls-Royce SMR, Reactor Plant Performance Design Basis Analysis Methodology, SMR0006250, Issue 2, November 2023. (ONRW-2019369590-5148)[2] Rolls-Royce SMR, EMIT Strategy (Examination, Maintenance, Inspection and Testing), SMR0009111, Issue 1, December 2023. (ONRW-2019369590-5803)[3] RQ-01081 – Full Response [4] RQ-01168 – Full Response[5] Rolls-Royce SMR, Environment, Safety, Security and Safeguards Design Principles, SMR0001603, Issue 1, August 2022. (ONRW-2019369590-7775)[6] ONR, Safety Assessment Principles for Nuclear Facilities, 2014 Edition, Revision 1, January 2020. [www.onr.org.uk/media/pobf24xm/saps2014.pdf](https://www.onr.org.uk/media/pobf24xm/saps2014.pdf) [7] ONR, Design Basis Analysis, NS-TAST-GD-006 Issue 5.1. [www.onr.org.uk/media/2dclmaio/ns-tast-gd-006.docx](http://www.onr.org.uk/media/2dclmaio/ns-tast-gd-006.docx)  |
| **REGULATORY OBSERVATION ACTIONS** |
| **RO-RRSMR-003.A1 – Demonstrate that the assumptions of unavailability due to planned maintenance for all modes of operation used in DBA are consistent with regulatory expectations.**ONR understands that the RP’s DBA rules assume there will be no planned maintenance of SSCs that would challenge delivery of safety functions during powered operations. Although a consistent approach is not presented in the RP’s documentation (Refs. [1] & [2])Based on Refs. [1] and [3] it is ONR’s understanding that for reactor faults originating during Modes 1 and 2 there will be no SSCs that are unavailable due to planned maintenance. It therefore follows that maintenance of those SSCs (and the support systems required to ensure their availability or operability) will be undertaken during Modes 3 to 6, although the DBA rules which cover assumptions of unavailability in these modes of operation have not been presented. In response to this Regulatory Observation Action, Rolls-Royce SMR Ltd should:* Confirm (or otherwise) ONR’s understanding of the RP’s rules regarding assumptions of unavailability due to planned maintenance.
* Provide a complete set of DBA rules which cover assumptions of unavailability due to planned maintenance for all modes of operation.
* Confirm that assumptions made in the DBA will be implemented in the operating rules governing planned maintenance.

Resolution required by *‘to be determined by the Rolls-Royce SMR Ltd Resolution Plan’* |
| **RO-RRSMR-003.A2 – Identify all Class 2 SSCs for which planned preventative maintenance may prevent delivery of safety functions**In response to this Regulatory Observation Action, Rolls-Royce SMR Ltd should:* Identify all Class 2 SSCs (including support systems, required to ensure availability or operability of said SSCs) that are claimed to deliver safety functions in the DBA fault sequences, and
* For each SSC identified in the previous bullet, determine whether planned maintenance activities could prevent delivery of safety functions (when other relevant design basis assumptions, such as single failure and consequential loss, are applied).

Resolution required by *‘to be determined by the Rolls-Royce SMR Ltd Resolution Plan’* |
| **RO-RRSMR-003.A3: Clarify the implications of the generic Rolls-Royce SMR’s design (with regards to the provision of redundancy) on the maintenance strategy**In response to this Regulatory Observation Action, Rolls-Royce SMR Ltd should:* For those SSCs identified in Action 2, for which planned maintenance activities may prevent delivery of safety functions, explain:
1. How the design (with regards to the provision of redundancy) has informed the development of a maintenance strategy, and how maintenance requirements have informed the provision of redundancy.
2. When planned maintenance, test or repair activities will be undertaken (i.e., in which operating states).
3. What operating constraints will be necessary to ensure adequate availability of SSCs (Operating Rules, temporary equipment etc.).

Resolution required by *‘to be determined by the Rolls-Royce SMR Ltd Resolution Plan’* |
| **RO-RRSMR-003.A4: Present the safety justification that the design of the generic Rolls-Royce SMR provides sufficient redundancy in Class 2 SSCs to adequately support the requirement for planned maintenance activities**In response to this Regulatory Observation Action, Rolls-Royce SMR Ltd should:* For those SSCs identified in Action 2, for which planned maintenance activities may challenge the redundancy required to deliver safety functions, provide a demonstration that the design reduces risks associated with the Rolls-Royce SMR design ALARP. Further guidance on ONR’s expectations can be found in Appendix 5 of [7].

The information provided should enable ONR to judge whether a suitable and sufficient safety case has been constructed for these aspects of the design, that meets UK regulatory expectations.Resolution required by *‘to be determined by the Rolls-Royce SMR Ltd Resolution Plan’* |

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| **REQUESTING PARTY TO COMPLETE** |
| **Actual Acknowledgement date** (dd/mm/yy)**:** |  |
| **RP stated Resolution Plan agreement date** (dd/mm/yy)**:** |  |