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REGULATORY OBSERVATION Resolution Plan	
RO Unique No.:	RO-UKHPR1000-0043
RO Title:	ALARP Demonstration for PSA
Technical Area(s)	PSA
Revision:	1
Overall RO Closure Date (Planned):	31/05/2021
Linked RQ(s)	RQ-UKHPR1000-0653
Linked RO(s)	
Related Technical Area(s)	
Other Related Documentation	
Scope of Work	

Background and Regulator's Expectations

The Requesting Party (RP) has submitted "*ALARP Demonstration Report for PSA*" [1], in October 2019. The analysed scope focused on internal event level 1 PSA, internal events Level 2 PSA, internal fire and internal flooding Level 1 PSA, and external hazards Level 1 PSA.

Office for Nuclear Regulation (UK) (ONR) has reviewed the report "*ALARP Demonstration Report for PSA*" [1] and raised *RQ-UKHPR1000-0653* [2] as the report did not meet ONR expectations for an adequate ALARP demonstration for PSA. There is a gap between regulatory expectations and the Requesting Party (RP)'s RQ response.

Besides, ONR has reviewed the Chapter 7 of report "*Internal Event Level 1 PSA*" [3] and find it difficult to trace the supporting information for event tree modelling.

ONR expects the RP to:

1) Develop and document a systematic process in detail for using PSA to identify the design improvements to reduce the risk of UK HPR1000 design to ALARP. The process should use PSA results themselves to identify potential design improvements and use PSA to inform potential improvements identified from other disciplines.

2) Document in detail the analysis and outcomes for using PSA to reduce the risk of UK HPR1000 design to ALARP, such as the identified options, related risk reduction evaluation, optioneering, decision-making justifications and the implementation of reasonably practicable design changes to be incorporated to the

design reference.

3) Document the accident sequence analysis in detail to demonstrate that the accident sequence analysis are traceable from the thermal-hydraulic and physics calculation evidence through to the description of the models in the PSA reports and finally to the PSA models.

Further works will be done by the Requesting Party (RP) to ensure that the PSA ALARP demonstration and Accident Sequence Analysis meet ONR's expectations during GDA phase. These works are described in this resolution plan to RO-UKHPR1000-0043.

Description of the Response and of the Scope of Work

This resolution plan provides a response to the gap on ALARP demonstration for PSA, as well as the gap on traceability demonstration of PSA reports, including:

1) Develop the process for using the PSA to reduce the risk of the generic UK HPR1000 design.

2) Use the PSA results to demonstrate that relevant risks are reduced to ALARP.

3) Provide clear and traceable supporting information for multiple accident sequences.

Deliverable Description

RO-UKHPR1000-0043.A1 – PSA ALARP demonstration process

The Regulatory Observation Action states that:

In response to this Regulatory Observation Action, GNSL should:

1) Develop and document a detailed process for using the PSA and results in a systematic and comprehensive way to identify potential options for design improvement to reduce the risk of the generic UK HPR1000 design to ALARP.

2) The response should include both use of the PSA results themselves to identify potential improvements and using the PSA to inform the optioneering of improvements identified through other means.

3) If relevant processes are already in place they should be identified.

For this action, RP will develop and document a detailed process for using the PSA and its results to identify the potential options for design improvements to reduce the risks of the generic UK HPR1000 design to ALARP.

The process includes:

1) Using the PSA results themselves to identify potential improvements.

2) Using the PSA to inform the optioneering of potential improvements identified through other means.

The analysis scope is the full scope PSA except for Level 3 PSA. The identification of risk insights and plant vulnerabilities based on Level 3 PSA will be considered in site licensing stage.

The above information will be supplemented in the following report:

1) Title: *ALARP Demonstration Report for PSA*, Rev. B.

2) Schedule: to be submitted before 30th September 2020.

RO-UKHPR1000-0043.A2 – Use of the PSA result to demonstrate relevant risks are reduced ALARP

The Regulatory Observation Action states that:

In response to this Regulatory Observation Action, GNSL should:

1) Action A2.1: Use the process developed under Action 1 to systematically and thoroughly use the PSA model and results to identify insights and vulnerabilities of the generic UK HPR1000 design.

2) Action A2.2: Develop a list of potential options for design improvements to address the insights and vulnerabilities identified. This list should have a clear and suitable scope, focusing on areas where the risk is high. The development of the list of options should be documented in detail.

3) Action A2.3: Use the PSA model to evaluate the risk reduction of the options identified. The evaluation of options should be documented in detail.

4) Action A2.4: Using the risk reduction analysis, decide which options are reasonably practicable to be incorporated into the UK HPR1000 design. The decision made for each option should be documented in detail, including justification for when an option is not considered for incorporation.

5) Action A2.5: Demonstrate which changes to the DR should be made prior to completion of GDA, or where this is not possible, how the commitment to make the change could be managed through the next stage of the design process and how closure of GDA does not preclude the options from being considered as part of future risk informed design activities.

6) Action A2.6: Summarise and document the outcomes from this work, to provide evidence to support the conclusion that there are no further reasonably practicable safety improvements identified for the generic plant design during GDA based upon the PSA results.

For Action A2.1, Requesting Party (RP) will use the developed process in action A1 to systematically identify UK HPR1000 risk insights and plant vulnerabilities. The analysis scope is the full scope PSA except for Level 3 PSA, since the identification of risk insights and plant vulnerabilities based on Level 3 PSA will be considered in site licensing stage.

For Action A2.2, RP will use the developed process in action A1 to identify the potential options for design improvements consideration to address the risk insights and plant vulnerabilities identified in action A2.1. The development and the outcomes for the list of options will be documented in detail, and the high risk options will be identified.

For Action A2.3, for options, the PSA model will be used to evaluate the risk reduction of the PSA identified options in Action A2.2. The related evaluations will be documented in detail.

For Action A2.4, CGN will perform the decision-making process to identify which PSA identified options are reasonably practicable to be incorporated into UK HPR1000 design. The decision-making process will comply with the procedure "*Provisions on Technical Decision-making System for UK HPR1000 Generic Design*

Assessment (GDA) Project (GH-30E-007)". The optioneering and decision-making process, related outcomes and justifications will be documented in detail.

For Action A2.5, RP will supplement the demonstration for changes to Design Reference (DR) which will be made prior to the completion of GDA, if it is not possible, how the commitment to make the changes could be managed after GDA. The related decisions and demonstrations will be documented in detail.

For Action A2.6, RP will summarise and document the related processes, outcomes of above actions.

The above information will be supplemented in the following reports and related supporting references:

1)Title: *ALARP Demonstration Report for PSA*, Rev. B, to be submitted before 30th September 2020.

The main updates compare with Rev. A:

- Supplement the ALARP demonstration process,
- Supplement the detail documentation about the analysis process and outcomes for using PSA to reduce the risks of UK HPR1000 design to ALARP, and the analysis scope focuses on the Internal Events Level 1 PSA, the Spent Fuel Pool PSA, the External Flooding Level 1 PSA and the Seismic PSA risk insights based on FCG 3 Seismic Level 1 PSA.

2)Title: *ALARP Demonstration Report for PSA*, Rev. C, to be submitted before 31st December 2020.

The main updates compare with Rev. B: supplement the analysis scope for Internal Fire Level 1 PSA, Internal Flooding Level 1 PSA, External Hazard Level 1 PSA and Level 2 PSA.

RO-UKHPR1000-0043.A3 –Traceability of the PSA

<u>The Regulatory Observation Action states that:</u>

The overall intent for this Action is for GNSL to provide a demonstration that the PSA is traceable from the thermalhydraulic and physics calculation evidence through to the description of the models in the PSA reports and finally to the PSA models.

In response to this Regulatory Observation Action, GNSL should:

- *Identify multiple accident sequences in the Level 1 PSA (ver. B) in which traceability will be demonstrated.*
- *Using the identified sequences, the progression of the accident sequence needs to be linked to any assumptions, timings or success criteria used to explain the accident sequences. There needs to be clear sign posting to the analysis from which the assumptions, timings or success criteria were derived from.*
- *Present the evidence (thermal hydraulic analysis/physics or other analyses) that was used to substantiate the demonstrated accidents sequences in enough detail to enable an independent review of evidence supporting the claims and arguments. If this evidence is already contained in extant reports that were previously submitted in GDA, clear referencing to this information is needed. When using extant reports, consistency of the evidence to the information used in the PSA needs to be ensured. If the evidence is in RP reports that were not submitted, then a reproduction of that evidence needs to be included in the response to this Action.*

- *Provide a strategy and programme for cascading this work through into the next version of the PSA and all future PSA reports, for GDA and beyond.*

For this action, RP will develop and document the detailed accident sequence analysis of IB-LOCA and LOOP accident to demonstrate the traceability from the thermalhydraulic and physics calculation evidence to the sequence analysis report and finally to the PSA models.

The response includes:

1) Selection of two accident sequence analysis to demonstrate their traceability: Intermediate Break -– Loss of Coolant Accident (IB-LOCA) and Loss of Offsite Power (LOOP) accident.

2) For the IB-LOCA and LOOP accident, detailed sequence analysis will be documented and linked to assumptions, timings or success criteria with clear justification to present how the modelling is performed.

3) For the IB-LOCA and LOOP accident, clear evidence and justification for each success criterion will be provided to support an independent review. The updated description will clarify and cite the evidence from references to ensure the consistency.

4) For the future accident sequence analysis reports, the improvement of traceability as described above will also be applied to support an independent review when they are updated.

The action above will be supplemented in the following report:

1) Title: *Detailed Accident Sequence Analysis for LOOP and IB-LOCA,* Rev. A.

2) Schedule: to be submitted before January 29th, 2021.

Impact on the GDA Submissions

The information related to Action A1 is incorporated into the report *ALARP Demonstration Report for PSA* (Rev. B, September 30th, 2020).

The information related to Action A2 will be incorporated into the report *ALARP Demonstration Report for PSA* (Rev. C, December 31st, 2020).

The information related to Action A3 will be incorporated into the report *Detailed Accident Sequence Analysis for LOOP and IB-LOCA* (Rev. A, January 29th, 2021).

Timetable and Milestone Programme Leading to the Deliverables

See attached Gantt Chart in APPENDIX A.

Reference

[1] CGN, ALARP Demonstration Report for PSA, Rev. A, October 2019, CM9 2019/310135

[2] ONR, RQ-UKHPR1000-0653, PSA Demonstration of ALARP and Optioneering, March 2020, CM9 2020/69812

[3] CGN, Internal Events Level 1 PSA, GHX00650001DOZJ02GN, Rev. B, April 2020.

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APPENDIX A RO-UKHPR1000-0043 Gantt Chart

Task and Schedule	2020								2021					
	31-May	30-Jun	31-Jul	31-Aug	30-Sep	31-Oct	30-Nov	31-Dec	31-Jan	28-Feb	31-Mar	30-Apr	31-May	30-Jun
RO Action A1														
Update and submission of " ALARP Demonstration Report for PSA (Rev. B)"					▲									
RO Action A2														
Update and submission of " ALARP Demonstration Report for PSA (Rev. B)"					▲									
Update and submission of " ALARP Demonstration Report for PSA (Rev. C)"								▲						
RO Action A3														
Submission of "*Detailed Accident Sequence Analysis for LOOP and IB-LOCA* (Rev. A)"									▲					
Assessment														
Regulators Assessment														
Target RO Closure Date													▲	