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REGULATORY OBSERVATION Resolution Plan	
RO Unique No.:	RO-UKHPR1000-0012
RO Title:	Identification and Application of Relevant Good Practice Applicable to Mechanical Engineering for the UK HPR1000 Design
Technical Area(s)	Mechanical Engineering
Revision:	Rev 0
Overall RO Closure Date (Planned):	30/04/2021
Linked RQ(s)	RQ-UKHPR1000-0001 (2017/452664) RQ-UKHPR1000-0077 (2018/155312) RQ-UKHPR1000-0185 (2019/40579)
Linked RO(s)	-
Related Technical Area(s)	5. Conventional Health & Safety 12. Internal Hazards 16. Radiological Protection 17. RadWaste, Decommissioning & Spent Fuel Management
Other Related Documentation	-

Scope of Work

Background

ONR issued Regulatory Observation (RO) – "Identification and Application of Relevant Good Practice Applicable to Mechanical Engineering for the UK HPR1000 Design".

RO-UKHPR1000-0012 placed the following actions:

A1– Prepare a strategy for the comprehensive analysis of the relevant good practice applicable to the mechanical engineering UK HPR1000 reference design

A2– Undertake an analysis of the UK HPR1000 reference design against relevant good practice associated with mechanical engineering

A3 – Undertake a mechanical engineering relevant good practice (RGP) "compliance"/gap analysis against the UK HPR1000 generic design

Requesting Party (RP) acknowledges the significance of RGP in UK context and the current scope of RGP needs to be developed, RP makes the resolution plan for this RO.

Scope of work

This Resolution Plan describes RP's current plan to address the RO. It contains the detailed strategy, the planned

activities, deliverables, milestones, timescales, as well as resources assignment.

The scope of Mechanical Engineering(ME) mainly includes the Structures, Systems, and Components (SSCs) that are important to nuclear safety. These SSCs include the nuclear island systems, nuclear island Heating, Ventilation and Air Conditioning System (HVAC), major conventional island systems and their associated components. These SSCs cover the items relevant to the whole lifetime of the nuclear power plant, including the design, manufacture, construction, installation, commissioning, normal operation, fault operation, maintenance, testing and inspection, etc.

The sources of RGP for ME include regulations, Approved Codes of Practice (ACOPs), Safety Assessment Principles (SAPs) and Technical Assessment Guides (TAGs), codes and standards, guidance, and relevant Operational Experience Feedback (OEF) and Operating Experience (OPEX). The work includes RGP identification, compliance analysis, gap analysis and related As Low As Reasonably Practicable(ALARP) analysis.

Deliverable Description

The main actions to be undertaken to resolve the RO are described as follows.

RO-UKHPR1000-0012.A1 –Present a strategy for the comprehensive analysis of the relevant good practice applicable to the mechanical engineering UK HPR1000 reference design

Actions requested by the Regulator as stated in the RO:

1. Submit a strategy to comprehensively analyse relevant good practice applicable to the UK HPR1000 mechanical engineering design.

2. Provide clear links to the "mechnical engineering safety case" being made for UK HPR1000 i.e. relevant SSCs, safety function categorisation, SSC safety classification etc.

3. Demonstrate its strategy has been developed with appropriate input from suitably qualified and experienced persons (SQEPs) familiar with the UK mechnical engineering nuclear safety context.

Resolution Plan:

The strategy for analysing relevant good practice, applicable to the UK HPR1000 mechanical engineering design, will be provided in a report "UK HPR1000 Strategy for Analysis of RGP in ME Design". This report will outline the process that will be adopted to ensure that the analysis forms a comprehensive basis for the ME design. The strategy will be based on the following sequence:

- Define scope of UK HPR1000 ME SSCs for RGP review and other activities;
- Collect RGP, i.e. relevant regulations /ACOPs/codes and standards/guidance;
- Provide RGP suitability analysis;
- Evaluate relative importance of RGP collected;
- Screen preliminary RGP;

- Define applicable RGP list;
- Provide UK HPR1000 compliance analysis against RGP;
- Undertake GAP identification against extant UK HPR1000 design and safety case.

The Strategy document will describe each of the above steps. It will also establish appropriate links to the design process.

The output of the Strategy document will be:

- Consolidate a comprehensive list of RGP that is applicable to the UK HPR1000 ME design,
- Deliver a compliance analysis that demonstrates which UK HPR1000 design elements comply with RGP,
- List any gaps against RGP that may arise.

Note - although the Strategy document primarily responds to ROA1, some of the steps outlined above will be developed further as part of the response to ROA2.

Deliverables:

1) UK HPR1000 Strategy for Analysis of RGP in Mechanical Engineering Design: no late than 31st December 2019

Resources:

1) CGN will prepare the strategy document in coordination with all the engineering and design sections involved.

2) UK Technical Support Company (TSC)

RO-UKHPR1000-0012.A2 –Undertake an analysis of the UK HPR1000 reference design against relevant good practice associated with mechanical engineering

Actions requested by the Regulator as stated in the RO:

1. Identify the UK HPR1000 sources of mechanical engineering relevant good practice (RGP). This should include the full range of what ONR considers to be RGP (listed above), be relevant to the UK nuclear industry and UK safety legislation.

2. Consider relevant Operational Experience Feedback (OEF) and Operating Experience (OPEX).

3. Justify the applicability (i.e. "relevance", to the UK HPR 1000 generic design) of the identified RGP/OEF/OPEX.

4. Provide "compliance"/gap analysis that identifies where the UK HPR1000 design does not meet mechanical engineering RGP. The analysis should be objective and transparent and seek to identify actual gaps and shortfalls in RGP; it should not be directed towards achieving a compliant conclusion.

5. Document the rationale/justification for the conclusions reached in the UK HPR1000 generic safety case.

6. Demonstrate its RGP "compliance"/gap analysis has been undertaken with appropriate input from SQEP familiar with the UK mechanical engineering nuclear safety context.

Resolution Plan:

The RP will undertake a thorough search for the applicable regulations / ACOPs / codes and standards / guidance and relevant OEF / OPEX for ME SSCs in cooperation with UK TSC. The RGP will cover the activities in whole lifecycle of an equipment to ensure the list is integrated.

The Hierarchy of Laws, Regulations, Codes and standards, Selection Principles and Process will be revised and presented in the document “General Principles for Application of Laws, Regulations, Codes and Standards”;

To ensure a targeted approach, the RP will identify the ranges for mechanical engineering UK HPR1000 SSCs, which will be described within the strategy document. Typical examples include HVAC systems, Mechanical systems, Static SSCs and Dynamic SSCs.

The RP will:

- Justify the applicability of each identified area of RGP. Note – RGP = RGP/OEF/OPEX
- Produce four separate suitability analysis reports for the typical samples of HVAC systems, Mechanical systems, Static SSCs and Dynamic SSCs.

The “General Principles for Application of Laws, Regulations, Codes and Standards report” will mainly include the following aspects:

- Describe the general principles, process and selection criteria
- Present the Hierarchy of Laws, Regulations, Codes and standards applicable to UK HPR1000;
- The Suitability Analysis reports will include the following aspects:
- Describe the suitability analysis process
- Collect the related RGP
- Screen the related RGP
- Assess the selected RGP
- List the applicable RGP

The List of RGP report for Mechanical Engineering will:

- Summarise the Applicable RGP. This will link to the SSCs safety category / classification.

The “Compliance”/Gap Analysis report will:

- Outline the compliance / gap analysis process
- Detail the compliance analysis results
- Identify any gaps and forward plan

- Document the rationale/justification for the conclusions reached in the UK HPR1000 ME design.

Deliverables:

1) General Principles Report:

- General Principles for Application of Laws, Regulations, Codes and Standards (by 29th February 2020)

2) Suitability Analysis Reports:

- Suitability Analysis of RGP for sample of HVAC Systems (by 31st March 2020)
- Suitability Analysis of RGP for sample of Mechanical Systems (by 31st March 2020)
- Suitability Analysis of RGP for sample of Static SSCs (by 31st May 2020)
- Suitability Analysis of RGP for sample of Dynamic SSCs (by 31st May 2020)

3) List of RGP Report:

- List of RGP for Mechanical Engineering (by 30th June 2020)

4) Compliance Analysis Reports:

- Compliance Analysis of RGP for sample of HVAC Systems (by 31st May 2020)
- Compliance Analysis of RGP for sample of Mechanical Systems (by 31st May 2020)
- Compliance Analysis of RGP for sample of Static SSCs (by 31st August 2020)
- Compliance Analysis of RGP for sample of Dynamic SSCs (by 31st August 2020)

5) Summarised Gap list Report:

- List of Gaps for Mechanical Engineering against RGP (by the 30th of September 2020)

Resources:

1) CGN: ME team, systems engineering sections and equipment design sections involved

2) UK TSC

RO-UKHPR1000-0012. A3 –Undertake a mechancial engineering RGP "compliance"/gap analysis against the UK HPR1000 generic design

Actions requested by the Regulator as stated in the RO:

1. Identify UK HPR1000 SSCs where mechanical engineering RGP is not satisfied in the UK context (i.e. the shortfalls/gaps).

2. Explain the significance of the shortfalls/gaps identified against mechanical engineering RGP. For example, whether design modifications might be required.

3. Explain how the identified gaps, will be addressed during GDA. This should include how and when the RP's ALARP methodology will be applied to demonstrate the UK HPR1000 generic design reduces relevant risks ALARP.

Resolution Plan:

The outcome of ROA2 is the main input for ROA3. Identified gaps will be subject to Optioneering Studies. GDA preferred options will be implemented into the UK HPR1000 design via modification process. Further holistic evaluation will identify any additional potential enhancement. This process continues until the assessment yield no further potential enhancements, the simplified diagram of ALARP is presented in Fig-1. If no gaps against RGP are identified, the necessity of the subsequently related reports will be removed after agreed with ONR.

Optioneering Study for Identified Gaps will include the following aspects:

- Present the optioneering process and assessment criteria;
- For each gap/difference, identifying all relevant options;
- Evaluate and score each option against the assessment criteria;
- Conclude on the chosen options that will form part of the baseline for the UK HPR1000 design.

The List of SSCs Affected by the Optimal Options reports will include the following aspects:

- Identify the UK HPR1000 SSCs requiring modification and present the reasons;
- Identify the UK HPR1000 SSCs not requiring modification and present the reasons;
- Present the strategies, plans and timescales to deal with any necessary modifications to SSCs in the UK HPR1000 generic design.

ALARP Demonstration reports will mainly include the following aspects:

- Present the purpose and scope of the report;
- Present the UK HPR1000 Design Reference;
- Summarise the gaps identified by the systematic review of UK HPR1000 Design reference against RGP and insight from PSA;
- Summarise the optioneering outcome for the identified gaps;
- Justify that no reasonably practicable improvements are available beyond the selected options during GDA process;
- Conclude the relevant risks reduced to ALARP.

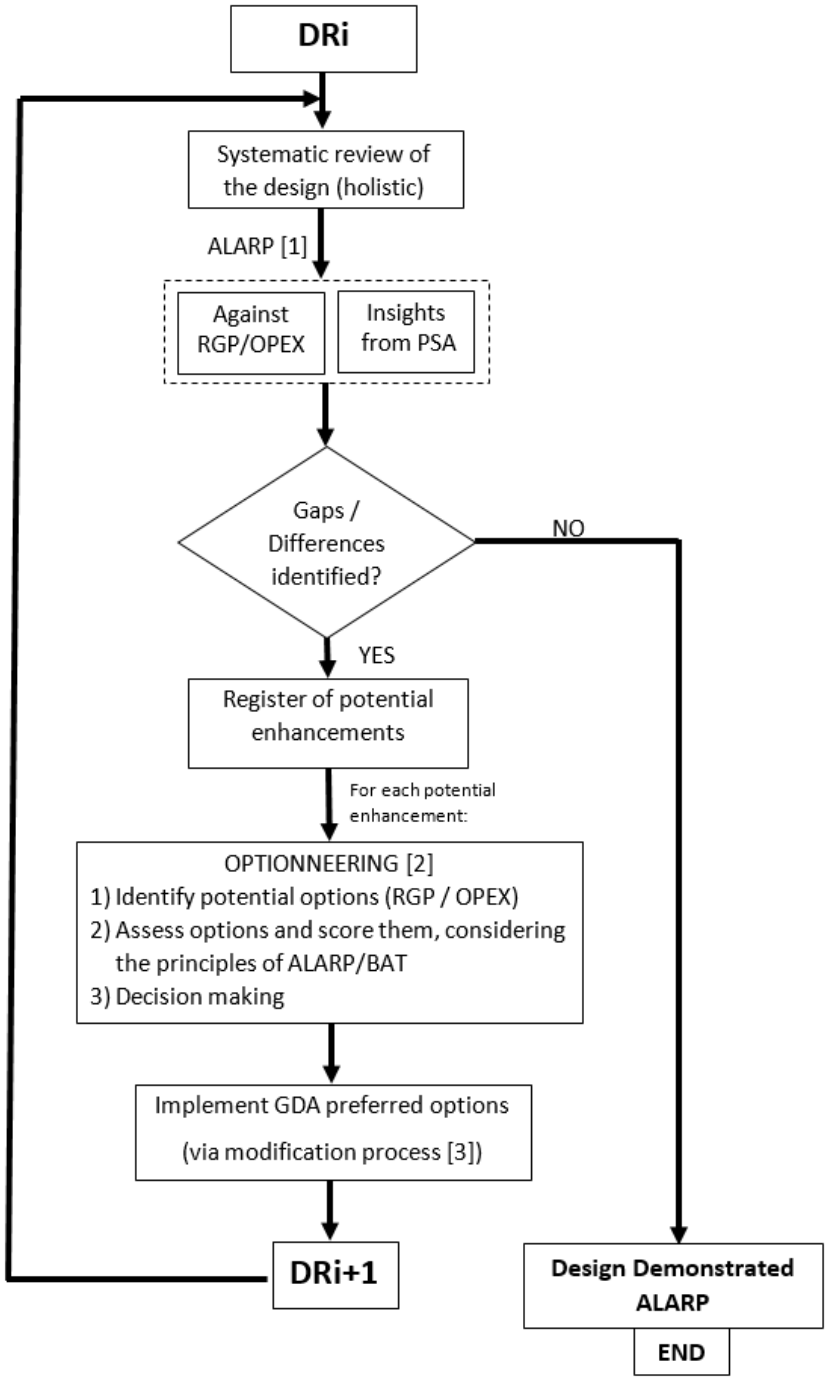

Fig-1 Simplified Diagram of ALARP

Note: DR: Design References for UK HPR1000 GDA;

[i]: The reference associated, listed in the hereafter Reference section.

Deliverables:

6) Optioneering Study Reports:

- Optioneering Study for Identified Gaps of sample of HVAC Systems (by 31st July 2020)
- Optioneering Study for Identified Gaps of sample of Mechanical Systems (by 31st July 2020)
- Optioneering Study for Identified Gaps of sample of Static SSCs (by 31st October 2020)
- Optioneering Study for Identified Gaps of sample of Dynamic SSCs (by 31st October 2020)

7) List of Affected SSCs Reports:

- The List of SSCs Affected by the Optimal Options for sample of HVAC Systems (by 31st August 2020)
- The List of SSCs Affected by the Optimal Options for sample of Mechanical Systems (by 31st August 2020)
- The List of SSCs Affected by the Optimal Options for sample of Static SSCs (by 31st November 2020)
- The List of SSCs Affected by the Optimal Options for sample of Dynamic SSCs (by 31st November 2020)

8) ALARP Demonstration Reports:

- ALARP Demonstration for Reactor Coolant System (by 31st December 2020)
- ALARP Demonstration Report for Safety Systems (by 31st December 2020)
- ALARP Demonstration for Auxiliary Systems (by 31st December 2020)
- ALARP Demonstration Report for Steam and Power (by 31st December 2020)
- ALARP Demonstration Report for Radioactive Waste Management (by 31st December 2020)
- ALARP Assessment of the PMC [FHSS] SSCs (by 31st December 2020)

For the reports outlined in response to RO A1, 2, 3, the anticipated timescales to submit these documents are given in the Gantt Chart in Appendix A.

Resources: CGN ME team, systems engineering sections and equipment design sections involved

References

[1] CGN, ALARP Methodology, GHX00100051DOZJ03GN, Rev. B, 2018

[2] CGN, Provisions on Optioneering process for UK HPR1000 Generic Design Assessment (GDA) Project, GH-40M-018, Rev. A, 2019

[3] CGN, Provisions on Configuration Change Management for UK HPR1000 Generic Design Assessment (GDA) Project, GH-40M-012, Rev. B, 2019

Impact on the GDA Submissions

The results of the gap analysis may lead to design changes. The impact on the UK HPR1000 safety case documentation

will need to be established. The main documents are as follows:

PCSR Sub-chapters

Safety Case Documents

Support Evidence Documents

These documents will be revised in accordance with the corresponding actions as the RO progress.

Timetable and Milestone Programme Leading to the Deliverables

See attached Gantt Chart in APPENDIX A.

Reference

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APPENDIX A RO-UKHPR1000-0012 Gantt Chart

Task and Schedule	2019		2020											2021				
	30-Nov	31-Dec	31-Jan	29-Feb	31-Mar	30-Apr	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
RO Action 1																			
Development and submission of “UK HPR1000 Strategy for Analysis of RGP in Mechanical Engineering Design”																			
Target ROA1 Close Date																			
RO Action 2																			
Update and submission of “General Principles for Application of Laws, Regulations, Codes and Standards”																			
Development and submission of “Suitability Analysis of RGP for Sample of HVAC Systems”																			
Development and submission of “Suitability Analysis of RGP for Sample of Mechanical Systems”																			
Development and submission of “Suitability Analysis of RGP for Sample of Static SSCs”																			
Development and submission of “Suitability Analysis of RGP for Sample of Dynamic SSCs”																			
Development and submission of “List of RGP for Mechanical Engineering”																			
Development and submission of “Compliance Analysis of RGP for Sample of HVAC Systems”																			
Development and submission of “Compliance Analysis of RGP for Sample of Mechanical Systems”																			
Development and submission of “Compliance Analysis of RGP for Sample of Static SSCs”																			
Development and submission of “Compliance Analysis of RGP for Sample of Dynamic SSCs”																			
Development and submission of “List of Gaps for Mechanical Engineering against RGP”																			
Target ROA2 Close Date																			
RO Action 3																			
Development and submission of “Optioneering Study for Identified Gaps of sample of HVAC Systems”																			
Development and submission of “Optioneering Study for Identified Gaps of sample of Mechanical Systems”																			
Development and submission of “Optioneering Study for Identified Gaps of sample of Static SSCs”																			
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Update and submission of “ALARP Demonstration for Reactor Coolant System”																			
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Update and submission of “ALARP Demonstration Report for Steam and Power”																			
Update and submission of “ALARP Demonstration Report for Radioactive Waste Management”																			
Update and submission of “ALARP Assessment of the PMC [FHSS] SSCs”																			
Target ROA3 Close Date																			
Assessment																			
Regulatory Assessment																			
Target RO Close Date																			