REGULATORY OBSERVATION

REGULATOR TO COMPLETE

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Observation title:	Identification and Application of Relevant Good Practice Applicable to Mechanical Engineering for the UK HPR1000 Design
Lead technical topic: 14. Mechanical Engineering	**Related technical topic(s):** 5. Conventional Health & Safety 12. Internal Hazards 16. Radiological Protection 17. RadWaste, Decommissioning & Spent Fuel Management

Regulatory Observation

Background

ONR considers relevant good practice (RGP) is those standards for controlling risk which have been judged and recognised by us as satisfying the law, when applied to a particular relevant case in an appropriate manner. http://www.onr.org.uk/documents/2017/risk-informed-regulatory-decision-making.pdf

Sources of good practice include:

- Guidance within Approved Codes of Practice (ACoP); for example, the Provision and Use of Work Equipment Regulations 1998;
- Health and Safety Executive (HSE) / Office for Nuclear Regulation (ONR) guidance including ONR's Safety Assessment Principles (SAPs), Technical Assessment Guides (TAGs) and Technical Inspection Guides (TIGs);
- Standards produced by standards making organisations, for example British Standards Institution (BSI), International Organisation for Standardisation (ISO), International Atomic Energy Agency (IAEA) and Western European Nuclear Regulators' Association (WENRA);
- Guidance agreed by a body representing an industrial / occupational sector; and
- Well defined and established standard practice adopted by an industrial / operational sector.

In the mechanical engineering discipline, ONR has received and assessed several of the Requesting Party's (RP) safety case documents relevant to RGP, codes etc. To date, ONR judges that RGP is not adequately considered within the following RP Generic Design Assessment (GDA) Step 3 submissions for UK HPR1000:

- The *"General Principles for Application of Laws, Regulations, Codes and Standards"* document [Ref. 1] identifies laws, regulations, ACoPs and guidance documents in addition to codes and standards. However, the selection process (Section 5) only considers guidance documents, codes and standards.

UK regulations and ACoPs are not identified in the selection process. It is therefore not apparent how the RP will ensure that the UK HPR1000 design will meet all RGP.

- The *"Compliance Analysis for RGP in Mechanical Engineering"* [Ref. 2] only considers RGP for standards produced by standards making organisations. There is therefore a significant amount of Mechanical Engineering RGP that remains to be analysed. Furthermore, the rationale/evidence for the conclusions reached is not presented, nor is it directly referred to.

Identifying and implementing RGP is one route, recognised by ONR (e.g. NS-TAST-GD-005, Guidance on the demonstration of ALARP) to satisfy the law. If properly executed, satisfying RGP can lead to an adequate demonstration of nuclear safety and ultimately that relevant risks will be reduced to as low as reasonably practicable (ALARP). The demonstration relevant risks are reduced so far as is reasonably practicable (SFAIRP)/ALARP[1] is the overriding, fundamental legal requirement enshrined in UK health and safety legislation.

ONR considers that new plant, installations or situations should conform to current good practice, as a starting point. Other potential options should be considered to determine whether further risk reduction measures are reasonably practicable.

In a non-prescriptive regulatory regime, identifying and satisfying RGP is not the only way to make an adequate demonstration of nuclear safety/ALARP. However, for UK HPR1000 GDA, the RP [Ref. 3] is pursuing this strategy. ONR's GDA Step 2 mechanical engineering assessment report [Ref. 4] identified several important follow-up items related to RGP, codes, standards and regulations:

- Management of gaps in RGP between the reference plant (Fangchenggang Nuclear Power Plant Unit 3) and UK HPR1000 (including application of ALARP principles); and
- Codes, standards and regulations.
- Safety categorisation / classification

Throughout GDA Step 2, and in the first half of Step 3, several mechanical engineering Regulatory Queries (RQs) [Ref. 5] were raised on the topic of RGP, relevant codes, standards, legislation etc. These topics were discussed in L4 meetings [Ref. 7]. As well as Refs. 1 and 2, ONR has also assessed the RP's submission, *"Suitability Analysis of ME [Mechanical Engineering] Codes and Standards"* [Ref. 6].

Based on ONR's mechanical engineering assessment to date, an adequate demonstration of RGP into the UK HPR1000 generic design has not been provided. The scope and purpose of the above reports in making the overall "mechanical engineering safety case" for UK HPR1000 is unclear. This Regulatory Observation (RO) has therefore been raised to:

- Explain ONR's regulatory expectations;
- Ensure the RP adequately identifies the mechanical engineering RGP, and other documents, it appropriately references within the UK HPR1000 generic safety case.
- Obtain confidence that all gaps in mechanical engineering RGP are identified and suitably addressed in the UK HPR1000 generic design. This will assist ONR's judgement of whether a robust ALARP demonstration is provided.

Relevant Legislation, Standards and Guidance

Regulations (examples)

[1] The precise term used in the Health and Safety at Work Act is to reduce risks so far as is reasonably practicable (SFAIRP). The term "ALARP" does not feature in the legislation. However, in practical terms, ALARP and SFAIRP are taken with the same meaning and used interchangeably.

- The Management of Health and Safety at Work Regulations 1999;
- The Construction and Design Management Regulations 2015;
- The Provision and Use of Work Equipment Regulations 1998;
- The Lifting Operations and Lifting Equipment Regulations 1998;
- The Pressure Systems Safety Regulations 2000; and
- The Work at Height Regulations 2005.

Including any Approved Codes of Practices (ACoPs) for such regulations.

Technical Assessment Guides (examples)

- NS-TAST-GD-005 Guidance on the demonstration of ALARP
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-005.pdf
- NS-TAST-GD-022 Ventilation
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-022.pdf
- NS-TAST-GD-036 Redundancy, diversity, segregation and layout of mechanical plant
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-036.pdf
- NS-TAST-GD-056 Nuclear lifting operations
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-056.pdf
- NS-TAST-GD-057 Design safety assurance
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-057.pdf
- NS-TAST-GD-067 Pressure systems safety
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-067.pdf
- NS-TAST-GD-102 General guidance for mechanical engineering specialism group
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-102.pdf
- NS-TAST-GD-103 Emergency Power Generation
  http://www.onr.org.uk/operational/tech_asst_guides/ns-tast-gd-103.pdf

Regulatory Expectations

To demonstrate the UK HPR1000 generic design reduces relevant risks to ALARP, the RP's strategy is to identify RGP and undertake a mechanical engineering gap analysis of the UK HPR1000 design against it.

Hence, ONR's regulatory expectation is that the UK HPR1000 generic safety case should adequately identify mechanical engineering RGP in the UK context. It should clearly articulate how any gaps/shortfalls against RGP will impact the UK HPR1000 generic design. Any gaps in RGP should be adequately progressed to robustly demonstrate the UK HPR1000 generic design reduces relevant risks to ALARP. To achieve this, as part of the resolution of this RO, the RP will need to undertake and document the following activities (applicable to mechanical engineering):

- Identify the sources of RGP in the UK context. Where appropriate, this should consider relevant Operational Experience Feedback (OEF) and Operating Experience (OPEX).
- Justify the applicability (i.e. "relevance", to the UK HPR 1000 generic design) of the RGP/OEF/OPEX identified.
- Provide a strategy for evaluating the UK HPR1000 generic design (i.e. undertaking a gap analysis) against sources of the RGP/OEF/OPEX identified. There should be clear links to the

"mechanical engineering safety case" for UK HPR1000 (i.e. specific structures, systems and components (SSCs), categorisation of the safety functions delivered and safety classification of the SSC's).

- Evaluate the UK HPR1000 generic design against the identified UK context RGP/OEF/OPEX. This should be based on the "mechanical engineering safety case" for UK HPR100. The rationale/justification for the conclusions reached should be articulated in the UK HPR1000 generic safety case.

- Identify gaps against UK context RGP for the UK HPR1000 generic design. The impacted SSCs should be clearly defined and significance of any identified gaps articulated.

- Explain how any identified gaps will be addressed during GDA. Plans and timescales for the application of the RP's ALARP methodologies should also be included; to be able to demonstrate, the UK HPR1000 generic design reduces risks to ALARP.

To be able to complete the above activities ONR expects the RP to consider the need to access suitably qualified and experienced personnel (SQEP), with mechanical engineering experience within the UK context.

The Regulatory Observation Actions (ROAs) given below are therefore structured in such a way as to enable the above information to be provided in a logical and step-wise manner, to facilitate ONR's assessment as GDA progresses.

References

[1] General Principles for Application of Laws, Regulations, Codes and Standards, GH-X-00100-018 DOZJ-03-GN, Revision F, September 2018 (2018/316416)

[2] Compliance Analysis of RGPs in Mechanical Engineering, GH-X-00800-006-DNHX-02-GN, Revision A, September 2018 (2018/402950)

[3] Pre-Construction Safety Report Chapter 1 – Introduction, HPR/GDA/PCSR/0001, Revision 000, September 2018 (2018/320148)

[4] GDA Step 2 Assessment of Mechanical Engineering for the UK HPR1000 Reactor, ONR-GDA-UKHPR1000-AR-18-014, October 2018

[5] Regulatory Queries:

- RQ-UKHPR1000-0001 – Mechanical Engineering - Gaps in Relevant Good Practice (Mechanical Engineering), November 2017 (2017/452664).

- RQ-UKHPR1000-0077 – Mechanical Engineering – Mechanical Codes and Standards, April 2018 (2018/155312).

- RQ-UKHPR1000-0185 – Mechanical Engineering - Spent Fuel Building - Prevention of Falls into Ponds and Pits and hoist wells, 21 January 2019 (2019/40579).

[6] Suitability Analysis of Codes and Standards in Mechanical Engineering, GH-X-00800-005-DNHX-02-GN, Revision A, September 2018 (2018/387002)

[7] UK HPR1000 GDA Step 3 Meetings:

- Mechanical Engineering Level 4 Meeting – Topic: HSG 253 Safe Isolation of Plant and Equipment, ONR-NR-CR-18-652, December 2018 (2018/404021)

- Mechanical Engineering Level 4 Meeting – Topic: Lifting, ONR-NR-CR-19-717, January 2019 (2019/33911)

- Mechanical Engineering Level 4 Meeting – Topic Mechanical Engineering Workshop, ONR-NR-

CR-19772 (2019/404021)

Regulatory Observation Actions

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

In response to this Regulatory Observation Action (ROA), the RP should:

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

The response to this ROA may be combined with any other ROA under this RO, if deemed appropriate.

Resolution required by '*to be determined by General Nuclear System Resolution Plan*'

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

In response to this ROA, based on the outcome of ROA1 above, the RP should:

- Identify the UK HPR1000 sources of mechnical 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.
- Consider relevant Operational Experience Feedback (OEF) and Operating Experience (OPEX).
- Justify the applicability (i.e. “relevance”, to the UK HPR 1000 generic design) of the identified RGP/OEF/OPEX.
- Provide a “compliance”/gap analysis that identifies where the UK HPR1000 design does not meet mechnical 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.
- Document the rationale/justification for the conclusions reached in the UK HPR1000 generic safety case.
- Demonstrate its RGP “compliance”/gap analysis has been undertaken with appropriate input from SQEP familiar with the UK mechanical engineering nuclear safety context

The response to this ROA may be combined with any other ROA under this RO, if deemed appropriate.

Resolution required by '*to be determined by General Nuclear System Resolution Plan*'

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

In response to this ROA, based on the outcomes of ROAs 1 and 2 above, the RP should:

- Identify UK HPR1000 SSCs where mechnical engineering RGP is not satisfied in the UK context (i.e. the shortfalls/gaps).
- Explain the significance of the shortfalls/gaps identified against mechanical engineering RGP. For

example, whether design modifications might be required.

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

The response to this ROA may be combined with any other ROA under this RO, if deemed appropriate.

Resolution required by '*to be determined by General Nuclear System Resolution Plan*'

REQUESTING PARTY TO COMPLETE	
Actual Acknowledgement date:	
RP stated Resolution Plan agreement date:	