

REGULATORY OBSERVATION	
REGULATOR TO COMPLETE	
RO unique no.:	RO-UKHPR1000-0002
Revision:	0
Date sent:	13/03/18
Acknowledgement required by:	05/04/18
Agreement of Resolution Plan Required by:	25/05/2018
TRIM Ref:	2018/43924
Related RQ / RO No. and TRIM Ref: (if any):	RQ-UKHPR1000-0008 2017/451654
Observation title:	Demonstration that the UK HPR1000 Design is Suitably Aligned with the Generic Site Envelope
Lead technical topic: 8. External Hazards	Related technical topics: 2. Civil Engineering 3. Control & Instrumentation 7. Electrical Engineering 14. Mechanical Engineering 20. Structural Integrity
<i>Regulatory Observation</i>	
<u>Background</u>	
<p>Under the ONR Safety Assessment Principles (SAPs) (Ref. 1) nuclear facilities must include the threat posed by external hazards within the safety case demonstrating the safety of the nuclear activities undertaken. External Hazards are defined as: <i>those natural or man-made hazards to a site and facilities that originate externally to both the site and its processes, ie the dutyholder may have very little or no control over the initiating event. External hazards include earthquake, aircraft impact, extreme weather, electromagnetic interference (off-site cause) and flooding as a result of extreme weather/climate change (this list is not exhaustive).</i> Assessment of the UKHPR1000 design against external hazards forms a part of the Generic Design Assessment (GDA).</p> <p>A fundamental objective of GDA for a new nuclear power station in the UK is to demonstrate the design is capable of being deployed on a UK site (for GDA, termed the Generic Site). This means that suitable and sufficient consideration of the prevailing environmental and geological conditions and the resulting external hazards characteristics anticipated at the Generic Site (ie the Generic Site Envelope) needs to be provided.</p> <p>During Step 2 of the GDA of the UK HPR1000 design, General Nuclear System Limited (GNS) submitted a Generic Site Report (Ref. 2) which defines the Generic Site Envelope. At the start of Step 2 of GDA GNS also submitted a Preliminary Safety Report (PSR). Chapter 18 of the PSR (Ref. 3) covers external hazards and presents values for external hazards magnitudes. The values used in Ref. 2 are based on the reference plant declared by GNS for the GDA of UK HPR1000 - Fanchenggang 3 (FCG 3) nuclear power plant, which is currently under construction in China.</p> <p>ONR's assessment of Refs. 2 and 3 identified that some external hazards which ONR expects to be considered for a UK site are not considered for the FCG 3 reference plant. Furthermore, some of the hazards that are considered have attracted design bases for FCG 3 that do not bound the Generic Site Envelope.</p> <p>GNS's response to RQ-UKHPR1000-0008 (Ref. 4, 5) and information presented by GNS during Level 4 meetings (Ref. 6), demonstrate they have already identified that some of the external hazards design bases used for FCG 3 do not bound the Generic Site Envelope.</p> <p>The information provided to date gives no details on how GNS intends to address these shortfalls. This shortfall includes assessment of the need for design modifications to UK HPR1000 to meet the Generic Site Envelope definition. ONR therefore has insufficient information to form a judgement on the likely impact that</p>	

the differences in external hazards design bases assumed for FCG 3 and the Generic Site Envelope may have on the generic design of the UK HPR1000, and hence UKHPR1000's suitability for deployment in the UK. This Regulatory Observation (RO) is raised to:

- Articulate ONR's regulatory expectations;
- Ensure that these gaps/differences are resolved in a satisfactory and timely manner during the GDA of UK HPR1000;
- Obtain confidence and the necessary assurances that the UK HPR1000 design will be robust against external hazards.

Relevant Legislation, Standards and Guidance

The requirement for a Generic Site Envelope to be defined during GDA is contained in the ONR Guide to Requesting Parties (Ref. 7), Appendix 3.

The expectations of the definition of the design basis external hazards is contained within the ONR SAPs (Ref. 1):

EHA.3:

For each internal or external hazard which cannot be excluded on the basis of either low frequency or insignificant consequence (see Principle EHA.19), a design basis event should be derived.

EHA.4

For natural external hazards, characterised by frequency of exceedance hazard curves and internal hazards, the design basis event for an internal or external hazard should be derived to have a predicted frequency of exceedance that accords with Fault Analysis Principle FA.5.

The thresholds set in Principle FA.5 for design basis events are 1 in 10 000 years for external hazards and 1 in 100 000 years for man-made external hazards and all internal hazards (see also paragraph 629).

FA.5 paragraph 629

Initiating fault frequencies should be determined on a best-estimate basis with the exception of natural hazards where a conservative approach should be adopted, eg to reflect uncertainties in the underlying data used when defining the most extreme events.

Regulatory Expectations

In summary, ONR's expectation is that the UKHPR1000 generic safety case should provide an adequate demonstration that the design is robust against external hazards and relevant risks are reduced to As Low As Reasonably Practicable (ALARP). To achieve this, as part of the resolution of this RO, GNS will need to provide the following:

- A gap analysis evaluation that adequately considers and identifies the differences between the external hazards and/or hazard magnitudes used for design of the FCG 3 reference plant and those defined in the Generic Site Envelope. This should clearly identify external hazards where the FCG 3 reference plant design bases do not bound the Generic Site Envelope.
- Proposed assessment methodologies / processes / procedures (including any assumptions) which GNS will use to evaluate the impact of the differences between the FCG3 reference plant and Generic Site Envelope external hazards (and/ or magnitudes) may have on the design of all relevant UK HPR1000 Structures, Systems and Components (SSCs), which are claimed as part of the external hazards safety case.
- A clear, written list of all UK HPR1000 SSCs which may be impacted by the differences in external hazards (and/ or magnitudes) between the FCG 3 reference plant and Generic Site Envelope.
- Identification of any SSCs where a modification *may* be required for the UK HPR1000 generic design to meet the requirements of the generic safety case and Generic Site Envelope.
- For those SSCs identified by the gap analysis, suitable and sufficient substantiation or justification (ie evidence) that the UK HPR1000 generic design is robust against external hazards, including the requirement to demonstrate all relevant risks are reduced to ALARP.

The Regulatory Observatory Actions (ROAs) given below are therefore structured in such a way as to enable provision of this information in a logical and step-wise manner, to facilitate ONR's assessment as GDA progresses.

References

1. Safety Assessment Principles for Nuclear Facilities 2014 Edition, Rev. 0. www.onr.org.uk/saps/saps2014.pdf
2. UK HPR1000 Generic Site Report Rev. 0, HPR/GDA/REPO/0015, November 2017. TRIM 2017/422938.
3. Preliminary Safety Report Chapter 18 External Hazards, Rev. 0, HPR/GDA/PSR/0018. TRIM 2017/401381.
4. Definition and applicability of the Generic Site Envelope (external hazards), RQ-UKHPR1000-0008,6 December 2017. TRIM 2017/451654.
5. Definition and applicability of the Generic Site Envelope (external hazards) – Full Response RQ-UKHPR1000-0008,8 January 2018. TRIM 2018/7185.
6. ONR-CR-NR-17-661, External Hazards Workshop Level 4. TRIM 2018/43923.
7. ONR New Nuclear Reactors: Generic Design Assessment Guide to Requesting Parties, ONR-GDA-GD-001, Rev. 3. September 2016. www.onr.org.uk/new-reactors/ngn03.pdf

Regulatory Observation Actions

RO-UKHPR1000-0002.A1 – FCG 3 design bases and Generic Site Envelope external hazards gap analysis

In response to this Regulatory Observation Action (ROA), GNS should provide a suitable and sufficient evaluation/gap analysis of the impact of the differences between the external hazards, and their magnitudes, used for the FCG 3 reference plant design and those defined in the Generic Site Envelope. ONR would expect GNS to:

- Identify external hazards in the Generic Site Envelope not considered in the design of FCG 3;
- Identify external hazards whose design bases for the FCG 3 reference plant do not bound the Generic Site Envelope;
- Explain how the gaps identified will be addressed during GDA (ie what methodologies/processes/procedures), and by when;
- Identify the relevant SSCs affected by the difference in design basis between FCG3 and the Generic Site Envelope.

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-UKHPR1000-0002.A2 – Substantiation of relevant UK HPR1000 SSCs against external hazards

In response to this ROA, and based on the outcome of the work to respond to ROA1 under this RO, GNS should provide a suitable and sufficient justification of the UK HPR1000 generic design against external hazards identified by the gap analysis in the ROA1 response. ONR would expect GNS to provide a proportionate justification, taking into account:

- The response to ROA1 under this RO;
- The claims made in the external hazards safety case;
- The nuclear safety significance (ie categorisation and classification) of the relevant SSCs;
- The UK requirement to demonstrate that, overall, relevant risks are reduced to ALARP.

The response to this ROA is not seeking the totality of the evidence required to substantiate the UK HPR1000 generic design against external hazards. The justification provided should be focussed on the impact of the external hazards/SSCs identified in the response to ROA 1, ie the “relevant UK HPR1000 SSCs”, and be proportionate to the maturity of the generic design presented during GDA. This should include a clear identification of where further work and/or any plant modifications may be necessary.

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-UKHPR1000-0002.A3 – Impact on the UK HPR1000 generic design

In response to this ROA, and based on the outcome of the work to respond to ROA2 under this RO, GNS should identify any aspects of the generic design that require modification to meet the requirements of the generic safety case and GDA Generic Site Envelope. The response should provide GNS' strategies, plans and timescales to deal with any necessary modifications that may need to be made to the UK HPR1000 generic

design during GDA. This should also include a clear identification and justification for any work that may need to be undertaken post-GDA.

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: