

<b>REGULATORY OBSERVATION</b>	
<b>REGULATOR TO COMPLETE</b>	
<b>RO unique no.:</b>	RO-ABWR-0067
<b>Date sent:</b>	17th February 2016
<b>Acknowledgement required by:</b>	9th March 2016
<b>Agreement of Resolution Plan Required by:</b>	<i>To be determined by Hitachi-GE Resolution Plan</i>
<b>Resolution of Regulatory Observation required by:</b>	<i>To be determined by Hitachi-GE Resolution Plan</i>
<b>TRIM Ref.:</b>	2016/57133
<b>Related RQ / RO No. and TRIM Ref. (if any):</b>	RQ-ABWR-0660 (TRIM ref 2015/386747) RQ-ABWR-0667 (TRIM ref 2015/410280) RO-ABWR-0039 (TRIM ref 2015/437531)
<b>Observation title:</b>	UK ABWR Generic Site Envelope – External Flooding and Beyond Design Basis events.
<b>Technical area(s)</b> 3. External Hazards	<b>Related technical area(s)</b> 2. Civil Engineering 4. PSA 18. Severe Accident Analysis
<b>Regulatory Observation</b>	
<b>Summary:</b> ONR's assessment of the Requesting Party's (RP) Step 3 GDA safety case submission in relation to External Hazards has identified shortfalls in respect of the treatment of beyond design basis assessment of external hazards generally, and external flooding specifically. Further work is required to address this justification issue and to provide evidence during GDA step 4 that there is no residual safety issue.	
<b>Background:</b> Two relevant Regulatory Queries have been raised within the External Hazards topic stream and responses have been received from the RP. In addition, a related RO was raised by the Severe Accident Analysis topic stream. A response has been received from the RP. This response is in the process of being assessed and currently this RO remains open.  RQ-ABWR-0660 (Ref 1) relates to External Flooding, specifically regarding the "dry site" concept and whether sufficient consideration has been given to the mitigation of flooding events within the Generic Site Envelope (GSE). The RP response to this RQ (Ref 2) did not provide sufficient justification to demonstrate that the mitigation measures for external flooding reduce risks ALARP, specifically regarding (but not limited to) the response to protection against sea water inundation. In this instance the "dry site" concept was used as justification of mitigation against flooding. Subsequent correspondence, however (Refs 3,4), has highlighted that not all GDA proposed candidate sites can be considered to achieve "dry site" status, with permanent external barriers or alternative measures now being considered. Post-Fukushima ONR Interim Recommendation finding, IR-10, states " <i>A demonstration of the UK ABWR's robustness against external flooding is required, including the consideration of proportionate flood protection enhancements.</i> "  RO-ABWR-0039 (Ref 5) relates to the UK learning from the Fukushima Dai-ichi events. This learning placed a requirement on every nuclear power generating country in Europe to carry out safety "stress tests". The tests require reassessment of safety margins in the light of extreme natural events, such as earthquake, flooding, extreme weather and tsunamis. The UK nuclear industry derived a significant number of improvements, mainly to enhance resilience for emergency actions following events beyond the design basis and also to enhance margin assessment methods. The response to this RO for external hazards was not sufficient to demonstrate that an adequate post-Fukushima assessment had been performed for the UK ABWR and RQ-ABWR-0667 was subsequently issued.  RQ-ABWR-0667 (Ref 6) relates to the post-Fukushima response (Ref 7) regarding external flooding, placement of the Backup Building and Beyond Design Basis (BDB) External Hazard events. Regarding external flooding, no evidence has been provided by the RP to show that the generic design reduces risks	

ALARP. Additionally no BDB margins against flooding have been presented on the basis that external flooding is considered a site specific hazard and for GDA, the generic site is defined as “dry”. Therefore no mitigation has been offered to demonstrate resilience to external flooding within the generic design. It is a requirement of the post-Fukushima ONR Stress Test Finding, STF-5, that “Licensees should further review the margins for all safety significant structures, systems and components (SSC), including cooling ponds, in a structured systematic and comprehensive manner to understand the beyond design basis sequence of failure and any cliff-edges that apply for all external hazards.”

**References:**

1. “External Flooding (Generic Site Envelope)”, RQ-ABWR-0660, ONR, TRIM Ref 2015/386747
2. “Response to RQ-ABWR-0660 (External Flooding (Generic Site Envelope)), GA91-9201-0003-01085 Rev 0, Hitachi-GE, TRIM Ref 2015/476663
3. “L4 External Hazards Discussion of Proposed Response to RQ-0667”, ONR-GDA-CR-15-339, ONR, TRIM Ref 2015/484768
4. “Outline of Draft Response to RQ-ABWR-0667”, AE-GD-0610 Rev. 0, Hitachi-GE, TRIM Ref 2015/482272
5. “UK Learning from Fukushima Dai-ichi events”, RO-ABWR-0039, ONR, TRIM Ref 2014/437531
6. “External Hazards post-Fukushima response”, RQ-ABWR-0667, ONR, TRIM Ref 2015/410280
7. “Applicability of the HM Chief Inspector’s Recommendations and ONR’s Stress Test Findings to the UK ABWR Design”, GA91-9201-0003-00868, Hitachi-GE, TRIM Ref 2015/326036

**Regulatory Observation Actions**

**RO-ABWR-0067.A1**

Following the requirement of post-Fukushima stress test finding STF-5, Hitachi-GE are requested to provide information relating to BDB events for all extreme external hazards considered to affect the generic design along with providing evidence that the proposed (but currently not quantified) margins are adequate. Severe accident measures, such as those to provide cooling water to the RPV, containment and SFP may be required to operate following a beyond design basis external hazard. Hitachi-GE should consider whether the UK-ABWR severe accident measures have sufficient resilience to be able to perform the required function against beyond design basis hazards, including external flooding.

Hitachi-GE are requested to supply:

- a) A BDB margin evaluation for flooding for all safety related Structures, Systems or Components (SSCs); specifically SSCs involved with the management of control, cooling, containment and spent fuel. This should include:
  - An outline of Hitachi-GE’s philosophy for the treatment of flooding as an external hazard for the design basis and BDB.
  - Confirmation of the elevations of proposed safety related SSCs above the platform level within the site plan including consideration of the effects of flooding scenarios at several different elevations, and any protection provided.
  - A description of potential cliff edge effects from external flooding considered within the Generic Design and any assumptions made in their derivation.
  - A description of ALARP risk reduction measures implemented and an explanation of the process used to determine them. This should include reasonably practicable measures to prevent SBO (Station Black Out) in the event of extreme BDB flooding.
- b) A description of the process used to evaluate BDB margins for all external hazards considered to affect the Generic Design. This should include:
  - A description of potential cliff edge effects from external hazards considered within the Generic Design and any assumptions made in their derivation.
  - A description of ALARP risk reduction measures implemented and an explanation of the process used to determine them. This should include reasonably practicable measures to

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prevent SBO (Station Black Out) in the event of extreme BDB external hazards.

This information is considered fundamental to aid understanding of the Generic Design's resilience against extreme external hazards.

**Resolution required by 31<sup>st</sup> October 2016**

**RO-ABWR-0067.A2**

*Hitachi-GE are requested to confirm that the existing generic flooding mitigation strategy will no longer depend on a "dry site" condition (as Hitachi-GE have advised ONR that this may no longer be appropriate to the proposed candidate sites) and to confirm that the relevant documentation referring solely to a "dry site" has been updated.*

**Resolution required by 31<sup>st</sup> October 2016**

**RO-ABWR-0067.A3**

*Section 5 of the RP response to RQ-ABWR-0660 (Ref 2) states "The GDA strategy will specify that the site specific design addresses the following. ... To secure further redundancy, the part of buildings above ground level shall maintain the appropriate water-tightness." Linked to Action 1a above, Hitachi-GE is requested to supply details of any additional methods that have been considered to secure this additional redundancy, along with reasoned argument as to how they reduce risks ALARP. This should include consideration of external openings on buildings and flooding via buried interconnecting tunnels and the drainage network.*

**Resolution required by 31<sup>st</sup> October 2016**

**REQUESTING PARTY TO COMPLETE**

**Actual Acknowledgement date:**

**RP stated Resolution Plan agreement date:**