Hitachi-GE Nuclear Energy, Ltd.
UK ABWR GENERIC DESIGN ASSESSMENT
Resolution Plan for RO-ABWR-0080
Development of Spent Fuel Export Contingency Arrangements

RO TITLE:	Development of Spent Fuel Export Contingency Arrangements	
REVISION :	0	
Overall RO Closure Date (Planned):		28th April 2017
REFERENCE DOCUMENTATION RELATED TO REGULATORY OBSERVATION		
Regulatory Queries	N/A	
Linked ROs	RO-ABWR-0011, RO-ABWR-0056	
Other Documentation	See Related Deliverables in Description of Work and References	

Scope of work :

Background

ONR has assessed the Hitachi-GE safety case submissions relating to the ABWR spent fuel export design. This assessment concluded that:

'Hitachi-GE has provided an adequate consideration of risk reduction options; provided an adequate ALARP study and demonstrated that additional measures would be grossly disproportionate.'

However, ONR's assessment also highlighted that the detailed design and subsequent implementation of the baseline design proposals during the site specific stage for SFE may result in modifications being required, and therefore Hitachi-GE should demonstrate that options are not foreclosed during GDA.

The RO goes on to state the following:

It is usual in GDA that design proposals are conceptual in nature and that there is a lack of clarity in the selection of plant and equipment. This is the case for the ABWR fuel export design, and therefore there is the potential that the detailed design may result in modifications being required, that ONR would not wish Hitachi-GE to foreclose their options on. ONR recognises this may be the case for other aspects of plant requiring detailed design, however there are specific issues that have been highlighted from our assessment that merit analysis.

The RO then provides a list of six specific issues as follows:

i. *The implementation of the braking arrangements on the crane should effectively manage high dynamic*

loading, to ensure that the crane does not destabilise in emergency operation. The baseline design shows that up to 4 sets of brakes are to be provided, and there is no information on how high dynamic loads under braking are proposed to be managed, which may adversely affect the crane structure, particularly under emergency conditions.

ii. *The dual load path proposed for the crane provides redundancy of key elements of the crane lifting systems, including ropes, gearboxes, motors, etc., and it is important that consideration be given to common mode failure of redundant elements to avoid hazards arising from dropped loads. For example, redundant ropes, gearboxes, etc. are likely to degrade/wear out at the same rate and, information in Hitachi-GE's submissions suggest that failure of a single redundant element may cause either maloperation during a lift, or potential dropped loads.*

iii. *The detailed design of the crane control and protection systems should ensure that it is fully maintainable so that end-to-end proof testing can be performed, to ensure that the EMIT is able to confirm that the 10^{-4}pfd reliability target can be demonstrably achieved throughout the operational lifetime of the crane and its safety systems. This is necessary given the complexity of the crane control and protection systems and the safety functions they are intended to perform. This point may be exacerbated by the use of complex components (load cells, centrifugal force limit switches, etc.) that are difficult to proof test when installed on a crane.*

iv. *The design of the hoist needs to be such that the potential for ledging or snagging hazards is eliminated or minimised, to prevent demands on the crane safety systems.*

v. *Details of the interlocking of the long- and cross-travel axes of the crane during lifting operations and for coupling the load to the crane are not defined within the Hitachi-GE submissions. The approach described implies that the drive systems will be switched-off rather than isolated; which is good practice in high integrity lifting operations. There is also no information on how brake monitoring and control will be implemented, to avoid risks of uncontrolled movement whilst drive system inertia is dissipated in normal operations.*

vi. *Additional provisions may need to be installed within the hoist well to ensure that the casks retain an appropriate orientation in accordance with the safety case should a drop occur during lifting operations.*

The RO recognises that it is too early to anticipate what, if any, future design modifications may be required to address the issues identified in the RO and other issues that may arise during development of the detailed design following GDA. However the RO states that '*it is not clear in the submissions whether the current concept design of the hoist well does not foreclose any of the modifications to be introduced in detailed design or whether it is needed to take consideration for extending of the hoist well in GDA which could allow for modifications to be introduced',* and hence have requested that Hitachi-GE consider how this could be achieved.

The RO also sets out ONRs expectations as:

'Hitachi-GE to establish by analysis the extent to which it may be possible to extend the dimensions of the hoist well. This analysis should take into account seismic and structural aspects of the reactor building civil construction.

ONR considers that Hitachi-GE have the capability to address this Regulatory Observation (RO) based on engineering judgement within GDA timescales without complete reanalysis of the Reactor Building'

Scope

The objective of this resolution plan is to present the strategy and plan for responding to RO-ABWR-0080, and to demonstrate this strategy will be compliant with ONR's expectations as defined in the RO-ABWR-0080. In particular the response will address the specific issues identified in the summary text of RO-ABWR-0080 as well as the regulatory observation action RO-ABWR-0080.A1.

Although it is recognised that RO-ABWR-0080 is linked to the related regulatory observations RO-ABWR-0011 and RO-ABWR-0056, their closure is not dependent on the work described in this Resolution Plan. It is Hitachi-GE's understanding that this RO does not challenge the cases presented in response to RO-ABWR-0011 or RO-ABWR-0056, but that this RO is asking for supplementary information to support the case for GDA. Therefore, the response will be developed on the understanding that RO-ABWR-0080 does not challenge any of the conclusions of the spent fuel export optioneering exercise that was undertaken as part of the response to these related ROs, which has previously been accepted by ONR. As such the response will provide supplementary information based on engineering judgement, and will not undertake detailed analysis, including changes to the seismic or structural model for the UK ABWR, or development of detailed design of any SSCs.

Description of work:

The regulatory observation (RO-ABWR-0080) includes a single action:

RO-ABWR-0080.A1: Perform an analysis of the hoist well civil structure to determine the extent to which it could be modified, as part of contingency arrangements to accommodate variations for spent fuel export required at later stages of the design development.

The RO explains this action as:
'*Hitachi-GE is requested to undertake and document a sensitivity analysis based on engineering judgement that takes into account seismic and structural aspects of the reactor building construction to determine whether there is scope for modifications to the hoist well civil structure that could be accommodated at the detailed design stage*'.

Furthermore, the regulatory observation also details a number of specific issues as detailed in points i to vi above.
Although these are not specifically related to the action, it is Hitachi-GE's understanding that the expectation is that all these issues are considered as part of the response.
Therefore the response to RO-ABWR-0080 will consist of the following tasks:

Task 1: Response to mechanical engineering related specific issues (items i to v above).

Items i to v above raise specific issues related to the concept deign of the reactor building crane, including its control and protection systems. The response will consider these and provide information in line with the level of detail commensurate with GDA. This will include signposting to documentation that has already been submitted within GDA and discussion of how the concept design for the reactor building crane has been developed during GDA.

Development of the responses will include input from cross cutting areas, such as civil design.

Task 2: Response to item vi.

Item vi above relates to how systems could be employed to maintain a cask in an appropriate orientation in a drop scenario. The response will consider the level of risk associated with the cask falling in different orientations and will be developed to a level of detail commensurate with this risk. The response will review the information already submitted regarding potential systems for maintaining casks in a specific orientation and how they could be implemented into the UK ABWR. As previously stated, engineering judgement, not detailed analyses, on the seismic model for UK ABWR, will be used to underpin the conclusions. The response will signpost towards already submitted information relevant to this query.

Task 3: Response to RO-ABWR-0080.A1

Hitachi-GE will undertake a sensitivity analysis based on engineering judgement to determine the scope for modifying the hoist well civil structure to accommodate variations for spent fuel export that may be required

at later stages of detailed design development. The response will:

- Highlight the margin available around the concept cask and hoist well design identified within GDA submissions.
- Identify the scope and boundary of the sensitivity analysis.
- Consider to what extent reasonably practicable changes can be made to the civil layout and design without challenging the overall seismic and structural case for the UK ABWR.
- Assess the impact of these potential changes in terms of adjacent systems.
- Present the findings of the assessment.

The response to all parts of the regulatory observation will be included in a single report as detailed below. The report will be delivered following the schedule shown in Table 1.

Summary of impact on GDA submissions:

GDA Submission Document	Submission Date to ONR
Development of Spent Fuel Export Contingency Arrangements	07 April 2017

Programme Milestones/ Schedule:

See attached Gantt Chart (Table 1)

Reference:

N/A

Table 1 RO-ABWR-0080 Gantt Chart

Resolution plan for RO-ABWR-0080				Feb			Mar				Apr			
Level	Action Title	Start	Finish	13	20	27	6	13	20	27	3	10	17	24
1	Spent Fuel Export – Contingency Arrangements													
1.1	Regulators Issue RO	17-Feb-17	17-Feb-17											
1.2	Hitachi-GE acknowledge RO & Issue Resolution Plan	24-Feb-17	24-Feb-17											
1.3	Regulators confirm credibility of Resolution Plan	03-Mar-17	08-Mar-17											
2	Preparation of RO response													
2.1	Mechanical related specific issues (Task 1)	27-Feb-17	07-Apr-17											
2.2	Civil design related specific issue (Task 2)	27-Feb-17	07-Apr-17											
2.3	Response to RO-ABWR-0080.A1 (Task 3)	27-Feb-17	07-Apr-17											
3	RO submission and closure													
3.1	RO response document submission	07-Apr-17	07-Apr-17											
3.2	Review and approval from ONR to close	10-Apr-17	28-Apr-17											