

## REGULATORY OBSERVATION

### REGULATOR TO COMPLETE

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| <b>RO unique no.:</b>                                    | RO-ABWR-0080   |
| <b>Date sent:</b>  | 08 February 2017   |
| <b>Acknowledgement required by:</b>                      | 01 March 2017  |
| <b>Agreement of Resolution Plan required by:</b>         | 08 March 2017  |
| <b>Resolution of Regulatory Observation required by:</b> | <i>To be determined by the Hitachi-GE Resolution Plan</i>  |
| <b>TRIM Ref.:</b>  | 2017/55611   |
| <b>Related RQ / RO No. and TRIM Ref. (if any):</b>       | RO-ABWR-0011<br>RO-ABWR-0056   |
| <b>Observation title:</b>                                | Development of Spent Fuel Export Contingency Arrangements  |
| <b>Technical area(s)</b><br>2. Civil Engineering         | <b>Related technical area(s)</b><br>1. Internal Hazards<br>5. Fault Studies<br>6. Control & Instrumentation<br>11. Mechanical Engineering<br>12. Structural Integrity<br>13. Human Factors |

### ***Regulatory Observation***

#### **Summary**

ONR has assessed the Hitachi-GE safety 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 which demonstrated that current conceptual design proposals meet the regulatory expectations 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 for SFE may result in modifications being required, and therefore Hitachi-GE should not foreclose options at this stage.

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 plan requiring detailed design, however there are specific issues that have been highlighted from our assessment that merit analysis. Specific issues include:

- 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.
- 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.
- 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.

- 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.
- 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.
- 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.

It is too early to anticipate what, if any, future design modifications may be required to address these and/or other issues highlighted through the detailed design. However ONR considers that extending the hoist well would allow for modifications to be introduced, and hence options would not be foreclosed.

### **Regulatory Expectations**

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

### **References:**

1. FRE-GD-0080 Rev. 3 "Spent Fuel Interim Storage Optioneering for Spent Fuel Removal from Spent Fuel Pool to Outside of Reactor Building".
2. FRE-GD-0144 Rev. 0 "ALARP Report for Spent Fuel Export".
3. HSL Report MH/16/165 "ABWR Fuel Export: Review of final information pack associated with various design options for spent-fuel cask removal".

### **Regulatory Observation Actions**

**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.**

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.

**Resolution required by: To be determined by the Hitachi-GE Resolution Plan**

### **REQUESTING PARTY TO COMPLETE**

**Actual Acknowledgement date:**

**RP stated Resolution Plan agreement date:**