

Hitachi-GE Nuclear Energy, Ltd.
UK ABWR GENERIC DESIGN ASSESSMENT
Resolution Plan for RO-ABWR-0004
Material/Forging/Weld/Clad Specifications for RPV Pressure Boundary

RO TITLE:	Material/Forging/Weld/Clad Specifications for RPV Pressure Boundary	
REVISION :	2	
Overall RO Closure Date (Planned):	Date (29. Sep. 2017)	
REFERENCE DOCUMENTATION RELATED TO REGULATORY OBSERVATION		
Regulatory Queries		
Linked ROs		
Other Documentation	ONR Document RO-ABWR-0004, "Material/Forging/Weld/Clad Specifications for RPV Pressure Boundary", Issue 01. Hitachi-GE Document RD-GD-0016, "RPV Detailed Material Report", Issue 0. Hitachi-GE Document RD-GD-0019, "RPV Manufacturing Report", Issue 0. Hitachi-GE Document RD-GD-0015, "Material Testing Strategy Report for RPV", Issue 0. Hitachi-GE Document RD-GD-0020, "RPV Topic Report", Issue 0.	

Scope of work :
<p>RO-ABWR-0004 Issue 01 was raised to enable the ONR to understand the approaches that Hitachi-GE will adopt in the specification and control of the material properties of the UK ABWR Reactor Pressure Vessel and the associated manufacturing processes. The RO is useful in so far as it clearly identified the issues that are of importance to the UK Regulator in the specification of material parameters for the highest reliability components in UK Nuclear Power Plants and it provided Hitachi-GE with an improved understanding of the UK Regulatory expectations.</p> <p>The RO discusses the parameters that are of importance in the specification of material properties and manufacturing processes and highlighted the importance of demonstrating a clear understanding of the interaction of these parameters in order to apply controls, which may be over and above those specified in the design codes, to ensure satisfactory finished forgings and vessel. In particular, the ONR identified the need for evidence in relation to the following:</p> <ol style="list-style-type: none"> 1. Chemical Composition of Forgings: 2. Casting and Forging Processes: 3. Welding and Cladding Processes: <p>The proposed approach to resolving this RO was based around the development of two technical reports; one describing the basis for the material specification in the UK ABWR RPV and the interdependence of this on the susceptibility to through-life degradation mechanisms and the potential for defect generation during manufacture and the second report describing the manufacturing processes used in the production of the UK ABWR RPV, including the production of forgings, plates and castings and the welding and cladding processes, and the interdependence of the manufacturing processes with the achievement of homogeneous material properties, the avoidance of defects during manufacture and on through life degradation.</p> <p>The RPV Detailed Material Report and RPV Manufacturing Report were therefore written during Step 3 to address the issues raised by the RO as described above.</p> <p>During Step 3 of the GDA process ONR acknowledged the good progress made by Hitachi-GE in producing the RPV Detailed Material Report and RPV Manufacturing Report. However, it was not deemed appropriate for ONR to close</p>

the RO because, since the reports had been produced during Step 3, the full evidence had yet to be presented.

The RO was up-issued by mutual consent between ONR and Hitachi-GE in order to request the appropriate evidence during Step 4. Actions were clarified and are detailed below.

Action 1.1:

Regarding Materials compositions, HGNE should provide evidence that:

- Relevant Good Practice regarding Materials compositions has been considered fully, notably from previous GDAs.*
- Irradiation Embrittlement surveillance programmes are adequate to mitigate the risk of irradiation embrittlement through-life.*

Action 1.2:

Regarding Casting and Forging, HGNE should provide evidence that:

- Operational Experience (OPEX) from world nuclear plant, especially in the field of forging quality control, has been captured and measures implemented to prevent recurrences for the UK ABWR.*
- Evidence that the test specimens included in the materials qualification process will meet ONR's expectations in terms of being representative.*

Action 1.3:

Regarding Welding and Cladding, HGNE should provide evidence that:

- How welding processes can be considered to be ALARP in terms of defect occurrence rates.*
- How the use of appropriate welding processes and procedures has been used to ensure that risks are maintained ALARP.*

Description of work:

The information provided in the RPV Detailed Material Report and RPV Manufacturing Report prepared in Step 3 was partially successful in addressing the ONR requirements. Of note, significant and substantial information was gained from the November 2015 visit to Japan Steel Works (JSW) which was too late for inclusion in the Step 3 versions of these reports.

Therefore, the RPV Detailed Material Report and RPV Manufacturing Report will be up-issued during Step 4 to address the actions above, introducing the necessary evidence where appropriate. Written comments and feedback on the RPV Detailed Material Report and RPV Manufacturing Report received from the ONR during the latter part of Step 3 and early part of Step 4 will also be addressed.

The evidence contained in the RPV Detailed Material Report and RPV Manufacturing Report will continue to be incorporated in to the PCSR as Level 3 supporting documents. A summary of these reports will be included in the RPV Topic Report produced during Step 4 of the GDA.

Summary of impact on GDA submissions:

GDA Submission Documents	C/U	Related GDA RO Actions(s)	Submission Date to ONR
PSCR (Step 4)	U	N/A	TBC
RPV Topic Report (Step 4)	U	N/A	TBC

Programme Milestones/ Schedule:

See attached Gantt Chart (Table 1).

Reference:

None

Table 1 RO-ABWR-0004 Rev.1 Gantt Chart

Resolution Plan for RO-ABWR-0004				2014												2015												2016												2017											
				1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Level	Action Title	Start (Plan)	Finish (Plan)																																																
1	Regulator's issue of RO	1-Feb-14	30-Jun-14	[Gantt bar from Feb 1 to Jun 30, 2014]																																															
1.1	ONR Issue RO	1-Feb-14	31-Mar-14	[Gantt bar from Feb 1 to Mar 31, 2014]																																															
1.2	Hitachi-GE acknowledge RO & issue Resolution Plan	1-Apr-14	12-May-14	[Gantt bar from Apr 1 to May 12, 2014]																																															
1.3	Regulators confirm credibility of Resolution Plan	12-May-14	27-May-14	[Gantt bar from May 12 to May 27, 2014]																																															
1.4	Regulators publish RO and Resolution Plan	28-May-14	30-Jun-14	[Gantt bar from May 28 to Jun 30, 2014]																																															
1.5	ONR Issue RO Rev.1 (add Action 1.1, 1.2, 1.3)	27-Aug-15	25-Mar-16	[Gantt bar from Aug 27, 2015 to Mar 25, 2016]																																															
1.6	Hitachi-GE acknowledge RO Rev.1 & issue modified Resolution Plan	25-Mar-16	10-Jun-16	[Gantt bar from Mar 25, 2016 to Jun 10, 2016]																																															
1.7	Regulators confirm credibility of modified Resolution Plan	10-Jun-16	17-Jun-16	[Gantt bar from Jun 10 to Jun 17, 2016]																																															
1.8	Regulators publish RO Rev.1 and modified Resolution Plan	17-Jun-16	30-Jun-16	[Gantt bar from Jun 17 to Jun 30, 2016]																																															
2	Preparation of Submission and Closure of RO Actions	1-May-14	28-Sep-17	[Gantt bar from May 1, 2014 to Sep 28, 2017]																																															
3	Regulator's Closure of RO																																																		
3.1	Regulator's Assessment	1-Jun-15	28-Sep-17	[Gantt bar from Jun 1, 2015 to Sep 28, 2017]																																															
3.2	Regulator's publication of RO closure letter	29-Sep-17	29-Sep-17	[Gantt bar from Sep 29, 2017 to Sep 29, 2017]																																															