

Hitachi-GE Nuclear Energy, Ltd.
UK ABWR GENERIC DESIGN ASSESSMENT
Resolution Plan for RO-ABWR-TBD
6.9kV Switchgear design for UK ABWR

| | | |
|--|-------------------------------------|--|
| RO TITLE: | 6.9kV Switchgear design for UK ABWR | |
| REVISION : | Rev.0 | |
| Overall RO Closure Date (Planned): | 28 th February 2017 | |
| REFERENCE DOCUMENTATION RELATED TO REGULATORY OBSERVATION | | |
| Regulatory Queries | - | |
| Linked ROs | - | |
| Other Documentation | - | |

| |
|--|
| Scope of work : |
| <p>Background</p> <p>Hitachi-GE has developed a programme for the development and type testing required to prove the capability of the UK ABWR switchgear to meet the electrical system ratings in accordance with IEC standards IEC 62271-1, IEC 62271-100 and IEC 62271-200. These ratings will be determined by the system studies. This programme shows development and type testing of the switchgear will continue beyond the timescale of GDA assessment.</p> <p>Based on preliminary study results the thermal and short circuit ratings required for the switchgear may be at the maximum for commercially available switchgear</p> <p>The proposed UK ABWR switchgear design is compact with a small footprint compared to equipment currently available on the market and which may be difficult to accommodate in the space available if the planned switchgear development and testing cannot be successfully completed.</p> <p>Accordingly Hitachi-GE proposes the following action for the resolution of RO-ABWR-0074.</p> <ul style="list-style-type: none"> • Hitachi-GE to complete the planned GDA system study work to determine generic design switchgear thermal and short circuit rating requirements. • Hitachi-GE to demonstrate that adequate spatial provisions have been made to accommodate the switchgear within the UK ABWR plant and that adequate provisions have been made for associated power cables. • Hitachi-GE to demonstrate that it has a robust and achievable programme to develop its switchgear to IEC standards to meet the thermal and short circuit rating requirements for the UK ABWR. • Hitachi-GE to demonstrate that the development programme for the switchgear includes testing the capability to protect against internal faults as defined in IEC 62271-200. • Hitachi-GE to provide a development plan which explains how it proposes to manage the design risks associated with current system study work and subsequent development and testing of 6.9kV switchgear to demonstrate the design options available to take account of technology and layout considerations. |

Description of work:

RO-ABWR-0074 Work

As stated in the Regulatory Observation;

Hitachi-GE to demonstrate the robustness of the 6.9kV switchgear design proposals for the UK ABWR by submitting the following documents to substantiate the approach being taken :

- *Complete the planned GDA System studies to establish thermal and short circuit rating requirements for the UK ABWR 6.9kV switchgear*
- *Definition of design parameters for the 6.9kV switchgear*
- *Layout drawings to demonstrate the layout and cabling for the 6.9kV switchgear*
- *Indicative development and test programme for the Hitachi 6.9kV switchgear to meet UK ABWR requirements*
- *Design development plan for 6.9kV switchgear which identifies risks and provides appropriate mitigation strategies.*

Summary of impact on GDA submissions:

| GDA Submission Documents (Title / Document I.D.) | Related GDA RO Actions | Submission Date to ONR | Potential Impact |
|---|----------------------------------|---------------------------|------------------|
| Submitted Document | | | |
| Electrical Modelling Phase 2 Study Report (Doc. ID: GA91-9920-0010-00001) | Action 1.1.1.1 | January 2017 (Rev. 1) | |
| Topic Report for Switchgear design (Doc. ID: GA91-9201-0001-00169) | Action 1.1.1.2 Action 1.1.1.4 | February 2017 (Rev. 2) | |
| Electrical Equipment and Raceway Separation Plan (Doc. ID: GA33-1001-0001-00001) | Action 1.1.1.3 | February 2017 (Rev. 2) | |
| Electrical Panel Layout Plan (Doc. ID: GA33-1001-0005-00001) | Action 1.1.1.3 | February 2017 (Rev. 2) | |
| Planned submissions | | | |
| 6.9kV Switchgear Development and Test Programme (Doc. ID: TBD) | Action 1.1.1.4 | February 2017 (Rev. 0) | |
| 6.9kV Switchgear Development Strategies (Doc. ID: TBD) | Action 1.1.1.5 | February 2017 (Rev. 0) | |

For clarity, the purpose and scope of each related document is listed below.

| No | Deliverables | Purpose and Scope |
|----|--|---|
| 1 | Electrical Modelling Phase 2 Study Report | ➤ To analyse and confirm the fault level. |
| 2 | Electrical Equipment and Raceway Separation Plan | ➤ To provide the adequacy of the space for the raceways. |
| 3 | Electrical Panel Layout Plan | ➤ To provide the adequacy of the space for the planned switchgear. |
| 4 | Topic Report for Switchgear design | <ul style="list-style-type: none"> ➤ To provide the high level requirement. ➤ To detail the technical explanation of the approach to the internal arc protection requirements (IEC requirements) ➤ To establish and justify the planned switchgear design including the fault level, interlock scheme and etc. |
| 5 | 6.9kV Switchgear Development and Test Programme | ➤ To provide the switchgear development and testing programme schedule. |
| 6 | 6.9kV Switchgear Development Strategies | ➤ To identify the potential risks and their mitigation strategies for the planned switchgear. |

Programme Milestones/ Schedule:

See attached Gantt Chart (Table 1).

Reference:

-

Table 1 RO-ABWR-0074 Gantt Chart

| Resolution Plan for RO-ABWR-0074 (2016/2017) | | | | August | | | | | | | September | | | | | | | October | | | | | | | November | | | | | | | December | | | | | | | January | | | | | | | February | | | | | | | March | | | | | | | April | | | | | | | May | | | | | | | June | | | | | | | July | | | | | | |
|--|---|-----------|-----------|--------|---|----|----|----|---|----|-----------|----|---|----|----|----|----|---------|----|----|----|---|----|----|----------|---|---|----|----|----|---|----------|----|----|---|---|----|----|---------|---|----|----|----|---|----|----------|----|---|---|----|----|----|-------|----|----|----|---|----|----|-------|----|--|--|--|--|--|-----|--|--|--|--|--|--|------|--|--|--|--|--|--|------|--|--|--|--|--|--|
| | | | | 1 | 8 | 15 | 22 | 29 | 5 | 12 | 19 | 26 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 | 4 | 11 | 18 | 25 | 1 | 8 | 15 | 22 | 29 | 5 | 12 | 19 | 26 | 2 | 9 | 16 | 23 | 30 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 1 | 8 | 15 | 22 | 29 | 5 | 12 | 19 | 26 | 3 | 10 | 17 | 24 | 31 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Level | Action Title | Start | Finish | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1 | Preparation of Submissions and Closure of RO Actions | 23-Nov-16 | 28-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1 | RO Action 1 | 23-Nov-16 | 28-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1.1 | To demonstrate the robustness of the 6.9kV switchgear design proposal for UK ABWR | 23-Nov-16 | 17-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1.1.1 | Complete the planned system studies to establish thermal and short circuit rating requirements for the UK ABWR 6.9kV switchgear | 1-Feb-16 | 31-Jan-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1.1.2 | Definition of design parameters for the 6.9kV switchgear | 5-Jan-17 | 31-Jan-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1.1.3 | Layout drawings to demonstrate the layout and cabling for the 6.9kV switchgear | 30-Sep-16 | 17-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1.1.4 | Indicative development and test programme for the Hitachi 6.9kV switchgear to meet UK ABWR requirements | 23-Nov-16 | 17-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.1.1.5 | Design and development plan which identifies risks and provides appropriate mitigation strategies | 23-Nov-16 | 17-Feb-17 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |