

Hitachi-GE Nuclear Energy, Ltd.
UK ABWR GENERIC DESIGN ASSESSMENT
Resolution Plan for RO-ABWR-0062
Testing and Maintenance of Safety Systems

RO TITLE:	Testing and Maintenance of Safety Systems	
REVISION :	0	
Overall RO Closure Date (Planned):	31 st January 2017	
REFERENCE DOCUMENTATION RELATED TO REGULATORY OBSERVATION		
Regulatory Queries	-	
Linked ROs	RO-ABWR-0032	
Other Documentation	-	

Scope of work :

Background

The ONR has raised RO-ABWR-0062 in respect of the Testing and Maintenance of Safety Systems that Hitachi-GE proposed in the PCSR (GA10-9101-0101-14000; C&I Pre-Construction Safety Report).

ONR has identified the purpose of the RO-0062 as follows:

“This RO is therefore focused on ONR obtaining a clear understanding of the methodology for testing and maintenance of safety systems, particularly with the NPP at power, Hitachi-GE propose for the UK ABWR.”
as “The submissions received to date do not provide adequate substantiation of testing and maintenance of safety systems.”.

The ONR has identified 5 key products expected in the response to this RO.

Hitachi-GE will provide documentation to demonstrate that the proposed UK ABWR is designed in such a way that the methodology for the Testing and Maintenance of Safety Systems has been adequately taken into account. The RO response will present a justification for the Testing and Maintenance of Safety Systems while the Nuclear Power Plant is at power (in-service operation), and to underpin “the testing frequency” and “the availability of the safety systems to respond to a demand when it is placed on them under fault conditions.” .

Hitachi-GE has proposed the method which has been implemented in the Japanese ABWR as the methodology for the Testing and Maintenance of Safety Systems for the UK ABWR SSLC during power operations in the current PCSR. The proposed test methods and its frequency are made in accordance with Japanese experience. Thus the SSLC is designed to enable the periodic test during power operations, and it is also designed with redundancy of divisions to enable the safety functions to be delivered in the event of a division failure while another division is under maintenance. Further, the SSLC is designed to enable each division to be independently tested, and its independent

testing will not inhibit the delivery of the safety functions.

Scope of Work

Hitachi-GE will explain the supporting rationale for the Testing and Maintenance of safety systems it has proposed and will show how they are consistent with ONR's Safety Assessment Principles (SAP). When explaining the rationale for the Testing and Maintenance of safety systems, Hitachi-GE will firstly clearly identify the mechanical process equipment that is specifically installed for carrying out testing during power operations and will secondly present an adequate justification that the function and equipment are correctly categorised and classified. Further, Hitachi-GE will confirm the range of testing to be carried out in order to cover the whole systems and will then present an adequate rationale for it. Hitachi-GE will present its justification for the testing frequency and will also show its link to the PSA. In addition, for some equipment, the SSLC has the transition function, which allows equipment under test to respond to a demand when it is placed on it. Hitachi-GE will describe and justify this transition.

Hitachi-GE will, as part of the response to this RO, also present the appropriate justifications in relation to the Fault Study Analysis, the PSA and to the electrical and mechanical systems when explaining the underpinning rationale.

This Resolution Plan describes Hitachi-GE's current plan to address this RO; however, as the work develops, it may be necessary to choose an alternative means to address RO-0062.

Description of work:

RO-ABWR-0062 Action 1 :

The RO action states that:

Hitachi-GE are to develop suitable documentation that describes and substantiates the methodology to testing and maintenance of safety systems. It is expected that the documentation will follow the claims, arguments and evidence approach and this will include the identification and justification of the cases where the system / part system under test can re-align itself in response to a demand during testing.

Resolution required by:- December 2015

Hitachi-GE will respond to this action by addressing the five key products identified by ONR in this RO. The output of the work to address RO-0062 will be included in the safety case in a programme of work as part of RO-0062 A2. This work will be undertaken jointly by the C&I, Mechanical Engineering, Electrical Engineering, Fault Studies and Probabilistic Safety Analysis teams. ONR's Safety Assessment Principles (SAPs) will be used to confirm the overall justification for methodology for testing and maintenance of safety systems.

The documentation that substantiates the methodology for testing and maintenance of safety systems and records the outcome of RO-0062 A1 will be submitted to ONR by 31st December 2015. The work will have the 5 steps of the RO-0062 key products:

- (1) The report for the testing and maintenance of safety systems will be provided to explain the approach taken to both proof testing and to maintenance. This report will include the identification of any vulnerabilities introduced by testing and maintenance activities, identify any time at risk arguments, and include a description of how unplanned maintenance is accounted for in the safety case.
- (2) A list of mechanical equipment that is associated with and tested by the SSLC will be prepared. The list will identify any additional mechanical equipment (e.g. valves and pipes) included in the system to allow the testing to be carried out. The class, failure mode, and failure consequence, of this additional equipment will be identified and it will be confirmed that the failure modes are modeled in PSA. The degraded status of the protection during execution of the test and maintenance test process will be identified as will the consequences of failure to correctly return the equipment to service. It is noted that some information may only set out the principles as the detail may not be available until the design is finalised.
- (3) Ideally a proof test will be from sensor to actuator; this is not always achievable as for example rod insertion and low pressure injection cannot be exercised at power. An explanation and justification of the coverage of the tests carried out will be provided to show how the use of individual and overlapping tests contribute to demonstration of the safety function as per the following description.

A Table will be prepared for the sensors, logic and the actuators implementing the SSLC safety functions. The test regime (individual / overlapping) of each item of equipment that is used to perform the safety functions will be identified and also the purpose of the test. The test frequency will be identified but the justification of its frequency and its relationship to the PSA will be provided as part of key product 4. The justification will be also provided for any equipment or actuator not tested.
- (4) A justification for the frequency of testing will be provided in a report that will supplement the frequencies provided in key product 3. This will provide the proposed frequencies for each test that has been assumed in the PSA and the origin of its frequency, e.g. based on the relevant experienced data, on the standardized data, or on that required to meet the reliability targets in the PSA. This report will be explicitly included in the PSA to meet the requirement of key product 3. According to these results, the testing frequencies will be evaluated and used as its justification logic.
- (5) Those tests undertaken that allows the safety equipment under test to respond to a demand placed upon it will be identified. The means by which the equipment transitions from test to service mode in the event of a demand and at the end of the test will be explained. The assumptions made in the PSA for the availability of the equipment will be set out and justified.

RO-ABWR-0062 Action 2 :

The RO action states that:

Hitachi-GE should confirm to ONR that the proposed methodology for testing and maintenance of safety systems has been included in the safety case for all related topic areas; e.g. mechanical and electrical engineering, and that it has been correctly accounted for (modelled in) the PSA and related fault studies.

Resolution required by:- January 2017

Hitachi-GE will confirm that the methodology for testing and maintenance of safety systems has been captured in the PSA and related fault studies and explicitly explained in the safety case for all related topic areas. Hitachi-GE will identify those documents requiring additional information on test and maintenance and will develop a schedule for inclusion of the material and delivery of the revised documents to ONR. This will be undertaken following completion of RO-0062 A1.

Hitachi-GE will submit the documents providing the results to ONR by January 2017.

RO-ABWR-0062 Action 3 :

The RO action states that:

Hitachi-GE should confirm that the methodology for testing and maintenance has been clearly communicated to the prospective licensee of the UK ABWR.

Resolution required by:- February 2016

Hitachi-GE will develop suitable documentation that describes and substantiates the methodology for testing and maintenance of safety systems in response to RO-0062 A1. Hitachi-GE will provide this documentation to the prospective licensees of the UK ABWR, Horizon Nuclear Power. Hitachi-GE will develop the methodology and principles to be followed to create the process and procedures for testing and maintenance for safety systems. Horizon Nuclear Power will be invited to participate in this work. The test and maintenance processes and procedures are a matter for the Licensee (Site Licence Condition 23) and it is anticipated these will be prepared by the Licensee as part of site licensing / permissioning of reactor operation.

Summary of impact on GDA submissions:

Related RO Actions	GDA Submission Document Title	Document ID (Document No.)	Submission Date to the Regulators
Submitted Document			
Action 2	Generic PCSR Chapter 14	GA91-9101-0101-14000, Rev.A	January 2017 (to submit Rev. C)
Action 2	BSC C&I Architecture	GA91-9201-0002-00022, Rev.1	February 2016 (to submit Rev. 2)
Action 2	BSC on SSLC system	GA91-9201-0002-00073, Rev.1	February 2016 (to submit Rev. 2)
Action 2	TR on SSLC system	GA91-9201-0001-00052, Rev.0	February 2016 (to submit Rev. 1)
Action 2	<i>Report on Fault studies report</i>	<i>(TBD)</i>	June 2016
Action 2	TR on internal event Level 1 PSA at power	GA91-9201-0001-00102, Rev.1	June 2016
Action 2	BSC on Control Rod Drive System	GA91-9201-0002-00013, Rev.1	June 2016
Action 2	BSC on Emergency Core Cooling System	GA91-9201-0002-00020, Rev.0	June 2016
Action 2	BSC on Containment Isolation System	GA91-9201-0002-00076, Rev.0	June 2016
Planned Submissions			
Action 1 and Action 3	TR on the methodology to testing and maintenance of safety systems	TBD	December 2015 (to submit Rev. 0) February 2016 (to submit Rev. 1)

Programme Milestones/ Schedule:

See attached Gantt Chart (Table 1).

Reference:

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