Hitachi-GE Nuclear Energy, Ltd.
UK ABWR GENERIC DESIGN ASSESSMENT
Resolution Plan for RO-ABWR-0077
(Demonstration of adequate protection for Pellet-cladding Interaction in response to Control-rod Movement Faults)

RO TITLE:	Demonstration of adequate protection for Pellet-cladding Interaction in response to Control-rod Movement Faults	
REVISION :	0	
Overall RO Closure Date (Planned):		30. June. 2017
REFERENCE DOCUMENTATION RELATED TO REGULATORY OBSERVATION		
Regulatory Queries		
Linked ROs		
Other Documentation		

Scope of work :

Background

ONR expects that protection is provided to maintain the integrity of the fuel pin cladding in normal operation and anticipated faults, so far as is reasonably practicable.

Hitachi-GE analysis indicates that failure of the rod control system has the potential to lead to power-distribution faults and a subset of these faults can lead to multiple fuel pin cladding failures as a result of thermal stress.

Hitachi-GE has proposed, as one of options, the use of differences in signals from the Local Power-Range Monitor (LPRM) to initiate a reactor trip. LPRMs are a part of the Class 1 Neutron Monitoring System (NMS) and this system supplies signals to the Reactor Protection System (RPS). Although they continue to examine other options.

In view of the need to potentially introduce a design change to the protection system, ONR considers it appropriate to raise a regulatory observation in order to monitor this work and ensure that the safety case is progressed sufficiently within GDA.

Scope of Work

Hitachi-GE will develop a safety case meeting UK expectations that fuel pin failures by corrosion-assisted cracking can be prevented in normal operation and control-rod movement faults.

This Resolution Plan describes Hitachi-GE's current plan to address the RO. As the work develops, we may choose alternative means to address the RO.

Description of work:

RO Action 1: Identification of the proposed change to the protection system and the modifications required to relevant protection-system design documents.

Resolution 1: Hitachi-GE will identify the change to the protection system and the modifications required to relevant protection-system design documents. This task will include 1) the assessment on initiating event of the spurious failure of Rod Control and Information System (RCIS) in order to identify the failure mode that a potential mitigation system will be aimed at, specifically considering the system structure with the preventive function; 2) the analysis of Unmitigated Case consequence and; 3) the requirement of potential mitigation system including Cat/Class and aimed fault core condition, which will be determined based on the above evaluation.

RO Action 2: Documentation detailing the impact of the protection on response to anticipated rod-movement faults and justification of the proposed set points (and alarm levels if appropriate). This is to include analysis demonstrating that the proposed setpoint will not have an adverse impact on the normal operation of the plant.

Resolution 2: Hitachi-GE will evaluate the impact of the protection on response to anticipated rod-movement faults and a justification of the proposed set points (and alarm levels if appropriate). This task will include 1) the study on options; 2) the system requirement specification to prevent the fuel failure at All Rod Insertion, including a setpoint for a trip, 3) an analysis demonstrating that the system will prevent a fuel failure at the subject event and will not have an adverse impact on the normal operation of the plant and; 4) the evaluation of system design impact, where the preliminary system design impact analysis will be performed.

RO Action 3: An ALARP optioneering study if appropriate. Generally this will be necessary if the option Hitachi-GE favour cannot be shown to reduce the risk of rod-movement faults to Broadly Acceptable levels.

Resolution 3: Hitachi-GE will report the ALARP Option to be defined based on Action 1 and Action 2.

Summary of impact on GDA submissions:

GDA Submission Document	Submission Date to ONR
Study on All Rod Insertion Fault GA91-9201-0003-01904 (UE-GD-0660)	Rev.0, 30 April 2017, Action 1 – 3
Topic Report on Design Basis Analysis GA91-9201-0001-00023 (UE-GD-0219)	Rev.12, 30 April 2017, Action 2
Topic Report on Neutron Monitoring System GA91-9201-0001-00054 (3E-GD-B017)	Rev.2, 30 April 2017, Action 2
Neutron Monitoring System System Design Description GC51-1001-0001-00001 (3D-GD-B001)	Rev.2, 30 April 2017, Action 2
Basis of Safety Cases on Safety System Logic and Control System GA91-9201-0002-00073 (3D-GD-A0008)	Rev.4, 30 April 2017, Action 2
Topic Report on Safety System Logic and Control System GA91-9201-0001-00052 (3E-GD-A0104)	Rev.3, 31 June 2017, Action 2

Safety System Logic and Control System Design Description GA32-1001-0002-00001 (3D-GD-A0002)	Rev.3, 31 May 2017, Action 2
Generic PCSR Chapter 14: Control and Instrumentation GA91-9101-0101-14000 (3E-GD-A0063)	Rev.C, 31 August 2017
Generic PCSR Chapter 24: Design Basis Analysis GA91-9101-0101-24000 (UE-GD-0208)	Rev.C, 31 August 2017

Programme Milestones/ Schedule:

See attached Gantt Chart (Table 1)

Reference:

Ref[1] “Topic Report on Design Basis Analysis”, GA91-9201-0001-00023 (UE-GD-0219)

Ref[2] “Topic Report on Neutron Monitoring System”, GA91-9201-0001-00054 (3E-GD-B017)

Ref[3] “Neutron Monitoring System System Design Description”, GC51-1001-0001-00001 (3D-GD-B001)

Ref[4] “Basis of Safety Cases on Safety System Logic and Control System”, GA91-9201-0002-00073 (3D-GD-A0008)

Ref[5] “Topic Report on Safety System Logic and Control System”, GA91-9201-0001-00052 (3E-GD-A0104)

Ref[6] “Safety System Logic and Control System Design Description”, GA32-1001-0002-00001 (3D-GD-A0002)

Ref[7] “Generic PCSR Chapter 14: Control and Instrumentation”, GA91-9101-0101-14000 (3E-GD-A0063)

Ref[8] “ Generic PCSR Chapter 24: Design Basis Analysis”, GA91-9101-0101-24000 (UE-GD-0208)

Table 1 RO-ABWR-0077 Gantt Chart