

## **Enclosure 1**

### **MFN 15-064, Revision 1, Supplement 1**

### **GEH's Revised Response and Supplemental Information to RAI 09.05.01-1**

#### **IMPORTANT NOTICE REGARDING CONTENTS OF THIS DOCUMENT Please Read Carefully**

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**(Below is GEH's revised response to 09.05.01-1 (Item 11) for convenience)**

**NRC Request for Additional Information 09.05.01-1 (Item 11):**

*On July 13, 1994, the U.S. Nuclear Regulatory Commission (NRC) issued the final design approval (FDA), along with the "Final Safety Evaluation Report [FSER] Related to the Certification of the Advanced Boiling Water Reactor Design" (NUREG-1503). On May 12, 1997, the NRC issued the final design certification rule (DCR) for the Advanced Boiling Water Reactor (ABWR) design in the Federal Register (62 FR 25800).*

*10 CFR 52.59(a) (2014) requires, in pertinent part, a finding of compliance with the regulations in effect at the time of original certification in order to issue a renewed design certification. In 1997, operating license Final Safety Analysis Reports (FSARs) were already required by 10 CFR 50.48(a) to include "[t]he means to limit fire damage to structures, systems, or components important to safety so that the capability to safely shut down the plant is ensured." However, further developments in the area of fire protection have taken place since then. Based on results from the industry documented in the 2002 EPRI Report No. 1006961, "Spurious Actuation of Electrical Circuits Due to Cable Fires," and NRC fire tests conducted after the certification of the ABWR DCD, as documented in the 2006 NUREG/CR-6931, "Cable Response to Live Fire," (ADAMS Accession Nos. ML081190230, ML081190248, and ML081190261), the NRC staff's position is that fire-induced circuit failures can cause spurious actuations, including multiple spurious actuations, and that a plant's fire hazard analysis should account for these spurious actuations in assessing the plant's safe shutdown capability.*

*In SECY-08-0093, "Resolution of Issues Related to Fire-Induced Circuit Failures," dated June 30, 2008 (ADAMS Accession No. ML081370346), the Commission was informed of the NRC's staff approach to resolving issues concerning fire-induced circuit failures and multiple spurious actuations. This SECY paper included a clarification of fire-induced circuit fault requirements as well as a commitment to develop additional evaluation methods and publish them in the appropriate regulatory document. As stated in the SECY paper, for new reactor plants, the applicants must demonstrate that they have systematically identified possible multiple spurious actuation scenarios that could prevent safe shutdown and must describe their approach to addressing each scenario such that post-fire safe shutdown is ensured. On September 3, 2008, the Commission approved the approach described in SECY-08-0093 as documented in the staff requirements memorandum (SRM) on SECY-08-0093 (ADAMS Accession No. ML082470571).*

*Regulatory Guide (RG) 1.189, Revision 2, "Fire Protection for Nuclear Power Plants," provides guidance on the issue of multiple spurious actuations. RG 1.189 endorses Nuclear Energy Institute (NEI) 00-01, Revision 2, "Guidance for Post Fire Safe Shutdown Circuit Analysis," with several exceptions.*

*GEH-ABWR DCD Tier 2, Section 9.5.1, "Fire Protection System," does not contain a discussion on the effects of multiple spurious actuations due to a fire. Addressing multiple spurious actuations due to the effects of fire is necessary to ensure compliance with 10 CFR 50.48(a) (1997).*

*Therefore, in accordance with 10 CFR 52.59(a) (2014) and 10 CFR 50.48(a) (1997), the applicant is requested to perform an evaluation for the effects of multiple spurious actuations due to a fire that is consistent with NEI 00-01, Revision 2, as modified in RG 1.89, Revision 2, or if an alternative approach is used, justify how the alternative approach complies with NRC regulations.*

**GEH Response; Revision 1:**

A detailed assessment of the ABWRs' vulnerability to Multiple Spurious Operations (MSO) would need to be conducted during the plant detailed design of the COL phase. GEH will include in ABWR DCD Subsection 9.5.13 a COL License Information item requiring that Multiple Spurious Operations (MSO) be addressed at the time of COL Application.

**Impact on DCD**

The ABWR DCD will be revised as follows to address this RAI:

1) Section 1.8; Table 1.8-20

Revise the entry for Regulatory Guide 1.189 to indicate that revision 2 issued October 2009 is applicable to NEI 00-01, Guidance for Post Fire Safe Shutdown Circuit Analysis, Revision 2, May 2009.

2) Section 1.8; Table 1.8-21

Add in section "other", "NEI 00-01, Guidance for Post Fire Safe Shutdown Circuit Analysis, Revision 2, May 2009"

3) Section 1.9 Table 1.9-1

Add item 9.39; "Multiple Spurious Operations Evaluation" 9.5.13.22

4) Section 9.5.1

Add new Section 9.5.1.6.5:

9.5.1.6.5 Multiple Spurious Operations Evaluation

The COL applicant shall provide an evaluation of the ABWR's susceptibility to Multiple Spurious Operations (MSO) in accordance with the methodology contained in NEI 00-01, Guidance For Post Fire Safe Shutdown Circuit Analysis, Revision 2 and as modified by Regulatory Guide 1.189, Revision 2. The COL applicant will submit the results of this evaluation to the NRC for review. See Subsection 9.5.13.22 for COL license information item.

5) Section 9.5.13

Add new section 9.5.13.22

9.5.13.22 Multiple Spurious Operations Evaluation

The COL applicant shall provide an evaluation of the ABWR's susceptibility to Multiple Spurious Operations (MSO) in accordance with the methodology contained in NEI 00-01, Guidance for Post Fire Safe Shutdown Circuit Analysis, Revision 2 and as modified by Regulatory Guide 1.189, Revision 2. The COL applicant will submit the results of this evaluation to the NRC for review.

6) Section 9.5.14

Add new reference 9.5-10

9.5-10 "NEI 00-01, Guidance for Post Fire Safe Shutdown Circuit Analysis, Revision 2, May 2009"

The ABWR DCD R5 revised marked up pages are provided in Enclosure 2 of MFN 15-064, Revision 1.

**NRC Request for Supplemental Information:**

*A teleconference was held between the US NRC Staff and GE Hitachi on January 19, 2016 during which the GEH response to RAI 09.05.01-1 was discussed. As part of this call, the Staff indicated that they were concerned with a statement in the DCD that MSO risk in digital equipment due to a fire is essentially zero and therefore not a concern. The specific item in question is last sentence of first paragraph of ABWR DCD Section 9.5.1.1.7:*

*“As stated above, the systems are separated by fire areas on a divisional basis. The multiplexing system is a dual channel system. Two simultaneous, identical digitized control signals are required at the de-multiplexer for control action to be taken at the field device. The probability of two spurious signals matching is essentially zero.”*

**GEH Supplemental Response to Revision 1:**

GEH explained that this statement was limited to fiber-optic transmission to the de-multiplexer and not the hardware in the de-multiplexer cabinet. The Staff was not convinced and stated that the ACRS, during the STP 3&4 COL hearings, had raised numerous questions about the possibility of digital systems creating spurious actuations due to fire and smoke.

Damage to fiber-optic cables, including damage due to fire, is highly unlikely to cause a spurious operation. This is due to the design that requires two matching digital signals being transmitted over redundant pathways. In order to clarify the issue, GEH will make the following changes to the DCD:

Section 9.5.1.1.7 paragraph 1 will be revised to read as follows:

“As stated above, the systems are separated by fire areas on a divisional basis. The multiplexing system is a dual channel system. Two simultaneous, identical digitized control signals are required at the de-multiplexer for control action to be taken at the field device. The probability of two identical spurious signals matching, induced by physical damage (including fire damage) to the fiber-optic transmission cable, is minuscule.

Additionally, a new second paragraph will be added to Section 9.5.1.1.7 as follows:

“Spurious operation of equipment controlled by Remote Multiplexing Units (RMU) in the field due to physical damage because of fire or smoke will be considered in cases where the connection between the RMU and the field devices is transmitting a command signal.”

The following sentence will be added to New DCD Section 9.5.1.6.5 inserted in GEH's Revision 1 response:

“Spurious operation of equipment due to fire damage to the RMUs will also be considered as described in Subsection 9.5.1.1.7.”

The following sentence will be added to New COL Information Item 9.5.13.22 inserted in GEH's Revision 1 response:

“Spurious operation of equipment due to fire damage to the RMUs will also be considered as described in Subsection 9.5.1.1.7.”

**Impact on DCD**

ABWR DCD Revision 6, Tier 2, Sections 9.5.1.1.7, 9.5.1.6.5 and 9.5.13.22 are being revised as indicated above. The marked up pages of ABWR DCD R6 for this supplemental response are provided in Enclosure 2. These replace the previously submitted pages for those sections discussed above.