From:	Ward, William
Sent:	Saturday, October 01, 2016 2:41 PM
To:	apr1400rai@khnp.co.kr; KHNPDCDRAIsPEm Resource; daegeun.ahn@gmail.com; Andy Jiyong Oh; Jungho Kim (jhokim082@gmail.com); Mannon, Steven (steven.mannon@aecom.com)
Cc:	Ward, William; Ciocco, Jeff; Curtis, David; Morton, Wendell
Subject:	APR1400 Design Certification Application RAI 522-8633 [7.7 Control Systems)
Attachments:	APR1400 DC RAI 522 ICE 8633.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, the following RAI question response times. We may adjust the schedule accordingly.

07.07-18 : 45days
07.07-19 : 60days
07.07-20 : 60days

Please submit your RAI response to the NRC Document Control Desk.

Thank you,

William R. Ward, P.E.
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Subject: APR1400 Design Certification Application RAI 522-8633 [7.7 Control Systems)
Sent Date: 10/1/2016 2:40:39 PM
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From: Ward, William

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REQUEST FOR ADDITIONAL INFORMATION 522-8633

QUESTIONS

07.07-18

10 CFR 50.55a(h)(3) requires compliance to IEEE Std. 603-1991. IEEE Std. 603-1991, Clause 5.6.3, states, in part, the safety system design shall be such that credible failure in, and consequential actions by other systems, as documented in Clause 4.8 of the design basis section of this standard, shall not prevent the safety systems from meeting the requirements of this standard. In a response to RAI 356-7881, Question 07-08, the applicant provided technical information with regard to its analysis of postulated common cause failure (CCF) of components with embedded digital devices in Section 4.10 of the Control System CCF Analysis technical report, APR1400-Z-J-NR-14012. The information provided by the applicant was vital in the staff's understanding of the background information used to make analytical conclusions within the report as this information provided clear and concise technical basis for these conclusions. However, in order to make its safety finding, the NRC staff needs more detail added to the technical report than the applicant committed to provide.

The staff requests the following from the applicant:

1. Update Section 4.10 of the Control System CCF Analysis technical report to specifically state the embedded technology used in safety and non-safety applications are diverse from each other, as stated in part one of the applicant's response.

2. Add the table that lists the different types of embedded digital devices and their functions, provided in part one of the applicant's response, to Section 4.10 of the Control System CCF Analysis technical report.

3. Add the explanation regarding Class 1E devices with embedded technology in part 4 of the response to Question 07-08, to Section 4.10 of the Control System CCF Analysis technical report or another suitable area of the licensing documentation. This is essential as this explanation describes the existence of embedded technology in safety applications.

REQUEST FOR ADDITIONAL INFORMATION 522-8633

07.07-19

10 CFR 50.55a(h)(3) requires compliance to IEEE Std. 603-1991. IEEE Std. 603-1991, Clause 5.6, in part, requires independence: (1) between redundant portions of a safety system; (2) between safety systems and the effects of design basis events; and, (3) between safety systems and other systems. The design function of the remote control console (RCC) is to provide the necessary controls and displays for the operator to achieve hot shutdown if an aircraft impact causes control failures in both the main control room (MCR) and the remote shutdown room (RSR). The RCC will need access to the control of various safety and non-safety related components to achieve this design function. The RCC will have direct interconnections to safety-related I&C functions and components in order to achieve hot shutdown functionality. The applicant's response to RAI 356-7881, Question 07-05 did not provide sufficient detail on how controls and displays in the RCC meet relevant safety I&C criteria.

1. For the newly added Figure 7.7-14, I&C System Architecture for the RCC Panel," identify the safety class of each component or panel. It is not clear what portions of the network configuration and component shown are safety class and which parts are not (specifically the safety class of the ESCMs on the RCC panel). The applicant used color coding on other network drawings such as Figure 7.1-1, "APR1400 I&C System Overview Architecture," in DCD FSAR Tier 2, Section 7.1 to denote safety class.

2. Demonstrate how the RCC meets Independence requirements (IEEE Std. 603-1991 Clause 5.6) for both redundant portions of the safety systems and between safety and non-safety systems.

3. In its response, the applicant only refers to a single panel within the RCC. The exact physical configuration of the controls and displays remains unclear to the staff. Clarify whether the RCC provides all controls and displays on a single panel or on multiple panels.

4. Are there any dedicated I&C equipment cabinets for the RCC? If so, describe how these cabinets are designed to meet applicable safety requirements such as environmental protections (e.g. cooling fans, temperature monitoring)?

5. Verify that the I&C equipment cabinets dedicated to the RCC are located in an area such that they will not be affected by an aircraft event that would affect the MCR and the RSR.

6. For Figure 7.7-14, Independence requirements are not clearly addressed for the RCC safety and non-safety systems. Describe on Figure 7.7-14 how isolation and separation for redundant portions of the safety systems and between safety and non-safety systems are implemented to address IEEE Std. 603-1991 Clause 5.6.

7. Provide an ITAAC for the RCC that verifies design information provided within the applicant's previous response to RAI 356-7881, Question 07-05 as well as all other subsequent RAI responses.

REQUEST FOR ADDITIONAL INFORMATION 522-8633

07.07-20

10 CFR 50.55a(h)(3) requires compliance to IEEE Std 603-1991. IEEE Std. 603-1991, Clause 5.6.3, states, in part, the safety system design shall be such that credible failure in and consequential actions by other systems, as documented in Clause 4.8 of the design basis section of this standard, shall not prevent the safety systems from meeting the requirements of this standard. In the applicant's response to RAI 356-7881, Question 07-09, the applicant presented clear and concise information regarding the criteria for determining which I&C systems were within the scope of the analysis provided in Technical Report APR1400-Z-J-NR-14012-P, "Control System CCF Analysis" as well as a table summarizing the safety-related barriers that could be breached in the presence of a failure of certain systems/components (e.g. fuel cladding) if a CCF should occur. This information is essential to the staff's understanding of the response, but the applicant did not commit to updating the technical report to reflect this information. In addition, the applicant states the following in its response:

"Control systems are included in the evaluation if their failures can affect critical safety functions, as described in Section 2 of the control systems CCF TeR."

The applicant goes on to state, as presented in DCD Tier 2, Section 15.0, that the limiting initiating event criteria for a control system being within the scope of the analysis is if the control system's failure can challenge fuel cladding integrity, primary system integrity, lead to a potential offsite does release and challenge containment integrity. However, it is not clear (within Technical Report APR1400-Z-J-NR-14012, "Control System CCF Analysis") that the failure control system(s) (e.g. block or inhibit a safety function as per the requirements of IEEE Std. 603-1991, Clause 5.6.3) is specifically addressed or enveloped by the analysis presented.

1. The staff requests the applicant provide Table 1 titled "Results of Screening Process for All Control System in the APR1400" as well as the screening process description provided in the applicant's response, be added to Technical Report APR1400-Z-J-NR-14012.

2. Clarify that the analysis contained within Technical Report APR1400-Z-J-NR-14012, "Control System CCF Analysis" also addresses control system failures that could block or inhibit safety functions and provide this clarification within Technical Report APR1400-Z-J-NR-14012, "Control System CCF Analysis" as per the requirements of IEEE Std. 603-1991, Clause 5.6.3.