# REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**APR1400 Design Certification**

**Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD**

**Docket No. 52-046**

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| **RAI No.:** | **68-7892** |
| **SRP Section:** | **7.7 – Control Systems** |
| **Application Section:** | **07.07** |
| **Date of RAI Issue:** | **07/10/2015** |

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## Question No. 07.07-7

Clarify the use of the word, "disappeared" in Technical Report APR1400-Z-J-NR-14012-P, Rev.0, “Control System CCF Analysis.”

10 CFR 52.47(a)(2) requires, in part, that the description of structures, systems and components shall be sufficient to permit understanding of the system designs. Technical Report APR1400-Z-J-NR-14012-P uses the term, "disappeared" in multiple places in Section 5, "Evaluation Method and Results," which is confusing since it would not seem to convey the technical idea that is appropriate for the context in which the term is used. For example, in Sheet 9 of 18 of Table 5.1-10, "Multiple Failure due to a Single Failure of Shared Signals," of the technical report, it states the following, "The above temporary excessive feedwater by ... is disappeared by ..." Given the safety significance of this technical issue, it is essential that the design description be expressed in the most accurate way possible.

Clarify the use of the term "disappeared" in Technical Report APR1400-Z-J-NR-14012-P.

## Response – (Rev. 1)

In technical report APR1400-Z-J-NR-14012-P, the term "disappeared" is used to mean that an abnormal state of the feedwater flow due to a shared signal failure is recovered or cleared by a high pass filter function of the FWCS, because the high pass filter has a steady-state gain equal to zero. For clarification, the term "disappeared" will be changed to “recovered” in technical report APR1400-Z-J-NR-14012-P.

The feedwater control system (FWCS) is composed of feed-forward control and feed-back control. The feed-forward control uses an error between feedwater and steam flows and the feed-back control uses the error between the steam generator level and the level setpoint. The flow error signal is dynamically compensated by a high pass filter function which generates zero output at steady state condition.

When reactor power is above 20%, the flow error is defined as the difference between the total feedwater flow and the measured steam flow signal. When the reactor power is low (e.g., 0 to 20% power), the flow error is defined as the difference between the downcomer feedwater flow and calculated steam flow (i.e., TLI signal + SBCS modulation signal) because the measured steam flow signal cannot be credited due to the very low signal strength.

At low power levels, the failure effects of the Turbine Load Index (TLI) signal are as follows.

1. TLI fails low
   Initially, feedwater flow is decreased due to the flow error signal and steam generator level will decrease. The output of the high pass filter due to the TLI failed low converges to zero and has no effect after some period of time. The steam generator level is recovered to the setpoint mainly by the feed-back control of FWCS.

2. TLI fails high
   Initially, feedwater flow is increased due to the flow error signal and steam generator level will increase. The output of the high pass filter due to the TLI failed high converges to zero and has no effect after some period of time. The steam generator level is recovered to the setpoint mainly by the feed-back control of FWCS.

Subsections 5.1.4.7 and 5.1.4.8, and Tables 5.1-9, 5.1-10, and 5.2-9 of technical report APR1400-Z-J-NR-14012-P will be revised as shown in the attachment associated with this response for clarification.

In Subsection 5.1.4.8 of technical report APR1400-Z-J-NR-14012-P, the evaluation is modified because the automatic withdrawal prohibit (AWP) function of the SBCS stops the CEA withdrawal when the steam dump induced by high pressurizer pressure or high steam header pressure is occurring.

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**Impact on DCD**

There is no impact on the DCD.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical Specifications**

There is no impact on the Technical Specifications.

**Impact on Technical/Topical/Environmental Reports**

Technical Report APR1400-Z-J-NR-14012-NP, Rev. 0 Subsections 5.1.4.7, 5.1.4.8 and Tables 5.1-9, 5.1-10, and 5.2-9 will be revised as indicated in the attachment associated with this response.

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Table 5.1-9 Multiple Failure due to a Single Failure of Shared Signals (8 of 18)

TS

Table 5.1-10 Multiple Failure due to a Single Failure of Shared Signals (9 of 18)

TS

Table 5.2-9 Multiple Failures of Single Control group (RRS/RPCS) (Sh. 1 of 2)

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