REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

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

Docket No. 52-046

RAI No.:	**301-8280**
SRP Section:	**07.01 – Instrumentation and Controls**
Application Section:	**07.01**
Date of RAI Issue:	**11/10/2015**

Question No. 07.01-42

For flow information, why is it acceptable to derive flow information from reactor coolant pump speed, SG differential pressure, and reactor coolant temperature?

10 CFR 50.55a(h) requires compliance to IEEE Std 603-1991. Clause 6.4, "Derivation of System Inputs," of IEEE Std 603-1991 requires, in part, that sense and command feature inputs shall be derived from signals that are direct measures of the desired variables as specified in the design basis, when practical. In other words, minimize the number of variables or derivatives of direct measured variables and secondary calculations required to provide the required measurement. The staff used SRP Appendix 7.1-C, "Guidance for Evaluation of Conformance to IEEE Std 603," as guidance for this area of the evaluation.
Technical Report, APR1400-Z-J-NR-14001, Revision 0, "Safety I&C System," Section A.6.4, states “in so far as is practicable, system inputs are derived from signals that are direct measures of the desired variables,” and that the “process variables and derived parameters used for the PPS actuation functions are set by the safety analysis.” Flow information is derived from reactor coolant pump speed measurement, SG differential pressure, and reactor coolant temperature. It is not clear to the staff why flow information is derived and not measured directly. Staff request applicant to provide rationale as to why it is acceptable to measure flow indirectly per Clause 6.4 of IEEE Std 603-1991.

Response - Rev. 1

In the core protection calculator system (CPCS), flow information is derived from reactor coolant pump speed and density of the coolant in the hot leg because no method that directly measures the flow information is available in modern engineering.

TS

Impact on DCD

DCD Tier 2 Section 7.2.1.1.e will be revised as shown in the attachment.

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 Report

There is no impact on any Technical, Topical, or Environmental Report.

2) Correction factor for ex-core flux power for shape annealing and CEA shadowing

3) Reactor coolant flow change rate from RCP speeds, and temperatures and DNBR penalty for pump speeds less than a setpoint

4) ΔT power from reactor coolant temperatures, pressure, and flow information

5) Ex-core flux power signals are summed and corrected for CEA shadowing, shape annealing, and cold leg temperature shadowing. This corrected flux power is periodically calibrated to the actual core power measured independently of the RPS.

6) Axial power distribution from the corrected ex-core flux power signals

7) Radial peaking factors based on CEA positions

(In the CPCS, flow information is derived from reactor coolant pump speed and density of the coolant in the hot leg because no method that directly measures the flow information is available in modern engineering.)

8) DNBR

9) Comparison of DNBR with a fixed trip setpoint

10) LPD

11) Comparison of LPD with a fixed trip setpoint

12) CEA deviation alarm

13) Calculation of cold leg temperature for asymmetric steam generator transient trip determination

14) Comparison of core power with CPC variable overpower trip setpoint

The outputs of each CPC are as follows:

1) DNBR low trip and pre-trip

2) LPD high trip and pre-trip

3) CEA withdrawal prohibit

4) CPC auxiliary trips (see Table 7.2-4)