# 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.:** | **435-8541** |
| **SRP Section:** | **07.02- Reactor Trip System** |
| **Application Section:** | **4.3, 4.4 and 7.2** |
| **Date of RAI Issue:** | **03/08/2016** |

## Question No. 07.02-15

**Regulatory Basis:**

10 CFR 50.55a(h)(3) states that applications filed on or after May 13, 1999, for design certifications under 10 CFR Part 52 must meet the requirements for safety systems in IEEE Std. 603–1991 and the correction sheet dated January 30, 1995.

IEEE Std. 603–1991 establishes functional and design requirements for power, instrumentation, and control portions of safety systems. According to this standard, “The design basis shall be consistent with the requirements of ANSI/ANS 51.1-1983 or ANSI/ANS 52.1-1983 and shall document as a minimum: [Criterion 4.9] “The methods to be used to determine that the reliability of the safety system design is appropriate for each safety system design and any qualitative or quantitative reliability goals that may be imposed on the system design.”

In addition, 10 CFR Part 50, Appendix B, Criterion III, “Design Control,” requires that “measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.2 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled. Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components.”

**Requests:**

To determine whether the core protection calculator (CPC) functions as designed and with acceptable reliability, in accordance with 10 CFR 50.55a(h)(3) and 10 CFR Part 50, Appendix B, the staff needs to ascertain that the computer codes and data used by the CPC are acceptable for application to APR1400. Specifically, the staff is unable to find program description and

validation documentation related to the CPCSIM and CEFAST codes, as well as modifications made to the CETOP code to incorporate the KCE-1 critical heat flux correlation associated with the PLUS7 fuel. Additionally, no direct evidence of staff review or approval has been located for the CPCSIM and CEFAST codes. Therefore, please provide documentation supporting the applicability and acceptability of these codes for the APR1400 design. The staff considers this information to be essential design information, and therefore should be incorporated by reference in the DCD.

## Response

The CPCSIM code is used to calculate the CPCS overall uncertainties for DNBR and LPD calculations, the methodology of which is based on CPCS Functional Design Requirement (FDR) (APR1400-F-C-NR-14003-P), CPC Setpoint Analysis Methodology for APR1400 (APR1400-F-C-NR-14001-P) and Modified Statistical Combination of Uncertainties (Reference 1) which has been approved by the NRC. CEFAST (Combustion Engineering FAst STartup) code provides the capability to perform the rapid analysis of NSSS data obtained during the startup tests to generate and validate CPC constants.

CPCS FDR and CPC Setpoint Analysis Methodology are used as the basis of the CPCSIM and CEFAST codes, which are used to calculate constants used by the CPCS. In accordance with References 2 and 3, the codes have been verified and validated. These codes are not used for safety analysis and are not of the level that require inclusion into the DCD, as corroborated by the absence in the Palo Verde Nuclear Generating Station Updated Final Safety Analysis Report (UFSAR). However, code manuals and the V&V reports for CPCSIM and CEFAST will be provided for the staff's information.

The modifications made to the CETOP code to incorporate the KCE-1 critical heat flux correlation are described in CCVR-TH-02-02 (KNF's 'Computer Code Verification Report,' dated 01/30/2002). The audit to inspect the compatibility of the CETOP code with the KCE-1 CHF correlation was performed by the NRC staff from February 28 through March 4, 2016.

Reference 1. CEN-356(V)-P-A, "Modified Statistical Combination of Uncertainties," Rev. 01-P-A, Combustion Engineering, Inc., May, 1988.
Reference 2. VV-FE-0095, "Software Verification and Validation Report CEFAST Version 3 Mod 0," Rev. 00, ABB Combustion Engineering, Inc., October 15, 1993.
Reference 3. VV-FE-0409, "Software Verification and Validation Report CPCSIM Version 4 Mod 8," Rev. 00, ABB Combustion Engineering, Inc., January 30, 1998.

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**Impact on DCD**

There is no impact on DCD.

**Impact on PRA**

There is no impact on PRA.

**Impact on Technical Specifications**

There is no impact on Technical Specifications.

**Impact on Technical/Topical/Environmental Report**

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