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Mr. Jeffrey Ciocco
APR1400 Design Certification, Lead Project Manager
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: APR1400 Standard Plant Design, Docket ID: NRC-2013-0244

Dear Mr. Ciocco:

The purpose of this correspondence is to provide a comment regarding the submittal of the Korea Hydro & Nuclear Power Company (KHNP) APR1400 Design Control Document for NRC review.

I have worked as a Fluid System Design Engineer on the Safety Injection Systems and Shutdown Cooling Systems provided in various ABB-CE NSSS designs, including Palo Verde Units 1, 2, and 3 and System 80+.

I see from the NRC website that KHNP has submitted the APR1400 Design Control Document for NRC review. I have a comment regarding operability requirements for the APR1400 Shutdown Cooling System.

I understand that the APR1400 design is based to a large extent on the ABB-CE System 80+ design. In designs prior to System 80+, two low pressure safety injection pumps were used to provide Emergency Core Cooling and also to provide Shutdown Cooling for residual heat removal. The System 80+ design eliminated the need for low pressure safety injection; however, two low head Shutdown Cooling pumps for residual heat removal were retained. These two Shutdown Cooling pumps were specified to have the same performance characteristics as two Containment Spray System pumps to allow the Shutdown Cooling pumps and Containment Spray pumps to be "interchangeable." My understanding of "interchangeable" is that these pumps could be interchangeable when not required to be available for their requisite design basis function.

ABB-CE designs prior to System 80+ had a Technical Specification LCO under "Plant Systems" that required two trains of shutdown cooling to be OPERABLE in Modes 1, 2, and 3. Even though Shutdown Cooling is not used in Modes 1, 2, or 3, the LCO was specified to ensure that at least one train of Shutdown Cooling would be available (OPERABLE) for design bases events, assuming a single failure, in accordance with 10CFR50, Appendix A, General Design Criterion 34, and NRC Branch Technical position RSB 5-1 (Attached to SRP 5.4.7, Rev. 3). Shutdown Cooling operability in Modes 1, 2, and 3 was required because Shutdown Cooling is credited (assumed) for small break LOCA's, various Chapter 15 events, and cooldown to cold shutdown following a natural circulation cooldown. All of these events assume the availability of at least one train of Shutdown Cooling after shutdown cooling entry conditions are established. It is reasonable to expect that if two trains of Shutdown Cooling are not operable in Mode 1, they will not be operable for an unplanned event such as a small break LOCA.

During the evolution of the System 80+ DCD design, ABB-CE evaluated shutdown risk issues. As a result, the System 80+ DCD Technical Specifications require two Shutdown Cooling trains to be operable during various shutdown modes; e.g., refueling operations with "low water level," defined as < 23 feet above the reactor vessel flange.

The System 80+ DCD Technical Specifications did not include a requirement for two trains of Shutdown Cooling to be operable on Modes 1, 2, and 3. The Technical Specification "Plant Systems" LCO requiring Shutdown Cooling operability in Modes 1, 2 and 3 for previous designs was not included in the System 80+ DCD Technical Specifications. Due to Shutdown Risk issues, attention was focused on ensuring System 80+ Shutdown Cooling System operability during shutdown modes. It was believed that maintenance on System

80+ Shutdown Cooling pumps could be performed during Modes 1, 2, and 3. I am not aware that the omission of the Shutdown Cooling operability requirement in Modes 1, 2, and 3 was reviewed/discussed with the NRC during System 80+ Design Certification.

I had several discussions with ABB-CE management regarding Shutdown Cooling operability requirements and compliance with GDC 34 and BTP RSB 5-1 for the System 80+ design. My understanding is that two Shutdown Cooling trains are required to be operable in Modes 1, 2, and 3 and that two Containment Spray trains are required to be operable in Modes 1, 2, 3 and 4. Therefore, the Shutdown Cooling pumps and Containment Spray pumps would not be interchangeable during these modes. I believe that if there is no requirement for operability of two Shutdown Cooling trains in Modes 1, 2, and 3, the Shutdown Cooling System will not be available when called upon for design basis events.

I suggested that it may be possible to show, for the System 80+ design, that one Shutdown Cooling train could be inoperable for extended periods (7 days or more) while the plant was operating in Modes 1, 2, or 3. Instead, ABB-CE chose to perform a preliminary evaluation to demonstrate that in the event of a small break LOCA that actuated Containment Spray, the operating Containment Spray pump (assuming a single failure) could be switched to provide the Shutdown Cooling function (assuming that no Shutdown Cooling pumps were operable). This operation was to be addressed by emergency procedures during the detailed System 80+ design. The detailed System 80+ design was not performed and this preliminary evaluation was not finalized. No System 80+ plants have been ordered.

I do not know the current status of the APR1400 design or how the APR1400 design addresses implementation of operability requirements for the Shutdown Cooling System in compliance with GDC 34 and BTP RSB 5-1. The issue is not limited to operability requirements for the Shutdown Cooling pumps. Operability affects piping, valves, and heat exchangers of both trains of the Shutdown Cooling System. Based on similarity to the System 80+ design, I expect that the APR1400 design does not require two trains of Shutdown Cooling operability in Modes 1, 2, and 3. If that is the case, it is not apparent to me how the APR1400 Shutdown Cooling design complies with GDC 34 and BTP RSB 5-1. However, it may be that the APR1400 design addresses Shutdown Cooling operability requirements separately from Technical Specifications; e.g., in a Technical Requirements Manual.

My comment on the APR1400 Shutdown Cooling System design is in the form of the following questions:

- 1) Is the APR1400 Shutdown Cooling System required to have two operable Shutdown Cooling trains in Modes 1, 2 and 3 to satisfy GDC 34 and BTP RSB 5-1?
- 2) If the answer to the above question is "Yes," how does the APR1400 Shutdown Cooling System design meet these operability requirements?

If any additional information is needed, I can be reached at my e-mail address, cjpoppe@aol.com or phone (860) 668-7396. Thank you for your consideration of this issue.

Very truly yours,



Charles J. Poppe