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.:	**446-8535**
SRP Section:	**19 - Probabilistic Risk Assessment and Severe Accident Evaluation Application Section**
Application Section:	**19**
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Question No. 19-99

10 CFR 52.47(a)(27) states that a design certification (DC) application must contain an FSAR that includes a description of the design-specific PRA and its results. In addition, SRP Chapter 19.0, draft Revision 3, Section II “Acceptance Criteria,” Item 4 on Page 19.0-13 states “The staff will determine that the applicant has identified risk-informed safety insights based on systematic evaluations of the risk associated with the design..". In RAI 8355, Question 28659, the staff requested additional risk insights to be added to the KHNP Risk Insights Table, DCD Table 19.1-4. The staff needs clarification on item 15 in the KHNP Risk Insights Table, DCD Table 19.1-4. Table 19.1-4 (item 15) that states, “Backup for SC pump: The Containment Spray System (CSS) is designed to provide a backup to the Shutdown Cooling System (SCS) for residual heat removal and for cooling of the IRWST during post-accident feed and bleed operations using the SIS and pressurizer POSRVs.” Referring to this insight, the staff requests the following information:

a. The staff requests a clarification in DCD Table 19.1-4 whether this insight represents full power internal events only. For low power shutdown (LPSD), the staff notes the containment spray pumps would be unavailable for decay heat removal if SCS suction is lost. The containment spray pumps were not modeled as a backup in the unrecoverable loss of SCS event trees. In these trees, CSS is only addressed in the Containment Heat Removal top event.

b. Related to the CSS pumps being designed as a backup to the SCS pump, on DCD page 19.1-13, it is stated that “The CSPs are designed to be functionally interchangeable with the SCPs. The SCPs can be utilized as backup for the CSPs (or the CSPs as backup for the SCPs).” The staff requests a clarification on page 19.1-13 if this insight represents full power internal events only, for the reasons identified above.

c. The staff is unclear whether, in one low power shutdown flooding scenario which results in flooding of both SCS divisions, the PRA credits the CSS with being able to sustain decay

heat removal. The staff requests clarification in the DCD Chapter 19 whether the CSS would be a viable backup to the SCS if CSS was not initiated prior to RCS boiling or loss of suction.

Response

The responses are as follows:

a. As per DCD 19.1.6.1.1.7 and the Shutdown Evaluation Report Table 1.4-1, each Containment Spray pump can be aligned and used as a backup for the Shutdown Cooling pump in the same division. Conservatively, the LPSD PRA model does not credit this capability. The DCD will be revised to reflect that this feature is applicable during power operation and at shutdown.

b. DCD page 19.1-13 will be revised to note the backup capability of the CS system during power operation and shutdown.

c. The CS pumps could be used to back up the SC pumps in a flooding scenario if the CS pumps were not also failed by the flood. However, the CS pumps were not credited as a backup function for the SC system in the shutdown flood analysis. Implicitly, the CS pumps cannot back up the SC pumps under conditions (such as a loss of NPSH) under which the SC pumps would not be able operate. The DCD 19.1.3.1 discussion already states that the SC and the CS pumps are functionally interchangeable, so that no additional clarification is required.

Impact on DCD

The DCD will be revised as shown in 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 Reports

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

feed and bleed operation using the pilot-operated safety relief valves (POSRVs) and SIPs.

c. Containment Spray System (CSS)

The CSS is designed to remove heat and fission products from the containment atmosphere in the event of a LOCA or MSLB inside the containment and thereby limit the leakage of airborne activity from the containment. The CSS takes borated water from the IRWST. A simplified diagram of CSS is shown in Figure 19.1-3.

The CSS consists of two trains. Each train includes a CSP, a containment spray heat exchanger, a containment spray minimum flow heat exchanger, a main spray header with nozzles, an auxiliary spray header with nozzles, and associated valves, piping and instrumentation. The CSPs are designed to be functionally interchangeable with the SCPs. The SCPs can be utilized as backup for the CSPs (or the CSPs as backup for the SCPs).

during power or shutdown operation. Conservatively, this backup capability is not credited in the PRA.

The functions of the CSS are to:

1) Reduce the containment atmosphere pressure and temperature below containment design limits with margin in the event of a postulated LOCA or MSLB inside containment, by removing heat from the containment atmosphere

2) Limit airborne iodine and particulate fission product inventory in the containment atmosphere in the event of an accident

3) Provide a backup to the SCS for decay heat removal and cooling of the IRWST during feed and bleed operations utilizing the SIS and the POSRVs

4) Provide an appropriate spray water chemical composition after an accident, which is required for hydrogen control, material compatibility, and long-term iodine control against re-evaporation

5) Provide long-term cooling of the IRWST to remove the decay heat if the containment spray operation through the spray header is not available to

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Table 19.1-4 (7 of 25)

No.	Insight	Disposition
	Risk Insights from Key Design Features	
15	The following are important aspects of the containment spray system (CSS) as represented in the PRA:	
	Containment heat removal: The CSS is designed so that the CS pumps and the SC pumps are functionally interchangeable when not required to perform their requisite design basis function, assuming a loss of offsite power and single failure. The SC pumps are designed to be aligned from the MCR to provide the containment spray.	Subsection 6.5.2.1
	Containment pressure control: Following a LOCA or MSLB, the containment pressure is reduced to near the atmospheric pressure with the CSS operation.	
	Fission product scrubbing: The CSS is a safety-grade system designed to remove fission products from the containment atmosphere following a DBA.	
	Backup for SC pump: The CSS is designed to provide a backup to the SCS for residual heat removal and for cooling of the IRWST during post-accident feed and bleed operations using the SIS and pressurizer POSRVs.	
	In addition to its design basis capabilities, the CSS provides the capability to cool the IRWST during accidents requiring "feed and bleed" operation.	Subsection 6.2.2.2
	The CS pump's NPSH is adequate to prevent pump cavitation and failure if the IRWST inventory is saturated.	Subsection 6.2.2.3
16	The charging pumps provide the RCP seal cooling and are used for emergency boration operation during an unlikely ATWS event. Divisional separation exists between redundant charging pumps and their power and instrument air supplies.	Subsection 9.4.3.2 Subsection 15.4.6.2

Conservatively, this backup capability is not credited in the PRA.

during power or shutdown operation,