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.:	**220-8269**
SRP Section:	**15.2.1-5 – Loss of External Load; Turbine Trip; Loss of Condenser Vacuum; Closure of Main Steam Isolation Valve (BWR); and Steam Pressure Regulator Failure (Closed)**
Application Section:	**SRP 15.2.1-5**
Date of RAI Issue:	**09/22/2015**

Question No. 15.02.01-2

GDC 10 requires design of reactor core and its coolant, control, and protection systems with appropriate margin so SAFDLs are not exceeded during any conditions of normal operation, including the effects of AOOs. In Tier 2 Table 1.9-2 (Sheet 28 of 33) the applicant stated that they are in conformance with the SRP 15.2.1-5. The SRPs provide an acceptable method of meeting the requirements, SRP 15.2.1-5 instructs the reviewer to evaluate the consequences of AOOs that could decrease heat removal by the secondary system and result in the fuel cladding thermal design criteria to be exceeded. RG 1.105 provides guidance for keeping instrument setpoints within technical specification limits.

GDC 13 requires the provision of instrumentation that is capable of monitoring variables and systems over their anticipated ranges to assure adequate safety, and of controls that can maintain these variables and systems within prescribed operating ranges. In order to demonstrate conformance with this GDC, SRP 15.2.1-5 instructs the reviewer to evaluate the sequences of events, including automatic actuations of protection systems, and manual actions, and determines whether the sequence of events is justified, based upon the expected values of the relevant monitored parameters and instruments indications.

In SRP 15.2.1-15.2.5 “Loss Of External Load; Turbine Trip; Loss Of Condenser Vacuum; Closure Of Main Steam Isolation Valve (BWR); And Steam Pressure Regulator Failure (Closed)” states that the applicant must present a quantitative analysis of the most limiting event.

In FSAR Tier 2 Section 15-2.3.4.2 “Input Parameters and Initial Conditions," the applicant discusses the scenario of the LOCV with outsite power available (without LOOP). In this scenario, the RCP is available and improves the heat transfer between the primary and secondary systems, therefore limiting RCS peak pressure. However, the staff finds that the applicant has not addressed how this scenario impacts the peak pressure on the secondary system.

The staff requests the applicant to discuss the consequences on the secondary side (peak SG

pressure) if the LOCV event occurs with outsite power available (RCP operating, and non-safety systems in manual control).

Response

To check the scenario of the LOCV with offsite power available impacts on the peak pressure of the secondary system, all the same initial data and assumptions of the scenario with LOOP excluding LOOP condition are used. The consequences on the secondary side (peak SG pressure) are as follows;

Offsite Power	Unavailable (with LOOP)	Available (without LOOP)	Acceptance Criteria
Peak SG Pressure, psia	1,294.04	1,293.93	1,320

As shown above, the effects of a LOOP on the peak SG pressure are negligible, and the peak SG pressure remains below the relevant acceptance criteria of 92.83 kg/cm^{2}A (1,320 psia) providing reasonable assurance of secondary system integrity.

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

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

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Application Section:	**SRP 15.2.1-5**
Date of RAI Issue:	**09/22/2015**

Question No. 15.02.01-3

GDC 10 requires design of reactor core and its coolant, control, and protection systems with appropriate margin so SAFDLs are not exceeded during any conditions of normal operation, including the effects of AOOs. In Tier 2 Table 1.9-2 (Sheet 28 of 33) the applicant stated that they are in conformance with the SRP 15.2.1-5. The SRPs provide an acceptable method of meeting the requirements, SRP 15.2.1-5 instructs the reviewer to evaluate the consequences of AOOs that could decrease heat removal by the secondary system and result in the fuel cladding thermal design criteria to be exceeded. RG 1.105 provides guidance for keeping instrument setpoints within technical specification limits.

GDC 13 requires the provision of instrumentation that is capable of monitoring variables and systems over their anticipated ranges to assure adequate safety, and of controls that can maintain these variables and systems within prescribed operating ranges. In order to demonstrate conformance with this GDC, SRP 15.2.1-5 instructs the reviewer to evaluate the sequences of events, including automatic actuations of protection systems, and manual actions, and determines whether the sequence of events is justified, based upon the expected values of the relevant monitored parameters and instruments indications.

SRP 15.2.1-15.2.5 “Loss Of External Load; Turbine Trip; Loss Of Condenser Vacuum; Closure Of Main Steam Isolation Valve (BWR); And Steam Pressure Regulator Failure (Closed)” Section III.3, states that to the extent deemed necessary, the reviewer evaluates the effect of single active system or component failures that may affect the course of the transient.

In FSAR Tier 2 Section 15-2.3.4.2 the applicant also states that the analysis determined that there were no single failures that, when combined with the event, resulted in a more severe peak pressure or minimum DNBR than the LOCV by itself. In FSAR Tier 2 Table 15.0-4 “Single Failures,” the applicant identifies the individual single failures evaluated. The staff identified that this table did not included the failure of a POSRV or a MSSV.

The staff requests the applicant to discuss the impact of a single active failure of a POSRV or a MSSV on the event progression and the results.

Response

NRC SRP 5.2.2 indicates that “Full credit is allowed for spring-loaded safety valves designed in accordance with the requirements of ASME Code Article NB-7511.1”, and POSRVs for the APR1400 are designed in accordance with ASME Code Article NB-7511.1 and operated by system pressure and passive springs.

Based on the SRP's allowance of taking full credit for spring-loaded safety valves and that the APR1400 POSRVs are designed in accordance with the ASME Code Article NB-7511.1, the applicant understands that POSRV failures (fail to open and fail to close) can be exempted from single failure consideration. NRC SRP 5.2.2 could be applicable to MSSVs, because they are also spring-loaded safety valves. That is the reason why DCD Table 15.0-4 “Single Failures” does not include the failure of a POSRV or a MSSV, and POSRV & MSSV failures have not been considered as single failure in safety analysis for the APR1400.

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

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

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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Application Section:	**SRP 15.2.1-5**
Date of RAI Issue:	**09/22/2015**

Question No. 15.02.01-4

GDC 10 requires design of reactor core and its coolant, control, and protection systems with appropriate margin so SAFDLs are not exceeded during any conditions of normal operation, including the effects of AOOs. In Tier 2 Table 1.9-2 (Sheet 28 of 33) the applicant stated that they are in conformance with the SRP 15.2.1-5. The SRPs provide an acceptable method of meeting the requirements, SRP 15.2.1-5 instructs the reviewer to evaluate the consequences of AOOs that could decrease heat removal by the secondary system and result in the fuel cladding thermal design criteria to be exceeded. RG 1.105 provides guidance for keeping instrument setpoints within technical specification limits.

In SRP 15.2.1-15.2.5 “Loss Of External Load; Turbine Trip; Loss Of Condenser Vacuum; Closure Of Main Steam Isolation Valve (BWR); And Steam Pressure Regulator Failure (Closed)” the staff identified five (5) events that need to be evaluated by the applicants. The staff identified that FSAR Tier 2 Section 15.2.5 “Steam Pressure Regulator Failure,” states that this event is not applicable to the APR1400 design. The staff determined that the applicant has not provided a justification that describes why this scenario is not applicable for the APR1400 design.

The staff requests the applicant to update the FSAR to include a justification as to how the applicant determined that this event is not applicable to the APR1400 design.

Response

The APR1400 design does not have a steam pressure regulator or a turbine power regulator, therefore, the safety analysis for this event is not presented. To clarify the applicability, Section 15.2.5 will be updated.

Impact on DCD

Section 15.2.5 of the DCD will be revised as indicated on 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 Reports

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

RCS pressurization and fuel performance than those of the LOCV event presented in Subsection 15.2.3.

15.2.4.4 Barrier Performance

For the MSIV closure event and the MSIV closure with coincident loss of offsite power, as well as these events in combination with a single failure, the maximum RCS pressure remains below 110 percent of the RCS design pressure, providing reasonable assurance of primary system integrity. The maximum SG pressure also is below 110 percent of the SG design pressure.

15.2.4.5 Radiological Consequences

This event is bounded by the feedwater system piping failure event described in Section 15.2.8 for the radiological consequences.

15.2.4.6 Conclusions

For the MSIV closure event and the MSIV closure with coincident loss of offsite power, as well as these events in combination with a single failure, the maximum RCS pressure remains below 193.34 kg/cm^{2}A (2,750 psia), providing reasonable assurance of primary system integrity. The maximum steam generator pressure remains below 92.83 kg/cm^{2}A (1,320 psia), providing reasonable assurance of secondary system integrity. The minimum DNBR remains above 1.29, providing reasonable assurance of fuel cladding integrity.

15.2.5 Steam Pressure Regulator Failure

because the APR1400 design does not have a steam pressure regulator or a turbine power regulator

This event does not apply to the APR1400 design, and therefore, is not presented.

15.2.6 Loss of Nonemergency AC Power to the Station Auxiliaries

15.2.6.1 Identification of Causes and Frequency Classification

The loss of nonemergency AC power to the station auxiliaries (LOAC) may be the result of a complete loss of the external grid or a loss of the onsite AC distribution system. An LOAC is presented as the initiating event for the four RCP loss of flow (LOF) events described in Subsection 15.3.1.