
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. 15.02.01-1

GDC 26 requires two independent reactivity control systems with different design principles to control reactivity changes so acceptable fuel design limits are not exceeded. 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. SRP 15.2.1-5 instructs reviewer to evaluate the consequences of AOOs that could decrease heat removal by the secondary system and lead to reactivity changes within the core causing the fuel cladding thermal design criteria to be exceeded.

FSAR Tier 2 Section 15.2.1 the applicant discusses the consequences of several AOOs (loss of external load, the turbine trip, the loss of condenser vacuum, and the closure of the main steam isolation) that could decrease the heat removal by the secondary system. In several locations the applicant states that the radiological consequences of these events are bounded by the feedwater system piping failure event described in FSAR Tier 2 Section 15.2.8. However the staff determined that the applicant has not provided a justification that demonstrates that the results of the feedwater system piping failure event bound the radiological consequences of the previously mention events

The staff requests the applicant to provide a justification that demonstrates that the results of the feedwater system piping failure event bound the radiological consequences of the following events:

- a. Loss of external load
- b. Turbine trip
- c. Loss of condenser vacuum
- d. Closure of the main steam isolation valve

Response

Although the acceptance dose criteria for the Feedwater Line Break (FLB) event in APR1400 DCD Section 15.2.8 is not specified in RG 1.183, the SRP 15.2.8 acceptance criteria for a corresponding event can be used to determine whether it is in compliance with 10 CFR 50.34(f)(1)(iii). This is consistent with the acceptance criteria of the AOOs specified in SRP 15.0.3.

It can be shown that the radiological consequences of the FLB event bounds that of the AOOs by comparing the FLB radiological consequences to those of the Loss of Condenser Vacuum (LOCV) event, because the LOCV is the limiting event of the other AOOs as explained below (DCD Section 15.2.3.2);

The feedwater flow is instantaneously terminated following a LOCV, whereas it ramps down following the loss of external load and the turbine trip events. And the MSIV closure event results in termination of all main steam flow. However, main steam flow is terminated more rapidly during the LOCV event since the closure time for the turbine stop valves is much shorter than that for the MSIVs. The steam generator pressure for LOCV event is higher than the other events, which affects the steam flow rate through the MSSV. Therefore, the radiological consequences of these events are bounded by the LOCV event.

Table 1 shows the values for the most important parameters and the resultant coolant mass released to the environment for the FLB and LOCV events. This qualitative evaluation is meaningful, because the initial primary and secondary coolant activity concentrations of the two events are the same. As shown in Table 1, the amount of both primary and secondary coolant released to the environment for FLB is much higher than those for LOCV. Therefore, the FLB event bounds the other AOO events for the radiological consequences.

Table 1 Comparison of Radioactive Releases for FLB and LOCV

| Events | Release Pathways | Release Duration [hr] ¹⁾ | Flashing Fraction For Leakage | | Mass Released to the Environment [kg] | |
|--------|-------------------------------------|-------------------------------------|-------------------------------|-------------|---------------------------------------|-------------------|
| | | | Unaffected SG | Affected SG | Primary coolant ²⁾ | Secondary coolant |
| LOCV | MSSV/ADV | 8 | 0% | 0% | 10.9 | 109,000 |
| FLB | MSSV/ADV, Containment ³⁾ | 8 | 24.4% | 100.0% | 137.7 | 1,040,558 |

Note)

- 1) The release duration for LOCV is conservatively assumed to be same as that for the FLB.
- 2) Total mass of primary to secondary leakage released to the environment is calculated considering the entire duration of release (i.e., 8 hour), partition coefficient of 100 for the unflashed fluid, and the SG leak rate of 0.6 gpm for both SGs (i.e., 0.3 gpm per SG).
- 3) For the FLB event, only the release to the environment through the unaffected SG is taken into account, since the primary to secondary leakage for the affected SG is discharged to the containment.

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.