

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.: 368-8515
SRP Section: 15.08 - Anticipated Transients Without Scram
Application Section: 15.08
Date of RAI Issue: 02/01/2016

Question No. 15.08-1

REGULATORY BASIS

10CFR 50.62 requires that each pressurized water reactor must have equipment from sensor output to final actuation device, that is diverse from the reactor trip system, to automatically initiate the auxiliary (or emergency) feedwater system and initiate a turbine trip under conditions indicative of an ATWS. This equipment must be designed to perform its function in a reliable manner and be independent (from sensor output to the final actuation device) from the existing reactor trip system. For PWRs manufactured by Combustion Engineering (C-E), the design must have a diverse scram system from the sensor output to interruption of power to the control rods. This scram system must be designed to perform its function in a reliable manner and be independent from the existing reactor trip system (from sensor output to interruption of power to the control rods)

The NUREG-0800 Standard Review Plan (SRP) Section 15.8 for ATWS evaluations identifies eight acceptance criteria which are to be applied to a wide spectrum of initiating events. These criteria pertain to:

1. The ATWS rule (acceptable reduction in risk from an ATWS event) (10CFR50.62)
2. Allowable peak cladding temperature limit is not exceeded (10CFR50.46)
3. Ensure that power/flow oscillations do not occur (GDC 12)
4. Ensure there is no coolant pressure boundary failure (GDC 14)
5. Ensure that containment design conditions are not exceeded (GDC 16)
6. Ensuring structural integrity of the fuel and cladding to ensure long term coolability and that negligible metal-water interactions occur (GDC 35)
7. Maintain containment pressure and temperatures at low levels when reactor coolant is deposited in the containment (GDC 38)
8. Ensure that the containment leakage rate does not exceed design limits (GDC50)

The ATWS evaluation in Section 15.8 and the Technical Report only addresses challenges to the RCS pressure boundary (criterion 4). Other acceptance criteria are not discussed in Section 15.8 or in the Technical Report.

Provide an evaluation of the full spectrum of events and evaluate their consequences with respect to each of the eight criteria identified above.

Response

Evaluations of ATWS events for APR1400 with regard to the NRC's recommended acceptance criteria specified in SRP Section 15.8 are as follows:

Criterion 1: APR1400 satisfies the ATWS rule for CE type PWR specified in 10CFR 50.62 by providing a diverse scram system independent from the existing reactor protection (trip) system from sensor output to interruption of power to the control rods.

Criterion 2 & 6: There is no significant RCS inventory loss or fuel uncover during AOOs without reactor trip up to 30 minutes after event initiation. So, the fuel integrity is maintained without any challenge of fuel heat-up and the long term coolability is ensured without metal-water reaction due to no fuel heat-up.

Criterion 3: There are no significant power and flow oscillations larger than those of Chap. 15 events such as a CEA withdrawal and a loss of reactor coolant flow, respectively, since the system reaches the new steady state without requiring the reactor trip.

Criterion 4: DPS (diverse protection system) for reactor trip on high pressurizer pressure and DPS for the auxiliary feedwater flow on low SG level will protect the RCS overpressurization as provided in the Technical Report, APR1400-Z-A-NR-14014-P.

Criterion 5, 7 & 8: As analyzed in CENPD-158, "ATWS analyses: Analysis of Anticipated Transients without Reactor Scram in Combustion Engineering NSSS's (1976)," the mass and energy release to the containment through pressurizer safety valves (POSRVs) is lower than that of Section 6.2.1.3, 'LOCA Mass and Energy Release'. So, the containment pressure and temperature will be lower than the design values and thus the containment leakage rate will not exceed the design limits.

Impact on DCD

There is no impact on DCD.

Impact on PRA

There is no impact on PRA.

Impact on Technical/Topical/Environmental Reports

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

Impact on Technical Specifications

There is no impact on the Technical Specifications.