

---

## 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.: 86-8003  
SRP Section: SRP 10  
Application Section: 10.4  
Date of RAI Issue: 07/16/2015

---

### **Question No. 10.04.09-6**

NUREG-0800, SRP 10.4.9, Section II, SRP Acceptance Criteria Item 5 states that, in regards to GDC 34, and 44, the recommendations of NUREG-0611 and NUREG-0635 shall also be met.

TMI Action Plan item II.E.1.1 of NUREG-0737 and 10 CFR 50.34(f)(1)(ii) for applicants subject to 10 CFR 50.34(f) require an AFWS reliability analysis. An acceptable AFWS should have unreliability in the range of  $10^{-4}$  to  $10^{-5}$  per demand, exclusive of station blackout scenarios. Compensating factors (e.g., other methods of accomplishing AFWS safety functions or other reliable methods for cooling the reactor core during abnormal conditions) may be considered to justify a larger AFWS unavailability.

DCD Tier 2, Section 10.4.9.1.2 (Item O) indicates that an AFWS reliability analysis was performed in accordance with Three Mile Island (TMI) Action Item II.E.1.1 of NUREG-0737, and that the AFWS is designed to have unavailability from  $10^{-5}$  to  $10^{-4}$  per demand as described in DCD Tier 2, Chapter 19. The staff was unable to locate the referenced information in Chapter 19. The applicant is requested to provide the staff with the description and results of the AFWS reliability analysis that reference was made to in DCD Section 10.4.9.1.2.

### **Response**

An AFWS reliability analysis was performed in accordance with Three Mile Island (TMI) Action Item II.E.1.1 of NUREG-0737. An acceptable AFWS should have unreliability in the range of  $10^{-4}$  to  $10^{-5}$  per demand. The AFWS achieves this reliability target, as described in below Table 1 below.

The results of the AF reliability analysis will be added as Table 10.4.9-6 in the DCD Section 10.4.9 .

Table 1. AFWS Unreliability Results

Initiating Event	Probability
Loss of Feedwater (LOFW)	7.94E-06
General Transient (GTRN)	7.94E-06
Loss of Offsite Power (LOOP), (offsite power recovery considered)	7.80E-05

---

**Impact on DCD**

DCD 10.4.9 (Subsection 10.4.9.1.2, 10.4.9.2.1 and Table 10.4.9-6) will be revised to reflect the response as shown in 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 Report.

**APR1400 DCD TIER 2**

- n. The AFWS meets the recommendations identified in NUREG-0635.
- o. An AFWS reliability analysis is performed in accordance with Three Mile Island (TMI) Action Item II.E.1.1 of NUREG-0737 (Reference 32). The AFWS is designed to have unavailability from  $10^{-5}$  to  $10^{-4}$  per demand ~~as described in Chapter 19~~ as shown in Table 10.4.9-6
- p. The AFWS design meets the provision of TMI Action Plan Item II.E.1.2 of NUREG-0737 and 10 CFR 50.62(c)(1) (Reference 33). The AFWS can be either manually actuated or automatically actuated by an auxiliary feedwater actuation signal (AFAS) from the engineered safety feature actuation system (ESFAS) described in Section 7.3 or the diverse protection system (DPS) described in Subsection 7.8.1.1.
- q. In conformance with guidance in 10 CFR 50.63 and NRC RG 1.155 (References 34 and 35, respectively), the APR1400 is provided with an AAC power source to cope with an SBO event as described in Section 8.4.
- r. The AFWS piping, associated supports, and restraints are designed so that the following do not occur as a result of a single event, such as a ruptured auxiliary feedwater line or a closed isolation valve:
- 1) Initiating a LOCA
  - 2) Causing failure of the other SG's safety class steam and feedwater lines, MSIVs, MFIVs, SG blowdown isolation valves, or MSADVs
  - 3) Reducing the capability of the ESFAS or the plant protection system
  - 4) Transmitting excessive loads to the containment pressure boundary
  - 5) Compromising the function of the MCR
  - 6) Precluding an orderly cooldown of the RCS

**APR1400 DCD TIER 2**

- s. Each turbine-driven pump is supplied with steam from a single SG (i.e., the one to which it supplies AFW).
- t. The AFW is delivered to the downcomer nozzles of the SGs.
- u. A non-safety-grade source of condensate from the condensate storage tank (by gravity feed) can be aligned if the safety-related source is exceeded before shutdown cooling system entry conditions are reached.
- v. The principal AFWS pressure-retaining materials are shown in Table 10.4.9-5.
- w. The recommendations of NRC RG 1.28 (Reference 3) are applied during fabrication of the AFWS, and preheat guidelines in ASME Section III, Appendix D, Article D-1000 for carbon steel are applied to the AFWS components.

#### 10.4.9.2 System Description

##### 10.4.9.2.1 General Description

The AFWS is shown in Figures 10.4.9-1. The AFWS consists of two 100 percent capacity motor-driven pumps, two 100 percent capacity turbine-driven pumps, two 100 percent auxiliary feedwater storage tanks (AFWSTs), valves, two cavitating flow-limiting venturis, and instrumentation. The SG makeup flow requirement is given in Table ~~10.4.9-6~~.

10.4.9-7

Each pump takes suction from a respective AFWST and has a respective discharge header. Each pump discharge header contains a pump discharge check valve, flow-modulating valve, AFW isolation valve, and SG isolation check valve. One motor-driven pump and one turbine-driven pump are configured into one mechanical division and joined together inside containment to feed their respective SG through a common auxiliary feedwater (AFW) header, which connects to the SG downcomer feedwater line. Each common AFW header contains a cavitating venturi to restrict the maximum AFW flow rate to each SG.

A cross-connection is provided between the AFWSTs so that either tank can supply either division of the AFWS. Each of the safety Class 3, seismic Category I AFWSTs contains 100 percent of the total volume specified in Subsection 10.4.9.1.1. A manually operated

Table 10.4.9-6

AFWS Unreliability Results

Initiating Event	Probability
Loss of Feedwater (LOFW)	7.94E-06
General Transient (GTRN)	7.94E-06
Loss of Offsite Power (LOOP) (offsite power recovery considered)	7.80E-05



New Table Added

**APR1400 DCD TIER 2****10.4.9-7**Table ~~10.4.9-6~~Steam Generator Makeup Flow Requirement

Flow requirement	2,461 L/min (650 gpm) to 1 SG
------------------	-------------------------------