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## REVISED 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.:** 198-8208  
**SRP Section:** 14.02 – Initial Plant Test Program – Design Certification and New License Applicants  
**Application Section:** 14.2  
**Date of RAI Issue:** 09/04/2015

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### **Question No. 14.02-28**

Demonstrate how the manual control functions of the auxiliary feedwater system (AFWS) are verified as part of the initial test program to meet the requirements of Criterion XI of Appendix B, to 10 CFR Part 50.

Criterion XI, "Test Control," of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50 states, in part, that a test program shall be established to assure that all testing required to demonstrate that SSCs will perform satisfactorily in service is identified and performed in accordance with written test procedures, which incorporate the requirements and acceptance limits contained in applicable design requirements. RG 1.68, "Initial Test Programs for Nuclear Power Plants" provides guidance on the initial test program.

APR1400 FSAR Tier 2, Section 14.2.12.1.34 provides the initial test descriptions for the AFWS. Test Method Item 3.9 verifies the proper operation of the AFWS in response to signals from the plant protection system and the diverse protection system. However, the staff could not identify a test method item that verifies the AFWS response to manual controls. Identify where this function is verified in the initial test program or modify APR1400 FSAR Tier 2, Section 14.2.12.1.34 to include this information.

### **Response**

KHNP has reviewed the subject question and understands the staff's request. KHNP is in the process of upgrading the test plans presented in Section 14.2 of the DCD. This effort is focused on adding additional SSCs that are important to safety and risk significant as well as increasing the level of detail described in the DCD for test prerequisites, test methods and acceptance criteria for the various tests. It has been determined that the actions to be taken as a result of this question is within the scope of the upgrade effort. Therefore, KHNP will address the noted items in the upgrade effort, which is scheduled to be completed by February 1, 2016. A revised

response to this question that incorporates the results of the upgrade effort will be submitted to the NRC after completion.

### **Response – (Rev. 1)**

As a result of the upgrade effort that was described in the original response, KHNP revised the test plan for the AFWS Subsection 14.2.12.1.34 and submitted that revised test plan to the NRC (ref. KHNP letter MKD/NW-16-0156L, dated February 24, 2016; ML16056A003). The revised test plan included several changes to verify the AFWS response to manual controls, including:

- Two new objectives on demonstrating manual operation of motor operated and solenoid operated valves (1.1) and manual operation of the AFW pumps (1.4)
- A new test method (3.7) to verify proper operation in response to manual control actions

Further review of the AFWS test plan has resulted an additional enhancement to 14.2.12.1.34 to include specifically the auxiliary feedwater actuation signal (AFAS) and includes the following:

- A revision to objective 1.9 to more specifically state the proper valve response from automatic actuation to auxiliary feedwater actuation signal (AFAS)
- A revision to test method 3.6 to specify that the signal used is a simulated AFAS signal
- A revision to data requirement 4.5 to clarify the data is from the response of AFW pumps and components to controls including AFAS
- A revision to acceptance criteria 5.4 to change that the AFW pumps and components properly responds to controls including AFAS

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### **Impact on DCD**

The upgraded DCD Tier 2, Section 14.2.12.1.34 submitted by KHNP in letter MKD/NW-16-0156L, dated February 24, 2016 will be revised as indicated in the Attachment associated with this response.

### **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**

1.2 To demonstrate the operability of the system indications, alarms and status lights

1.3 To demonstrate the fail positions of the solenoid valves

1.4 To demonstrate the manual operation of the auxiliary feedwater system (AFWS)pumps

1.5 To record baseline vibration and temperature data of the auxiliary feedwater pumps while operating at recirculation flow and design flow

1.6 To verify the time to open and close valves

1.7 To demonstrate AFW pumps design performance

1.8 To demonstrate supply feedwater of the raw water tank and CST

1.9 To demonstrate proper valve response to the steam generators automatic actuation and override signals

auxiliary feedwater  
actuation signal (AFAS)



1.10 To demonstrate AFW Pump response to automatic actuation and override signals

1.11 To verify endurance of the AFW Pump for design emergency conditionsa 48-hour test

## 2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested are complete.

2.2 Permanently installed instrumentation is operable and calibrated.

2.3 Test instrumentation is available and calibrated.

**APR1400 DCD TIER 2**

2.4 Plant systems required to support testing are operable, or temporary systems are installed and operable.

**3.0 TEST METHOD**

3.1 Verify all control logic.

3.2 Verify head and flow characteristics of motor-driven auxiliary feedwater pumps.

3.3 Verify the starting time and head and flow characteristics of the turbine-driven auxiliary feedwater pump at the full design range of steam pressures (hot functional test / power ascension test [HFT/PAT]).

3.4 During the startup program, demonstrate five consecutive cold quick starts for the turbine-driven auxiliary feedwater pump (HFT/PAT).

3.5 Verify all design flow paths and verify that flow downstream of venturi meets design requirement.

3.6 Verify proper operation in response to ~~signals~~ from the plant protection system and the diverse protection system.

simulated AFAS



~~3.7~~3.7 **Verify proper operation in response to manual control actions**

3.8 Verify, if appropriate, proper operation, stroking speed, and position indication of control valves.

~~3.8~~3.8 Verify AFW discharge line isolation valves stroke properly with design basis differential pressure across them.

~~3.9~~3.9 Verify proper operation of protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs.

~~3.10~~3.10 Demonstrate proper pump performance during an endurance test.

**APR1400 DCD TIER 2**

3.412 Verify power-operated valves fail to the position specified in Subsection 10.4.9 upon loss of motive power.

## 4.0 DATA REQUIRED

- 4.1 Valve position indications
- 4.2 Valve opening and closing times, where required, including valve stroke time under design basis differential pressure
- 4.3 Pump head-versus-flow curves
- 4.4 Flow rates downstream of venturi
- 4.5 ~~Response of auxiliary feedwater pumps to engineering safety features actuation system (ESFAS) signals~~
- 4.6 Pump start times Response of AFW pumps and components to controls including AFAS
- 4.7 Position response of valves to loss of motive power

## 5.0 ACCEPTANCE CRITERIA

- 5.1 ~~The Auxiliary feedwater pumps suction/discharge pressure hi/low alarms are properly annunciated.~~
- 5.2 ~~AFWP discharge temperature Hi alarms are properly annunciated.~~
- 5.3 ~~AFW pump provide design flowrate at total developed head greater than minimum design value.~~
- 5.4 ~~AFW pump properly responds to automatic actuation signals.~~ ←
- 5.5 ~~48-hour endurance test is performed on all AFWS performs as described in Subsections 7.3.1.9 epumps. Following the 48-hour run, the pumps~~

AFW pumps and components properly responds to controls including AFAS.