

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 – Verification Test Program
Application Section: 14.02
Date of RAI Issued: 09/04/2015

Question No. 14.02-27

Provide specific objectives and corresponding test methods for the reactor power cutback system (RPCS) test specified in APR1400 FSAR Tier 2, Section 14.2.12.1.32.

General Design Criterion (GDC) 1, "Quality standards and records" of Appendix A, "General Design Criteria for Nuclear Power Plants" to 10 CFR Part 50 states, in part, that structures, systems, and components important to safety shall be tested to quality standards commensurate with the importance of the safety functions to be performed.

APR1400 FSAR Tier 2, Section 14.2.12.1.32 describes the initial test for the RPCS. The test objective for this section states, "To demonstrate proper operation of the [RPCS]." However, based on the test method and corresponding reference to APR1400 FSAR Tier 2 Subsection 7.7.1.1 e, "Reactor power cutback system," it is not clear what the specific functions are being verified with this test. Specifically, APR1400 FSAR Tier 2, Section 7.1.1.1.e states that the RPCS reduces reactor power by dropping of pre-selected groups of full strength regulating core element assemblies (CEAs) and subsequently sending control signals to the turbine to rebalance turbine and reactor power. The staff finds that these RPCS functions should be verified in this test and should be identified as test objectives. The corresponding test method and acceptance criteria should support demonstrating how these functions are verified in the initial test program. Modify APR1400 FSAR Tier 2, Section 14.2.12.1.32 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 are 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. 2

The test specified in 14.2.12.1.32 is to ensure that given a simulated input signal that the RPCS output is reasonable. The RPCS function is tested during power ascension tests with the interface systems. Specifically, the functional test of RPCS with the CEAs position and balance between turbine and reactor power is performed by dropping of pre-selected CEA groups as described in ITP 14.2.12.4.6 “Unit Load Rejection Test.”

KHNP’s submittal MKD/NW-16-0156L dated February 24, 2016; ML16056A003 revised Objective 1.3 and Acceptance Criteria 5.4 to include assurance that the RPCS functions properly. Since the verification of RPCS function is included in section 14.2.12.4.6, it is not necessary to also include it in section 14.2.12.1.32.

Since most of interface systems (e.g., Turbine Control System) are not operable during the RPCS pre-operational test in 14.2.12.1.32, only the status of the RPCS outputs received at the input of the interfacing equipment is checked to confirm the circuit between the RPCS and interfacing equipment is adequate.

Clarification to Section 14.2.12.1.32, including objectives and prerequisites will be added.

Impact on DCD

DCD Sections [14.2.12.1.32](#) and 14.2.12.4.6 included in KHNP’s submittal MKD/NW-16-0156L dated February 24, 2016; ML16056A003 will be changed 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 Environment Report.

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4.0 DATA REQUIRED

- 4.1 Record values of all simulated inputs, appropriate intermediate values, and outputs. (The online test program automatically performs this task.)

5.0 ACCEPTANCE CRITERIA

- 5.1 The COLSS performs as described in Subsection 7.7.1.4.

5.2 The test result of COLSS test program should meet the acceptance criteria for each test case which is specified in related design documents.

14.2.12.1.32 Reactor Power Cutback System Test1.0 ~~OBJECTIVE~~ OBJECTIVES

- 1.1 To demonstrate proper operation of the ~~reactor power cutback system (RPCS)~~

2.0 PREREQUISITES

1.2 To verify operation of the MTP and the IPS to the RPCS.
1.3 To verify that the applicable RPCS output signals are received by the interfacing equipment or systems.

- 2.1 Construction activities on the RPCS have been completed.

- 2.2 RPCS instrumentation has been calibrated.

- 2.3 External test equipment has been checked and calibrated.

- 2.4 Support systems required for the operation of the RPCS are operational.

3.0 TEST METHOD

2.5 Wiring has been completed between the RPCS and interface equipment.

- 3.1 Using actual or simulated interface inputs to the RPCS, observe receipt of these signals at the RPCS.

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- 3.2 Using installed and external instrumentation, vary all input signals to the system and observe output responses at the RPCS and at interfacing equipment.

4.0 DATA REQUIRED

- 4.1 Input signal values
- 4.2 Status of interfacing control board equipment
- 4.3 RPCS output response
- 4.4 Status of outputs received at interfacing equipment

5.0 ACCEPTANCE CRITERIA

- 5.1 The RPCS performs as described in Subsection 7.7.1.1 e.

14.2.12.1.33 Fuel ~~Storage and Handling and Storage System~~system Test**1.0 ~~OBJECTIVE~~OBJECTIVES**

- 1.1 To verify the proper operation of the fuel handling equipment

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 Plant systems required to support testing are operable or temporary systems are installed and operable.
- 2.4 Test instrumentation is available and calibrated.

14.2.12.4.6 Unit Load Rejection Test1.0 ~~OBJECTIVE~~ OBJECTIVES


1.1 To demonstrate that full load rejections from 100% power can be accommodated without initiating a Reactor Protection System (RPS) signal or an ESFAS signal, without opening any primary and/or secondary safety valves

1.2 To demonstrate that ~~the plant responds and~~ house load operation is controlled as designed following a 100 percent ~~capable during the~~ load rejection ~~with~~ transient

1.3 To assess the performance of SBCS, FWCS, RRS, PPCS & PLCS, ~~RPCS-in-service~~, DRCS and TCS following full load rejection from 100% power

2.0 PREREQUISITES

2.1 The reactor is operating above 95 percent power.

2.2 The RRS, PPCS, PLCS, FWCS, SBCS,  ~~FWCS, RRS, CEDMCS, and~~ RPCS, ~~and pressurizer pressure and level control~~ are in automatic operation.

3.0 TEST METHOD

3.1 A switchyard breaker(s) is tripped so as to subject the turbine to the maximum credible overspeed condition.

3.2 Plant behavior is monitored to provide reasonable assurance that the RRS, CEDMCS, SBCS, RPCS, FWCS, and pressurizer pressure and level control systems maintain the monitored parameters.

APR1400 DCD TIER 2**4.0 DATA REQUIRED**

~~4.1 Plant condition prior to load rejection~~

~~4.2 The following acceptance criteria parameters are monitored prior to and throughout the transient:~~

~~4.2.1 Pressurizer~~ Many plant data are obtained including reactor power, CEA positions, RCS temperatures, pressurizer pressure and level

~~4.2.2 RCS hot leg temperatures~~

~~4.2.3 SG, steam generator pressures and levels, steam and feedwater flows, POSRV and MSSV opening status, etc.~~

~~4.3 Additional key plant parameters are monitored for baseline data.~~

4.2 Sequence of events data are obtained.

5.0 ACCEPTANCE CRITERIA

~~5.1 The measured values of the acceptance criteria parameters in step 4.2 (above) are within the single-valued acceptance limits based on test predictions using methodology described in Subsection 15.0.2.~~

~~5.2 A reactor trip does not occur during the test.~~

~~5.3 The RPCS operates as described in Subsection 7.7.1.1 e.~~

5.1 The RPS shall not initiate a reactor trip.

5.2 The ESFAS shall not be actuated.

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5.3 The primary (POSRV) and/or secondary (MSSV) safety valves shall not open.

5.4 The ~~plant responds as described in Subsection 15.2.1~~RPCS shall drop the selected CEA groups into the core.

5.5 The 100% power load rejection shall be accommodated without tripping the turbine and with the turbine generator supplying house loads.

14.2.12.4.7 Shutdown from Outside the Main Control Room Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate that the ~~plant~~reactor can be ~~maintained in hot standby~~tripped from outside the ~~main~~ control room ~~(MCR) following a reactor trip~~

1.2 To demonstrate ~~the potential for safely cooling down that~~ the plant ~~from~~can be placed in the hot standby ~~to cold shutdown conditions~~condition from outside the control room—

1.3 To demonstrate that the plant can be controlled and maintained in the hot standby condition for at least 30 minutes from outside the control room

2.0 PREREQUISITES

2.1 The reactor is operating in the range of 10 to 25 percent of rated power with plant systems in their normal configuration with the turbine-generator in operation.

2.2 The capability to cool down the plant from the ~~remote shutdown console (RSC)~~RSC has been demonstrated during pre-core or post-core hot functional tests.