SUPPLEMENTAL 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:	**14.2**
Date of RAI Issue:	**09/04/2015**

Question No. 14.02-24

Demonstrate how the Reactor Regulating System (RRS) Test described in APR1400 FSAR Tier 2, Section 14.2.12.1.28 meets the requirements of General Design Criterion (GDC) 1 of Appendix A to 10 CFR Part 50.

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 14.2.12.1.28 describes the initial test for the RRS. The staff reviewed this test and finds that additional information is required regarding the pre-requisites for the RRS test. Specifically, Prerequisite Item 2.2 states, “RRS software is installed and instrumentation has been calibrated.” The staff reviewed the tests proposed in the initial test program for other software-based instrumentation and control (I&C) systems and did not find software installation a prerequisite for these systems. Clarify whether software installation should be a prerequisite for those other I&C system tests.

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. 1)

A prerequisite for completing construction activities includes software installation and therefore, the necessity to test the functions of the software driven systems. For clarification, the prerequisite for testing other major software-based instrumentation and control (I&C) systems will be revised to include software installation. As the Ex-Core Neutron Flux Monitoring System (ENFMS) has no software, DCD Sections 14.2.12.1.25 will be revised. For the software installation of the Plant Protection System (PPS), the Engineered Safety Features-Component Control System (ESF-CCS), the Fixed In-core Detector Amplification System (FIDAS) and the Reactor Power Cutback System (RPCS), DCD Sections 14.2.12.1.23, 14.2.12.1.24, 14.2.12.1.26 and 14.2.12.1.32 will be revised.

Supplemental Response

In addition, DCD Section 14.2.12.1 will be revised to add the software installation prerequisite for the following sytem tests: Boronometer Subsystem (14.2.12.1.17), Process Radiation Monitor Subsystem (14.2.12.1.18), Gas Stripper Effluent Radiation Monitor Subsystem (14.2.12.1.19), Remote Shutdown Console (14.2.12.1.48), Diverse Protection System (DPS) (14.2.12.1.49), Process and Primary Sampling System (14.2.12.1.83), Hydrogen Mitigation System (14.2.12.1.101), Process and Effluent Radiological Monitoring System (14.2.12.1.106), Area Radiation Monitoring System (14.2.1.12.1.107), Seismic Monitoring Instrumentation System (14.2.12.1.127), Core Protection Calculator System (CPCS) (14.2.12.1.138), and the Diverse Indication System (DIS) (14.2.12.1.139).

Impact on DCD

DCD Subsection 14.2.12 will be revised as indicated in 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 and Environmental Report.

5.3 The gas stripper skid valves fail to the required position on loss of air and power and go to the position indicated upon restoration of air and power

5.4 Gas stripper skid valve interlocks are verified

5.5 Gas stripper alarms are verified

5.6 Gas stripper discharge pumps are capable of developing sufficient head to process the gas stripper column as required flow rate

5.7 Gas stripper discharge pump Interlocks are verified

5.8 The gas stripper is capable of reducing dissolved gas in the process stream by a required factor

14.2.12.1.17 Boronometer Subsystem Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To ~~demonstrate~~ verify the proper operation of the boronometer subsystem.

2.0 PREREQUISITES

2.1 The boronometer has been calibrated and is operational.

2.2 Support systems required for boronometer subsystem operation are complete and operational.

2.3 System software is installed.

3.0 TEST METHOD

3.1 Using the built-in test features, observe boronometer indications, outputs to interface equipment, and alarm operation.

2.0 PREREQUISITES

2.1 The process radiation monitor has been installed, all interconnections have been completed, and the sample chamber has been filled with reactor makeup water.

2.2 The process radiation monitor has been calibrated.

2.3 A check source is available.

2.4 Support systems required for operation of the process radiation monitor are complete and operational.

2.5 System software is installed.

3.0 TEST METHOD

3.1 Using the built-in test features, observe process monitor indications, outputs to interface equipment, and alarm operation.

3.2 Using the check source, verify calibration of the process monitor.

4.0 DATA REQUIRED

4.1 Check source data

4.2 Process monitor operating data

4.3 Process monitor response to the check source

4.4 Value of parameters required to actuate alarms

5.0 ACCEPTANCE CRITERIA

5.1 The process radiation monitor of the process sampling system performs as described in Subsections 9.3.2.3 and 9.3.4.5.6.

5.2 PRMS energization shall be as designed

5.3 PRMS gross channel alarms are verified

5.4 The error of PRMS between the true output and observed output shall be within required range

5.5 PRMS spectrometer channel alarms are verified

5.6 The error of PRMS spectrometer channel between the true output and observed output shall be within required range

14.2.12.1.19 Gas Stripper Effluent Radiation Monitor Subsystem Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To ~~demonstrate~~verify the proper energization of the GSERMS

1.2 To verify the proper operation of the ~~gas stripper effluent radiation monitor subsystem~~GSERMS Gross Channel, including the gross gamma activity output to the BOP RMS

2.0 PREREQUISITES

2.1 The gas stripper effluent radiation monitor has been installed, all interconnections have been completed, and the sample chamber has been filled with reactor makeup water.

2.2 The gas stripper radiation monitor has been calibrated.

2.3 Support systems required for operation of the gas stripper effluent radiation monitor subsystem are complete and operational.

2.4 A check source is available.

2.5 System software is installed.

1.5 To verify the operation of the maintenance and test panel/interface and test processor for ESF-CCS

1.6 To verify the proper indication and alarms for ESF-CCS

1.7 To verify the operation of the operator module for ESF-CCS

1.8 To verify RSR Transfer function

1.9 To verify the operation of the ESF-CCS power supplies

1.10 To demonstrate redundancy, electrical independence, coincidence, and

2.0 PREREQUISITES

2.1 Construction activities on the ~~engineered safety feature actuation system (~~ESFAS~~)~~ have been completed and system software is installed.

2.2 ESFAS instrumentation has been calibrated.

2.3 External test instrumentation is available and calibrated.

2.4 Support systems required for operation of the ESFAS are operational.

3.0 TEST METHOD

3.1 Energize power supplies and observe output voltages.

3.2 Simulate ground faults and observe operation of the ground fault detectors.

3.3 Individually de-energize each group relay and monitor contact operation.

3.4 Test manual trips and monitor relay operation.

2.2 PPS and ESF-CCS ~~system~~ software is installed.

2.3 PPS instrumentation has been calibrated.

2.~~3~~4 External test instrumentation is available and calibrated.

2.~~4 Support~~5 The interface systems ~~required~~ for ~~operation of the trip circuit breakers, ESF-CCS, and PPS~~PPS such as CPCS, RTSS and ESF-

3.0 TEST METHOD

3.1 Energize power supplies and verify output voltage.

~~3.2 Simulate ground faults and observe operation of the ground fault detectors.~~

~~3.3~~3.2 Using simulated reactor trip signals, trip each reactor trip circuit breaker located in the RTSS with the breaker in the test position. Observe the reactor trip circuit breaker operation.

3.~~4~~3 Repeat Step 3.~~3~~2 with the reactor trip circuit breakers in the operate position.

3.~~5 Exercise~~4 Perform the bistable ~~comparators~~ logic test using ~~internal and external test circuitry~~the MTP and observe the setpoints used in the bistable logic and operation of the appropriate ~~ESFAS~~bistable logic.~~–~~

3.5 Perform the coincidence logic test using the MTP and observe the operation of the coincidence logic.

3.6 Check the operation of ~~trip channel~~operating bypass features ~~including, where applicable, observation of the~~ observe the setpoints at which the ~~trip~~operating bypasses are ~~canceled~~ automatically removed.

5.8 Bistable trip function operations should be as specified in the related design specification.

5.9 Interlock functions should operate as specified in the related design specification.

5.10 Operating bypass operation should be as specified in the related design specification.

5.11 Trip channel bypass operation should be as specified in the related design specification.

14.2.12.1.25 Ex-Core Neutron Flux Monitoring System

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify the proper functional performance of the ex-core neutron flux monitoring system

1.2 To verify the proper performance of audio and visual indicators

2.0 PREREQUISITES

2.1 Construction activities on the ex-core neutron flux monitoring system have been completed ~~and system software is intalled~~.

2.2 Ex-core neutron flux monitoring system instrumentation has been calibrated.

2.3 External test equipment has been calibrated and is operational.

2.4 Support systems required for operation of the ex-core neutron flux monitoring system are operational.

1.2 To verify the measured output is provided to the IPS through the data link server and DCS network.

1.3 Verify Cable Continuity.

1.4 Verify Cable Insulation Resistance.

2.0 PREREQUISITES

2.1 Construction activities on the in-core nuclear instrumentation system are complete ~~.~~ and system software is installed ~~(~~Detectors do not need to be installed ~~)~~.

2.2 Fixed in-core nuclear signal channel instrumentation has been calibrated.

2.3 External test equipment has been checked and calibrated.

2.4 Support systems required for operation of the in-core nuclear instrumentation system are operational.

3.0 TEST METHOD

3.1 Measure and record cabling insulation resistance.

3.2 Using external test instrumentation, simulate in-core detector signals into the signal conditioning circuits.

3.3 Using internal test circuits, test each amplifier for proper operation in accordance with manufacturer's instruction manual.

3.4 Vary the simulated inputs to the amplifier and record its values displayed by the information processing system.

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 Test

1.0 ~~OBJECTIVE~~OBJECTIVES

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

2.0 PREREQUISITES

2.1 Construction activities on the RPCS have been completed.

2.2 RPCS instrumentation has been calibrated.

and RPCS software is installed.

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

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

5.0 ACCEPTANCE CRITERIA

~~5.1 All narrow-range instrument readings agree within the accuracy of the instrumentation as described in Subsections 7.7.1.4 and 7.5.1.1.~~

~~5.2 All wide-range~~5.1 All instrument readings agree within the accuracy of the instrumentation as described in Subsections 7.7.1.4 and 7.5.1.1.

14.2.12.1.48 Remote Shutdown Console Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify proper operation of the remote shutdown instrumentation

1.2 To determine transfer of control occurs and that the plant can be cooled down from the remote shutdown console

2.0 PREREQUISITES

2.1 All construction activities on the remote shutdown console have been completed.

and system software is installed.

2.2 All remote shutdown console instrumentation has been calibrated.

2.3 The communication systems between the ~~main control room (~~MCR~~)~~ and remote shutdown console location have been demonstrated to be operational.

3.0 TEST METHOD

3.1 Using simulated signals, verify proper operation of remote shutdown console instrumentation.

1.5 To verify that the DPS trip and pretrip setpoints have been installed properly, and are within the acceptable tolerances.

1.6 To verify the auxiliary feedwater initiation and safety injection initiation

1.7 To verify the DPS response time

2.0 PREREQUISITES

2.1 Construction activities on the ~~reactor trip switch system (~~RTSS~~)~~ and the DPS have been ~~completed.~~ completed, and DPS software is installed.

2.2 DPS instrumentation has been calibrated.

2.3 External test instrumentation is available and calibrated.

2.4 Support systems required for operation of the RTSS and DPS are operational.

3.0 TEST METHODS

3.1 Energize power supplies and verify output voltage.

3.2 Using simulated signals, trip each reactor trip circuit breaker with the breaker in the test position. ~~—~~Observe RTSS trip circuit breaker operation.

3.3 Using simulated input signals, observe alternate auxiliary feedwater actuation ~~signals~~signal, and safety injection actuation signal.

4.0 DATA REQUIRED

4.1 Power supply voltages

4.2 Resistance for ground fault detector operation

1.3 To demonstrate containment isolation valves closure times

1.4 To demonstrate containment isolation valves responses to CIAS signals

1.5 To demonstrate the fail position of the primary sampling system valves

1.6 To demonstrate the operation of the post-accident primary sample isolation & drain valves, normal primary sample system valves, post-accident sample valves and the nitrogen flush valves

1.7 To demonstrate the operation of the sample mixing pump, the containment sample pump and the drain pump in the Post-accident Primary Sample Sink(PPSS)

1.8 To demonstrate the operation of the primary off-gas sample pump

1.9 To demonstrate the sample system heat tracing operates correctly

1.10 To demonstrate all status light and system alarms

1.11 To verify the ability of the process sampling system to collect and deliver representative samples of liquids and gases in various process systems to sample stations for chemical and radiological analysis during operation, cooldown, and post-accident modes

2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested ~~have been~~are completed.

and system software is installed.

2.2 Systems being sampled are at or near normal operating pressure and temperature.

2.3 Calibrating gases and solutions are available.

14.2.12.1.101 Hydrogen Mitigation System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the proper operation of ~~the hydrogen mitigation system (~~HMS~~)~~

2.0 PREREQUISITES

2.1 Construction activities on the HMS have been completed.

2.2 Hydrogen instrumentation has been calibrated.

2.3 Electrical power systems required for the HMS are available.

2.4 Test instrumentation is available and calibrated.

2.5 Hydrogen monitoring system software is installed.

3.0 TEST METHOD

3.1 Verify HMS igniter control logic and indication.

3.2 Demonstrate each igniter reaches proper operating temperature.

4.0 DATA REQUIRED

4.1 Igniter temperatures

5.0 ACCEPTANCE CRITERIA

5.1 The HMS operates as described in Subsection 6.2.5.

1.4 To verify the operation of parameter adjustment & control from OIU

1.5 To verify the alarm detection & display function

1.6 To verify the local SKID control function

1.7 To verify the MMIS communication

1.8 To verify the alarm verification functions of RMS computer & SRDC

1.9 To verify the RMS computer hand over function

1.10 To verify the interface between RMS computer and Perimeter computer

1.11 To verify the manual/automatic operation & closure time of all Monitor sample containment isolation valves

1.12 To demonstrate the operation of ESFAS-CREVAS at specified monitors

2.0 PREREQUISITES

2.1 Construction activities on the process and effluent radiological monitoring system have been completed.

and system software is installed.

2.2 Process and effluent radiological monitoring system instrumentation has been calibrated.

2.3 Support systems required for operation of the process and effluent radiological monitoring system are completed and operational.

2.4 Test instrumentation is available and calibrated.

2.5 Calibration check source is available.

1.6 To verify the local SKID control function

1.7 To verify the MMIS communication

1.8 To verify the alarm verification functions of RMS computer & SRDC

1.9 To verify the RMS computer hand over function

1.10 To verify the interface between RMS computer and Perimeter computer

1.11 To verify the manual/automatic operation & closure time of all Monitor sample containment isolation valves

1.12 To demonstrate the operation of ESFAS-CPIAS at specified monitors

1.13 To demonstrate the operation of ESFAS-FHEVAS at specified monitors

2.0 PREREQUISITES

2.1 Construction activities on the area radiation monitoring system have been completed.

and system software is installed.

2.2 Area radiation monitoring system instrumentation has been calibrated.

2.3 Support systems required for operation of the area radiation monitoring system are completed and operational.

2.4 Test instrumentation is available and calibrated.

2.5 Calibration check source is available.

3.0 TEST METHOD

3.1 Using a check source and external test equipment, verify the calibration and operation of the monitor.

5.0 ACCEPTANCE CRITERIA

5.1 The mid-loop instrumentation provides accurate indication of RCS parameters as described in ~~Subsections~~subsections 7.7.1.1 and 19.2.2.2.

5.2 The temporary ultrasonic flow meter can be installed and can measure flow.

14.2.12.1.127 Seismic Monitoring Instrumentation System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate proper operation of the seismic monitoring instrumentation system

2.0 PREREQUISITES

2.1 Construction activities on the seismic monitoring instrumentation system have been completed.

and system software is installed.

2.2 Seismic monitoring instrumentation system instrumentation has been calibrated.

2.3 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify operability of internal calibration devices by recording calibration records on all applicable sensors.

3.2 Verify system response to simulated seismic events by actuating the appropriate trigger units, recording accelerograph outputs, and playing back all records for analysis.

3.3 Verify and calibrate all system alarms and indicators.

1.2 To verify use of software loading laptop computer

1.3 To verify the CPCS related alarm functions

1.4 To verify operation of CPCS components from the input side of I/O Chassis to the interfacing equipment

1.5 To verify the CPCS Operator Module and Maintenance and Test Panel (MTP) Function

1.6 To verify the interface integrity for the Periodic Test between the CPCS I/O Simulator and CPCS

1.7 To verify the operation of watchdog timer of CPCS

1.8 To verify display hierarchy, page and screen status displayed on CPCS

1.9 To verify the operation of the CPCS power supplies

2.0 PREREQUISITES

2.1 CPCS instrumentation has been calibrated.

2.2 External test instrumentation is available and calibrated.

2.3 CPCS software is installed.

3.0 TEST METHOD

3.1 Energize power supplies and verify output voltage.

3.2 Verify proper loading of the CPCS software.

3.3 Verify that the appropriate alarms are activated.

3.4 Verify proper operation of the CPCS by input/output and internal function tests.

14.2.12.1.139 Diverse Indication System Test

1.0 OBJECTIVES

1.1 To verify that the DIS is installed properly, responds correctly to external input signals, and display plant parameters on the DIS display device.

2.0 PREREQUISITES

completed, and DIS software is installed.

2.1 Construction activities on the system to be tested are ~~complete.~~

2.2 Vendor and owner manuals are available and up-to-date.

2.3 External test equipment and instrumentation are available and calibrated.

2.4 Plant systems required to support this test are operable to the extent necessary to perform the test.

3.0 TEST METHOD

3.1 Verify power sources to all related equipment.

3.2 Using appropriate test equipment, simulate and vary input signals to the DIS.

3.3 Verify that input signals are received and processed correctly by the appropriate system devices.

3.4 Verify the operability of the DIS application software

3.5 Verify the calculation of part of parameters by the DIS application software.

SUPPLEMENTAL 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:	**14.2**
Date of RAI Issue:	**09/04/2015**

Question No. 14.02-26

Demonstrate that the feedwater control system (FWCS) test described in APR1400 FSAR Tier 2, Section 14.2.12.1.30 verify that the FWCS operates as required in all conditions specified in APR1400 FSAR Tier 2 Section 7.7.1.1.c, "Feedwater control system."

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 14.2.12.1.30 provides the initial test for the FWCS. APR1400 FSAR Tier 2, Section 7.1.1.1.c states, “The steam generator level is controlled during the following conditions: 1) steady state operations, 2) 1 percent per minute turbine load ramps between 5 percent and 15 percent NSSS power, and 5 percent per minute turbine load ramps between 15 percent and 100 percent NSSS power….” The staff reviewed the test methods specified in Item 3.0 of this test and could not find where all the conditions that require the operation of the FWCS tested. For example, Section 7.1.1.1.c states “As NSSS power increases above the valve transfer setpoint, 10 percent of the full power main feedwater flow rate goes to the downcomer valve while the remainder of the feedwater is injected into the economizer valve.” Where is this design criterion verified? Modify this test to include testing for the FWCS during all conditions described in APR1400 FSAR Tier 2, Section 7.1.1.1.c.

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. 1)

KHNP has revised the ITP Acceptance Criteria for the Feedwater Control System Test to include the conditions specified in Section 7.1.1.1.c. The changes to the ITP were transmitted to the NRC previously in KHNP submittal MKD/NW-16-0156L dated February 24, 2016; ML16056A003.

Supplemental Response

The testing for the FWCS during all conditions, including the verification of feedwater flow percentages that occurs above the transfer setpoint is covered in Section 14.2.12.4.3 (Control Systems Checkout Test) and Section 14.2.12.4.13 (Feedwater and Auxiliary Feedwater Systems Test), since these tests are better performed during power ascension rather than during preoperational testing.

Impact on DCD

DCD Tier 2 Section 14.2.12.1.30 will be changed as shown in KHNP submittal MKD/NW-16-0156L dated February 24, 2016; ML16056A003 and is attached for information.

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 and Environmental Report.

5.14 Turbine runback demand should be as specified in the related design specification.

5.15 Turbine bypass valve 1-8 digital and analog outputs should be as specified in the related design specification.

5.16 Main and permissive controller outputs should be as specified in the related design specification.

5.17 Dedicated controllers on safety console should be as specified in the related design specification.

5.18 SBCS valve stroke test should be as specified in the related design specification.

14.2.12.1.30 Feedwater Control System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the proper operation of the ~~feedwater control system (~~FWCS~~)~~

1.2 To verify operation of the EWS and the IFPDs for FWCS

2.0 PREREQUISITES

2.1 Construction activities on the FWCS and interfacing equipment have been completed.

2.2 FWCS software is installed and instrumentation has been calibrated.

2.3 External test equipment has been calibrated and is operational.

2.4 Support systems required for the operation of the FWCS are operational.

2.5 Cabling has been completed between the FWCS and interfacing equipment.

3.0 TEST METHOD

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

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

3.3 Monitor the system during initial operation and verify proper operation.

4.0 DATA REQUIRED

4.1 Input signal values

4.2 Status of interfacing control board equipment

4.3 FWCS output response

4.4 Status of output received at interfacing equipment

5.0 ACCEPTANCE CRITERIA

5.1 The FWCS performs as described in Subsections 7.7.1.1 c and 10.4.7.

5.2 Feedwater Temperature should be as specified in the related design specification.

5.3 Main steam header pressure should be as specified in the related design specification.

5.4 Feedwater common header pressure should be as specified in the related design specification.

5.5 Total feedwater flow should be as specified in the related design specification.

5.6 SG level should be as specified in the related design specification.

5.7 Downcomer feedwater flow should be as specified in the related design specification.

5.8 Input signals from the interfacing systems should be as specified in the related design specification.

5.9 Reactor trip override should be as specified in the related design specification.

5.10 Feedwater pump speed and valve position demand programs should be as specified in the related design specification.

5.11 Feedwater pump and valve M/A controllers should be as specified in the related design specification.

5.12 Steam/feedwater flow error should be as specified in the related design specification.

5.13 SG level setpoint should be as specified in the related design specification.

5.14 Pressure setpoint signal should be as specified in the related design specification.

5.15 Feedwater pump speed setpoint Bias should be as specified in the related design specification.

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Docket No. 52-046

RAI No.:	**198-8208**
SRP Section:	**14.02 - Initial Plant Test Program - Design Certification and New License Applicants**
Application Section:	**14.02**
Date of RAI Issue:	**09/04/2015**

Question No. 14.02-30

Justify why operation of the ex-core neutron flux monitoring system(ENFMS) is not a prerequisite for the Internal Vibration Monitoring System (IVMS) Test.

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 qualify standards commensurate with the importance of the safety functions to be performed.

APR 1400 FSAR Tier 2, Section 14.2.12.1.41 provides the Initial test descriptions for the IVMS test. APR 1400 FSAR Tier 2, Section 7.7.1.5 “Nuclear Steam Supply System Integrity Monitoring System”, states that the IVMS monitors the motion of the reactor internals by using the ex-core neutron flux signals from the ENFMS detectors. However, the operation of the ENFMS is not required as a prerequisite for this test. Justify why the operation of the ENMFS is not required for this test.

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)

Neutron flux signals from ENFMS are not needed to check the IVMS function for pre-operational testing; rather, simulated neutron flux signals are used in accordance with Section 14.2.1.1 which states that simulated signals or inputs are used to demonstrate the full range of the systems that are used during normal operation. Since ex-core signals are only valid after fuel-loading and the test of IVMS, section 14.2.12.1.41, is conducted during pre-operational test before fuel loading, simulated neutron flux signals are made by signal generators as input to IVMS for the test. Therefore, the pre-operational test of IVMS does not require ENFMS operation as a prerequisite.

Supplemental Response

The acceptance criterion 5.2 in KHNP submittal MKD/NW-16-0156L for test plan 14.2.12.1.41 states that all 12 channels of ex-core signals are received at the IVMS system as described in the related design specification. For this test, it is not necessary to state whether the ex-core signals are simulated or from actual neutron flux since it is understood that the actual ex-core signals are unavailable at the time of the pre-operational test.

In performing the test, the 12 channels of the ex-core simulated signals are generated from signal generators and transmitted by injecting into the Fiber Optic Transmitter (FOT) of the ENFMS and not directly into the IVMS.

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 Report.