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.:	**283-8229**
SRP Section:	**14.02 – Initial Plant Test Program - Design Certification and New License Applicants**
Application Section:	**14.2**
Date of RAI Issue:	**11/02/2015**

Question No. 14.02-62

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.

RG 1.68 also states that the ITP should include testing the performance of non-safety related risk significant systems. These items are identified in DCD Table 17.4-1.

In review of DCD Table 17.4-1 NRC staff observes the description of SSCs that are non-safety but risk significant as seen in index numbers 183, 184, and 375 of table 17.4-1. Staff review of 14.2.12.1.103 and 14.2.12.1.105 does not identify specific test methods or acceptance criteria to test the described SSC.

Staff requests the following information:

1. Provide a description of that key SSCs would be identified by the Expert Panel for index numbers 184 and 375.

2. Provide a description of the testing method to verify the operation of the Gaseous Radwaste System - Containment Isolation Valve in section 14.2.12.1.105 or wherever applicable.

3. Provide a description of the testing method to verify the operation of ‘key SSCs’ in the Gaseous Waste Management System in 14.2.12.1.105 or wherever applicable.

4. Provide a description of the testing method to verify the operation of ‘key SSCs’ in the Liquid Waste Management System in section 14.2.12.1.103 or wherever applicable.

Please address these items and provide a markup for the proposed DCD changes.

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. 2)

1. The Expert Panel considered PRA importance and deterministic method to identify the Key SSCs. The gaseous waste management system (GWMS - 184) and the liquid waste management system (LWMS - 375) were identified by deterministic consideration. These systems are those that are designed to maintain radwaste materials contained within the system boundary to prevent spreading of radwaste materials outside of the defined boundary. As shown in Table 17.4-1, the specific SSCs identified by the Expert Panel for GWMS and LWMS included only the containment isolation valves (Level 2) because GWMS and LWMS are not credited in the PRA model except for the containment isolation valves.

2~4. As a result of the upgrade effort described in the original response (ref. KHNP submittal MKD/NW-16-0156L "Submittal of Revised DCD Section 14.2 Initial Plant Test Program" dated February 24, 2016; ML16056A003), the contents of Section 14.2.12.1.103 and 14.2.12.1.105 of DCD Tier 2 has been generally enhanced. The preoperational test for liquid and gaseous waste management system has also included the description for testing of the key system control, alarms and indications in accordance with RG 1.68 as required by sub-questions 2 through 4 of this RAI. The revised Sections 14.2.12.1.103 and 14.2.12.1.105 including previous markups are provided in the Attachment for clarity.

   Since the test for the containment isolation valve operation of gaseous radwaste system will be performed in accordance with Section 14.2.12.1.129, Section 14.2.12.1.105 will be revised as indicated in Attachment to this response. Section 14.2.12.1.129 was previously revised to address the CIV, (also submitted by MKD/NW-16-0156L), and is provided in the Attachment for information.

Impact on DCD

Section 14.2.12.1.105 will be revised as indicated in Attachment to 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.

in a performance test apparatus and exposed to a known air/hydrogen sample. The test instrumentation is used to measure degradation in catalytic action.

4.0 DATA REQUIRED

4.1 Plant temperature

4.2 Depletion rate

5.0 ACCEPTANCE CRITERIA

5.1 The passive autocatalytic recombiners are verified to provide a hydrogen depletion rate of greater than or equal to the minimum depletion rate identified in Subsection 6.2.5. It is also verified that the required number of recombiners are installed at the locations defined in Subsection 6.2.5.

14.2.12.1.103 Liquid Waste Management System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the ~~operability~~manual/auto operation of ~~the~~ liquid waste management system ~~(LWMS) for collection, processing~~equipment and ~~recycling of~~ components including pumps, tanks, heater and valves

1.2 To demonstrate the operation of isolation function for liquid ~~wastes, and for preparation of liquid waste for release to~~discharge line

1.3 To demonstrate the ~~environment~~operation of status lights and system alarms and instruments

1.4 To demonstrate the performance characteristics of R/O package

2.0 PREREQUISITES

2.1 Construction activities on the LWMS have been completed.

2.2 LWMS instrumentation has been calibrated.

2.3 Support systems required for operation of the LWMS are completed and operational.

2.4 Test instrumentation is available and calibrated.

2.5 Proper types and amounts of filtration, membranes, and resins are loaded in the R/O package.

3.0 TEST METHOD

3.1 Operate control valves from all appropriate control positions. –Observe valve operation and position indication.– Measure opening and closing times, where required.

3.2 Verify the proper operation of the tank level alarms and interlocks.

3.3 Verify the proper operation of system pumps and valves.

3.4 Verify the proper operation of ~~high differential pressure alarms for the process vessel.~~

~~3.5 Verify the proper operation of~~ the tank mixers.

~~3.6 Verify the proper operation of the filtration unit.~~

~~3.7~~ 3.5 Demonstrate ~~that discharge~~ the isolation features ~~and other system controls function~~ properly.~~–~~ to discharge the liquid waste effluent. Simulate a high-radiation signal to the LWMS discharge radiation

monitor. Discharge radiation monitors are tested as described in Section 14.2.12.1.106.

3.~~8~~6 Verify alarms, ~~indicating~~ instruments, and status lights are functional. ~~Simulate a high-radiation signal to the LWMS discharge radiation monitor and verify alarm actuation~~

3.7 Verify the process flow rate, filtration efficiency, and operability of R/O package.

4.0 DATA REQUIRED

4.1 Waste pump operating data

4.2 Valve opening and closing times, where required

4.3 Valve position indication

4.4 Setpoints at which alarms and interlocks occur

4.5 Filtration unit operating data

5.0 ACCEPTANCE CRITERIA

5.1 The LWMS operates as described in Section 11.2.

~~5.2 The LWMS discharge radiation monitor operates as described in Table 11.5-2.~~

5.2 The liquid waste management system pumps should be manually started and stopped by their respective control switches, and their status should be indicated on Radwaste Control Console.

5.3 When the following tanks are "Lo" level, their respective pumps and cross-tied pumps should be stopped automatically, and their status should be indicated on radwaste control console.

5.4 The Caustic Storage Tank Heater should be manually operated by control switch on local panel and automatically started or stopped by Tank temperature "Lo" or "Hi" in AUTO mode.

5.5 Specified valves should be manually operated by their respective control switches on radwaste control console and their position lights should be illuminated on control switches.

5.6 Alarm, pump shoutdown, and valve closure should be automatically operated upon detection of a high radiation signal.

5.7 Alarms should be annunciated at radwaste control console upon specified conditions.

5.8 When specified cross-tie valves are operated manually at local, their respective position lights should be indicated on radwaste control console.

5.9 The process flow rate, decontamination factor and filtration efficiency of major process components are equal to or greater than the design basis.

14.2.12.1.104 Solid Waste Management System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the ~~operability~~operation of the ~~solid waste management~~ system ~~(SWMS) to collect~~valves

1.2 To demonstrate the failed position of system valves

5.0 ACCEPTANCE CRITERIA

5.1 ~~The SWMS operates as~~Specified valves shall be manually opened and closed by their respective hand switches located at Information FPD on the radwaste control console and at local.

5.2 Specified valve strokes full open and full close in response to FIK-003 located at information FPD on the radwaste control console, and status is properly indicated.

5.3 System alarms shall be operated per design.

5.4 New resin tank shall be capable of charging the specified equipment with new resin.

5.5 Spent resin shall be transferred from specified equipment to low activity spent resin Tanks.

5.6 Specified valves fail in the required position on loss of control power and loss of air, and return to the connect position on restoration of air or control power. Inoperable status indicates properly.

5.7 Wet solid wastes shall be stabilized or dewatered and satisfied 10 CFR 61.56 in described in Section 11.4.1.4.

5.8 No leakage shall be satisfied in at where fluid carrying is proceed between mobile processing equipment and permanently installed plant subsystems.

14.2.12.1.105 Gaseous Waste Management System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate the ~~ability~~manual/auto operation of GRS equipment and components including valves

1.2 To demonstrate the verification of manual and automatic response to the system normal control, alarms, and indications.

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RAI 192-8180 Q. 14.02-15

1.3 ~~1.2~~ To demonstrate the capability of the controlling the explosive gas mixture

1.4 ~~1.3~~ To demonstrate the operation of isolation function for gaseous ~~waste management system (GWMS) to collect and process radioactive gases vented from plant equipment~~effluent discharge line

2.0 PREREQUISITES

2.1 Construction activities on the ~~GWMS~~GRS have been completed.

2.2 ~~GWMS~~Initial loading of the charcoal into the charcoal beds has been completed, and types and actual amounts of charcoal have been verified before the initial loading to ensure that the gaseous releases are within the regulatory limits.

2.3 GRS instrumentation has been calibrated.

2.~~3~~4 Support systems required for operation of the ~~GWMS~~GRS are completed and operational.

2.~~4~~5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 ~~Verify flow paths.~~

~~3.2 Demonstrate that discharge isolation features and other system controls function properly. Simulate a high radiation signal to the GWMS discharge radiation monitor.~~

~~3.3 Verify alarms, indicating instruments, and status lights are functional. Simulate a high radiation signal to the GWMS discharge radiation monitor and verify alarm actuation in the main control room.~~

~~3.4 Demonstrate the operation of the gas drying equipment.~~

~~3.5 Demonstrate proper holdup time of gas through the charcoal adsorbers.~~

~~3.6 Demonstrate the operation of the system gas analyzers.~~

~~3.7~~ Operate control valves from all appropriate control positions. Observe valve operation and position indication. ~~Measure opening and closing times, where required.~~

3.2 Verify that alarms, indicating instruments, and status lights are functional.

3.3 Verify that operations of equipment in gaseous radwaste system package are functional.

a high-high

RAI 284-8234 Q. 14.02-65

3.4 The automatic nitrogen injection operation upon the receipt of ~~high~~ oxygen concentration signal is verified.

signal is verified.

RAI 192-8180 Q. 14.02-15

3.5 The automatic discharge isolation valve operation upon the receipt of high radiation ~~condition is verified with simulated signal, RMS test will be performed as described in Section 14.2.12.1.106.~~

3.6 The test for the containment isolation valves in the GRS is conducted as described in Section 14.2.12.1.129.

4.0 DATA REQUIRED

~~4.1~~4.1 The properties and verification data for loaded charcoal in charcoal beds.

4.2 Setpoints of alarms, interlocks, and controls

~~4.2 Gas dryer operating data~~

4.3 ~~Gas analyzer operating~~Gaseous radwaste system package design data

~~4.4 Gas transport times~~

5.0 ACCEPTANCE CRITERIA

5.1 The ~~GWMS~~GRS operates as described in Section 11.3.

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5.2 → ~~5.5~~ GRS valves are opened and closed by their respective handswitches and by each setpoint as designed.

5.3 → ~~5.8~~ The GRS alarms, indicating instruments, and status lights are functional as designed.

5.4 → ~~5.2~~ The ~~GWMS~~GRS discharge valves are closed automatically upon receipt of high radiation ~~monitor operates~~signal. The verification for high radiation alarm actuation in main control room is conducted as described in ~~Table 11.5-~~Section 14.2.12.1.106.

, including monitoring and indication,

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5.5 → ~~5.3~~ The nitrogen injection valves are opened automatically upon receipt of ~~high~~ oxygen concentration signal. The verification for ~~high~~ oxygen concentration alarm actuation in main control room is conducted as described in Section 14.2.12.1.83.

, including monitoring and indication,

the high-high

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5.6 → ~~5.4~~ Containment isolation valves are closed automatically upon receipt of a CIAS signal.

14.2.12.1.106 Process and Effluent Radiological Monitoring System Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify that the ~~process and effluent radiological monitoring system (~~PERMS~~)~~ can detect and record specific radiation levels, and to verify all alarms and interlocks

1.2 To verify the power status of RMS computer, SRDC, Local units

1.3 To verify the Rate-meter Communication conditions

4.3 Valve position indication

4.4 Response of power-operated valves to loss of motive power

4.5 Setpoints at which alarms and interlocks occur

4.6 Pump operating data

5.0 ACCEPTANCE CRITERIA

5.1 The auxiliary steam system provides steam flow to designated components and systems.

5.2 The auxiliary steam ~~boiler~~system meets manufacturers design performance.

14.2.12.1.129 Containment Isolation Valves Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To demonstrate that containment isolation valves can be operated manually and operate in response to automatic actuation

1.2 To verify that upon loss of actuating power, the valves fail as designed

1.3 To verify that all valves operate in less than the time specified in the valve test procedure

2.0 PREREQUISITES

2.1 Construction activities on the containment isolation valves have been completed.

2.2 Support system required to operate the containment isolation valves are operable.

2.3 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Operate containment isolation valves from all appropriate control positions. Verify position indication, and measure opening and closing times, including at rated flow and no-flow conditions.

3.2 Verify containment isolation valves fail to the position specified in the safety analysis upon loss of motive power.

3.3 Initiate the following simulated activation signals and verify the appropriate valves move to the design positions.

CIAS	containment isolation actuation signal
CSAS	containment spray actuation signal
MSIS	main steam isolation signal
AFAS	auxiliary feedwater actuation signal
AAFAS	alternate auxiliary feedwater actuation signal
HRAS	high-radiation actuation signal
HHAS	high-humidity actuation signal
SIAS	safety injection actuation signal
CCWLLSTAS	component cooling water low-low surge tank actuation signal

4.0 DATA REQUIRED

4.1 Valve opening and closing times under differential pressure, flow, and temperature conditions as applicable

4.2 Valve position indications

4.3 Position response of valves to loss of motive power

4.4 Valve response to a simulated actuation signal

5.0 ACCEPTANCE CRITERIA

5.1 The containment isolation valves operate as described in ~~Subsection~~subsection 6.2.4.

5.2 The containment isolation valves can be operated manually and operate in response to automatic actuation as designed.

5.3 The containment isolation valves fail to the position specified in the safety analysis upon loss of motive power.

5.4 The containment isolation valves move to the design positions by simulated activation signals.

14.2.12.1.130 Post-Accident Monitoring Instrumentation Test

1.0 ~~OBJECTIVE~~OBJECTIVES

1.1 To verify that the post-accident monitor instrumentation is installed properly, responds correctly to external inputs, and provides proper outputs to the distributed display and recording equipment