
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.: 274-8277
SRP Section: 07.01 - Instrumentation and Controls - Introduction
Application Section: Section 7.1, 7.3, and 10.2
Date of RAI Issue: 10/27/2015

Question No. 07.01-36

Incorporate by reference specific technical and topical reports referenced in the APR1400 FSAR.

10 CFR 52.47(a)(2) requires, in part, the applicant to provide a description and analysis of the structures, systems, and components (SSCs) of the facility, with emphasis upon performance requirements, the bases, with technical justification therefor, upon which these requirements have been established, and the evaluations required to show that safety functions will be accomplished. It is expected that the standard plant will reflect through its design, construction, and operation an extremely low probability for accidents that could result in the release of significant quantities of radioactive fission products. The description shall be sufficient to permit understanding of the system designs and their relationship to the safety evaluations.

The submittal letter by Korea Electric Power Corporation and Korea Hydro & Nuclear Power Co., Ltd for the application for design certification of the APR1400 Standard Design, dated December 23, 2014 (ML15006A037), provides a list of technical reports that contain analyses and other information that supplement the materials included in the DCD, with certain technical reports shown as incorporated by reference. APR1400 FSAR, Tier 2, Tables 1.6-1, "List of Topical Reports," and 1.6-2, "List of Technical Reports," provide a list of topical and technical reports. However, these two lists in the APR1400 FSAR do not correspond to the list provided in the APR1400 design certification submittal letter. Further, APR1400 FSAR, Tier 2, Tables 1.6-1 and 1.6-2, do not indicate which of the technical or topical reports are incorporated by referenced. As such, the staff requests the applicant to ensure that these two lists are consistent and to indicate which technical or topical reports are incorporated by referenced in APR1400 FSAR, Tier 2, Tables 1.6-1 and 1.6-2. In addition, the staff requests the applicant to incorporate by reference additional technical and topical reports currently not listed as IBRed in the APR1400 design certification submittal letter. Specifically, APR1400 FSAR, Tier 2 Chapter 7 references several technical and topical reports that the staff uses to as bases in their safety evaluation. These reports include:

- APR1400-A-J-NR-14003, “APR1400 Disposition of Common Q Topical Report NRC Generic Open Items and Plant Specific Action Items”
- APR1400-A-J-NR-14004, “Common Q Platform Supplemental Information in Support of APR1400 Design Certification”
- APR1400-E-J-NR-14001, “Component Interface Module”
- APR1400-F-C-NR-14003, “Functional design Requirements for a Core Protection Calculator System for APR1400”
- APR1400-Z-A-NR-14019, “CCF [(Common Cause Failure)] Coping Analysis”
- APR1400-Z-J-NR-14002, “Diversity and Defense-in-Depth”
- APR1400-Z-J-NR-14012, “Control System CCF Analysis”
- APR1400-Z-J-NR-14013, “Response Time Analysis of Safety I&C System”
- WCAP-10697-P-A, Revision 3, “Common Qualified Platform Topical Report”

The staff requests these technical and topical reports be incorporated by reference in APR1400 FSAR Tier 2, Tables 1.6-1 and 1.6-2.

Response – (Rev. 1)

The technical and topical reports related to APR1400 DCD Tier 2 Chapter 7 which are stated in the question are incorporated by reference (IBR). APR1400 DCD Tier 2, Tables 1.6-1 and 1.6-2 will be revised as indicated in the attachment associated with this response.

[The attachment to this RAI response is being revised to add applicable references to the design information of the qualified PLC platform, Common Q, and to more appropriately illustrate the IBR of WCAP-17922 and WCAP-17926.](#)

Impact on DCD

APR1400 DCD Tier 2, Tables 1.6-1 and 1.6-2 [and Sections 7.1 and 7.1.5](#) 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

RAI 274-8277_Question 07.01-36

RAI 274-8277_Question 07.01-36_Rev.1

Table 1.6-1

List of Topical Reports

Report Number ⁽¹⁾	Title	DCD Tier 2 Section
APR1400-F-A-TR-12004-P APR1400-F-A-TR-12004-NP	Realistic Evaluation Methodology for Large-Break LOCA of the APR1400, Rev. 0	6.2.1.5.1, 15.6
APR1400-F-C-TR-12002-P APR1400-F-C-TR-12002-NP	KCE-1 Critical Heat Flux Correlation for PLUS7 Thermal Design, Rev. 0	4.4, 15.0~15.6
APR1400-F-M-TR-13001-P APR1400-F-M-TR-13001-NP	PLUS7 Fuel Design for the APR1400, Rev. 0	4.2, 4.4
APR1400-K-Q-TR-11005-NP	QAPD for the APR1400 DC, Rev. 4	17.1, 17.2, 17.3, 17.5
APR1400-Z-M-TR-12003-P APR1400-Z-M-TR-12003-NP	Fluidic Device Design for the APR1400, Rev. 0	6.3.2.1

(1) P – denotes document is proprietary.
NP – denotes document is non-proprietary.

Add "A" on the page 3.

APR1400 DCD TIER 2

RAI 274-8277_Question 07.01-36

RAI 274-8277_Question 07.01-36_Rev.1

Table 1.6-2 (2 of 2)

Report Number ⁽¹⁾	Title	DCD Tier 2 Section
APR1400-F-A-NR-14002-P APR1400-F-A-NR-14002-NP	The Effect of Thermal Conductivity Degradation on APR1400 Design and Safety Analyses	15.4 15.6
APR1400-F-A-NR-14003-P APR1400-F-A-NR-14003-NP	Post-LOCA Long Term Cooling Evaluation Model	15.6
APR1400-H-N-NR-14012-P APR1400-H-N-NR-14012-NP	Mechanical Analysis for New and Spent Fuel Storage Racks	9.1.2
APR1400-K-I-NR-14005-P APR1400-K-I-NR-14005-NP	Staffing and Qualifications Implementation Plan	18.5
APR1400-K-I-NR-14009-P APR1400-K-I-NR-14009-NP	Design Implementation Plan	18.11
APR1400-Z-A-NR-14006-P APR1400-Z-A-NR-14006-NP	Non-LOCA Safety Analysis Methodology	15.0.2
APR1400-Z-A-NR-14007-P APR1400-Z-A-NR-14007-NP	LOCA Mass and Energy Release Methodology	6.2.1.3
APR1400-Z-J-NR-14001-P APR1400-Z-J-NR-14001-NP	Safety I&C System	7.1, 7.2, 7.3, 7.4, 7.5, 7.8, 7.9
APR1400-Z-J-NR-14003-P APR1400-Z-J-NR-14003-NP	Software Program Manual	7.1.4, 7.2.2.2, 7.3.1
APR1400-Z-J-NR-14004-P APR1400-Z-J-NR-14004-NP	Uncertainty Methodology and Application for Instrumentation	7.2.2.7, 7.3.2.7
APR1400-Z-J-NR-14005-P APR1400-Z-J-NR-14005-NP	Setpoint Methodology for Plant Protection System	7.2.2.7, 7.3.2.7
APR1400-Z-M-NR-14008-P APR1400-Z-M-NR-14008-NP	Pressure-Temperature Limits Methodology for RCS Heatup and Cooldown	5.2, 5.3

(1) P – denotes document is proprietary.

NP – denotes document is non-proprietary.

Add "B" on the page 3.

"A"

WCAP-10697-P-A	Common Qualified Platform Topical Report, Rev. 3	7
----------------	--	---

7.1

APR1400-A-J-NR-14003-P
(WCAP-17926-P)

"B"

WCAP-17926/APR1400-A-J-NR-14003	APR1400 Disposition of Common Q Topical Report NRC Generic Open Items and Plant Specific Action Items	7
WCAP-17922/APR1400-A-J-NR-14004	Common Q Platform Supplemental Information in Support of the APR1400 Design Certification	7
APR1400-E-J-NR-14001-P APR1400-E-J-NR-14001-NP	Component Interface Module	7.3.1.11, 7.3.2.4, 7.8
APR1400-F-C-NR-14003-P APR1400-F-C-NR-14003-NP	Functional Design Requirements for a Core Protection Calculator System for APR1400	7.2.1.1
APR1400-Z-A-NR-14019-P APR1400-Z-A-NR-14019-NP	CCF Coping Analysis	7.7.2.8, 7.8
APR1400-Z-J-NR-14002-P APR1400-Z-J-NR-14002-NP	Diversity and Defense-in-Depth	7.1, 7.2, 7.3, 7.7, 7.8
APR1400-Z-J-NR-14012-P APR1400-Z-J-NR-14012-NP	Control System CCF Analysis	7.7.2.3, 7.7.2.8
APR1400-Z-J-NR-14013-P APR1400-Z-J-NR-14013-NP	Response Time Analysis of Safety I&C System	7.2.2.7, 7.3.2.7

APR1400-A-J-NR-14004-P
(WCAP-17922-P)

- d. ESF-CCS soft control module (ESCM)
- e. Qualified indication and alarm system – P (QIAS-P)

The Safety I&C System Technical Report (Reference 2) describes the functional requirements and design features, and the Software Program Manual Technical Report describes the software design process of the safety I&C system, particularly the PPS, CPCS, ESF-CCS, and QIAS-P.

The following safety I&C systems are implemented on independent platforms that are diverse from the safety-qualified PLC platform: ex-core neutron flux monitoring system (ENFMS) (see Subsection 7.2.1.1.c), auxiliary process cabinet – safety (APC-S) (see Subsection 7.2.1), safety portion of radiation monitoring system (RMS) (refer to Section 11.5 and Subsection 12.3.4) and component interface module (CIM) (see Subsection 7.3.1.11).

Non-Safety Systems

The specific design information of the qualified PLC platform is described in Common Qualified Platform Topical Report (Reference 79), APR1400 Disposition of Common Q Topical Report NRC Generic Open Items and Plant Specific Action Items (Reference 80), and Common Q Platform Supplemental Information in Support of the APR1400 Design Certification (Reference 81).

Most of the non-safety I&C systems are implemented by a DCS-based common platform that has been proven in operating experience in the nuclear industry and other industries. The DCS conducts the functions of the operator interface, component-level control, automatic process control, high-level group control, and data processing for normal operation. The DCS is designed with a redundant and fault-tolerant architecture for high reliability and to prevent the failure of a single component from causing a spurious plant trip.

The following systems are implemented on the DCS platform:

- a. Process-component control system (P-CCS), which includes the NSSS process control system (NPCS)
- b. Power control system (PCS)
- c. Information processing system (IPS)

The qualified indication and alarm system – non-safety (QIAS-N) is also implemented on the common PLC platform, even though it is a non-safety system, because it displays the important plant parameters and maintains diversity from the IPS.

APR1400 DCD TIER 2

RAI 274-8277-Question 07.01-36

RAI 274-8277-Question 07.01-36_Rev.1

69. NUREG-0800, Standard Review Plan, BTP 7-13, "Guidance on Cross-Calibration of Protection System Resistance Temperature Detectors," Rev. 5, U.S. Nuclear Regulatory Commission, March 2007.
70. NUREG-0800, Standard Review Plan, BTP 7-14, "Guidance on Software Reviews for Digital Computer-Based Instrumentation and Control Systems," Rev. 5, U.S. Nuclear Regulatory Commission, March 2007.
71. NUREG-0800, Standard Review Plan, BTP 7-17, "Guidance on Self-Test and Surveillance Test Provisions," Rev. 5, U.S. Nuclear Regulatory Commission, March 2007.
72. NUREG-0800, Standard Review Plan, BTP 7-18, "Guidance on the Use of Programmable Logic Controllers in Digital Computer-Based Instrumentation and Control Systems," Rev. 5, U.S. Nuclear Regulatory Commission, March 2007.
73. NUREG-0800, Standard Review Plan, BTP 7-19, "Guidance for Evaluation of Diversity and Defense-In-Depth in Digital Computer-Based Instrumentation and Control Systems," Rev. 6, U.S. Nuclear Regulatory Commission, July 2012.
74. NUREG-0800, Standard Review Plan, BTP 7-21, "Guidance on Digital Computer Real-Time Performance," Rev. 5, U.S. Nuclear Regulatory Commission, March 2007.
75. APR1400-Z-J-NR-14005-P, "Setpoint Methodology for Plant Protection System," KHNP, November 2014.
76. DI&C-ISG-04, Rev. 1, "Highly Integrated Control Rooms – Communications Issues (HICRc)," U.S. Nuclear Regulatory Commission, 2009.
77. APR1400-Z-J-NR-14013-P, "Response Time Analysis of Safety I&C System," KHNP, November 2014.
78. NUREG-0737, Supplement No. 1, "Clarification of TMI Action Plan Requirements: Requirements for Emergency Response Capability," U.S. Nuclear Regulatory Commission, 1983.
79. WCAP-16097-P-A, "Common Qualified Platform Topical Report," Rev. 3, February 2013.
80. APR1400-A-J-NR-14003-P (WCAP-17926-P), "APR1400 Disposition of Common Q Topical Report NRC Generic Open Item and Plant Specific Action Items," Rev. 0, October 2014.
81. APR1400-A-J-NR-14004-P (WCAP-17922-P), "Common Q Platform Supplemental Information in Support of the APR1400 Design Certification," Rev. 0, August 2014.