

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.: 294-8302
SRP Section: 07.05 – Information Systems Important to Safety Application Section
Application Section: 07.05
Date of RAI Issue: 11/05/2015

Question No. 07.05-4

Provide the assessment documentation and demonstration of allowances for uncertainties consistent with the APR1400 methodology that conforms to Regulatory Guide (RG) 1.105, Revision 3, including environmental and/or seismic conditions.

10 CFR Part 50, Appendix A, General Design Criteria 13, requires, in part, instrumentation to be provided to monitor variables and systems over their anticipated ranges for normal operation, anticipated operational occurrences, and accident conditions. RG 1.97, Rev.4, "Criteria For Accident Monitoring Instrumentation for Nuclear Power Plants," endorses IEEE Std 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations". IEEE Std 497-2002, Section 5.6, states:

An assessment for each of the performance criteria shall be conducted. This assessment shall be done to assure the as-designed performance meets or exceeds the performance criteria. The results of this assessment shall be documented and shall consider:

- a) Allowances for calibration uncertainties, loop errors, and drift consistent with the methodology given in ANSI/ISA Std 67.04.01.
- b) The magnitude and direction of errors imposed on the accident monitoring instrumentation by environmental and/or seismic conditions during and after the postulated event.

The staff was not able to locate the assessment pertaining to the guidance in RG 1.97, Rev. 4, although the APR1400 design certification application states conformance to the guidance. Provide the assessment documentation and the demonstration of allowances for uncertainties consistent with the APR1400 methodology that conforms to Regulatory Guide (RG) 1.105, Revision 3, "Setpoints for Safety-Related Instrumentation," including environmental and/or seismic conditions.

Response

Technical report APR1400-Z-J-NR-14004-P, Rev. 0, "Uncertainty Methodology and Application for Instrumentation" provides the methodology for calculating instrumentation uncertainties. Sections 4 and 5 of APR1400-Z-J-NR-14004 describe the environmental and/or seismic conditions and instrumentation effects, such as calibration uncertainties, loop errors, and drift, which are considered when performing uncertainty calculations.

The plant-specific setpoint bases document for the EOPs is to be provided by the COL applicant and provides the method for determining the setpoints applicable to the plant-specific EOPs. The instrumentation uncertainties used in determining the EOP action points are derived from final design data conforming to Regulatory Guide (RG) 1.105, Rev. 3. The final design data will be incorporated into the bases document during the plant construction stage. COL Item 7.5(3) will be added to have the COL applicant provide the bases document for the EOP action points. Conformance to RG 1.105 will be incorporated in DCD sections 7.5.2.1 and 7.5.5.

The assessment of allowances for uncertainties that conforms to Regulatory Guide (RG) 1.105 and the assessment for each of the performance criteria of IEEE Std 497-2002 is performed based on final design data during the plant construction stage. Therefore, the assessment requested is not provided in the APR1400 design certification application.

Impact on DCD

DCD sections 7.5.2.1, 7.5.4 and 7.5.5 and Table 1.8-2 will be revised as indicated in the 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.

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Recording is provided for at least one division of AMI Type B and C variables. Recording on the IPS is also provided for AMI Type E variables. Recording on the IPS is provided for at least 30 minutes pre-event and 12 hours post-event.

d. Display identification

Type B and C variables are identified as AMI variables with a characteristic designation to discern information intended for use under accident conditions.

e. Performance criteria

1) Range

The range of AMI described in Table 7.5-1 is established to provide reasonable assurance that it covers AOOs and PAs. Separate, narrow-range instrumentation is provided where the required range of monitoring instrumentation results in a loss of sensitivity during normal operating conditions.

The QIAS-P, QIAS-N, and IPS also allow access to individual divisions for each range.

The IPS and the QIAS-N attempt to validate data using narrow range sensors. If successful, narrow range scale and demarcation are displayed. If the parameter is out of the narrow range, wide-range sensors are used for the display with wide range scale and demarcation.

2) Accuracy

The required accuracy of AMI is established based on the assigned function.

3) Response Time

The instrumentation uncertainties used in determining the emergency operating procedure (EOP) action points for AMI variables are derived from final design data conforming to RG 1.105 (Reference 19). The response time between detection and indication is approximately 1 to 3 seconds. The update frequency is less than 1 second.

add

The instrumentation uncertainties used in determining the emergency operating procedure (EOP) action points for AMI variables are derived from final design data conforming to RG 1.105 (Reference 19).

add

The COL applicant is to provide the bases document accounting for measurement uncertainties for the EOP action points (COL 7.5(3)).

APR1400 DCD TIER 2

QIAS-N, and IPS provide the operator with plant status information during AOOs, PAs, and post-accident conditions.

During and after plant accident conditions, the QIAS-N and QIAS-P provide all information required for achieving plant safe shutdown and performing ~~emergency operating procedure (EOP)~~ even though the IPS is unavailable.

To satisfy this design feature, the QIAS-N and QIAS-P are seismically and environmentally qualified.

7.5.4 Combined License Information

COL 7.5(1) The COL applicant is to provide a description of the site-specific AMI variables such as wind speed and atmosphere stability temperature difference.

COL 7.5(2) The COL applicant is to provide a description of the site-specific EOF.

add ↖ COL 7.5(3) The COL applicant is to provide the bases document accounting for measurement uncertainties for the EOP action points.

1. Regulatory Guide 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Rev. 4, U.S. Nuclear Regulatory Commission, June 2006.
2. NUREG-0737, "Clarification of TMI Action Plan Requirements," TMI Action Plan Item II.F.2, "Instrumentation for Detection of Inadequate Core Cooling," U.S. Nuclear Regulatory Commission, 1980.
3. IEEE Std. 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 1991.
4. NUREG-0696, "Functional Criteria for Emergency Response Facilities," U.S. Nuclear Regulatory Commission, February 1981.
5. NUREG-0737, Supplement No. 1, "Clarification of TMI Action Plan Requirements" U.S. Nuclear Regulatory Commission, 1983.
6. APR1400-E-I-NR-14012-P, "Style Guide," KHNP, December 2014.

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7. Regulatory Guide 1.47, "Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems," Rev. 1, U.S. Nuclear Regulatory Commission, February 2010.
8. IEEE Std. 497-2002, "IEEE Standard Criteria for Accident Monitoring Instrumentation for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2002.
9. IEEE Std. 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," Institute of Electrical and Electronics Engineers, 1992.
10. Regulatory Guide 1.118, "Periodic Testing of Electric Power and Protection Systems," Rev. 3, U.S. Nuclear Regulatory Commission, April 1995.
11. 10 CFR 50.34(f)(2)(xviii), "Instrumentation for Detection of Inadequate Core Cooling," [II.F.2], U.S. Nuclear Regulatory Commission.
12. 10 CFR 50.34(f)(2)(v), "Bypass and Inoperable Status Indication," [I.D.3], U.S. Nuclear Regulatory Commission.
13. SRM to SECY-93-087, Item II.T, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advance Light-Water Reactor (ALWR) Designs," U.S. Nuclear Regulatory Commission, April 2, 1993.
14. 10 CFR 50.34(f)(2)(iv), "Safety Parameter Display Console" [I.D.2] U.S. Nuclear Regulatory Commission.
15. 10 CFR 50.34 (f)(2)(xxv), "Additional TMI-related Requirements," [III.A.1.2], U.S. Nuclear Regulatory Commission.
16. IEEE Std. 7-4.3.2-2003, "IEEE Standard Design for Digital Computers in Safety Systems of Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, 2003.
17. APR1400-Z-J-NR-14001-P, "Safety I&C System," KHNP, November 2014.
18. 10 CFR 50.34(f)(2)(xi), "Direct Indication of Relief and Safety Valve Position (Open or Closed) in the Control Room," [II.D.3], U.S. Nuclear Regulatory Commission.

add



19. Regulatory Guide 1.105, "Setpoint for Safety-Related Instrumentation," Rev.3, U.S. Nuclear Regulatory Commission, December 1999.

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Table 1.8-2 (9 of 29)

Item No.	Description
COL 6.1(1)	The COL applicant is to identify the implementation milestones for the coatings program.
COL 6.2(1)	The COL applicant is to identify the implementation milestone for the CILRT program.
COL 6.3(1)	The COL applicant is to prepare operational procedures and maintenance programs as related to leak detection and contamination control.
COL 6.3(2)	The COL applicant is to maintain complete documentation of system design, construction, design modifications, field changes, and operations.
COL 6.4(1)	The COL applicant is to provide automatic and manual operating procedures for the control room HVAC system, which are required in the event of a postulated toxic gas release.
COL 6.4(2)	The COL applicant is to provide the details of specific toxic chemicals of mobile and stationary sources and evaluate the MCR habitability based on the recommendations in NRC RG 1.78 to meet the requirements of TMI Action Plan Item III.D.3.4 and GDC 19.
COL 6.4(3)	The COL applicant is to identify and develop toxic gas detection requirements to protect the operators and provide reasonable assurance of the MCR habitability. The number, locations, sensitivity, range, type, and design of the toxic gas detectors are to be developed by the COL applicant.
COL 6.5(1)	The COL applicant is to provide the operational procedures and maintenance program as related to leak detection and contamination control.
COL 6.5(2)	The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations.
COL 6.6(1)	The COL applicant is to identify the implementation milestones for ASME Section XI inservice inspection program for ASME Code Section III Class 2 and 3 components.
COL 6.6(2)	The COL applicant is to identify the implementation milestone for the augmented inservice inspection program.
COL 6.8(1)	The COL applicant is to provide the operational procedures and maintenance program for leak detection and contamination control.
COL 6.8(2)	The COL applicant is to provide the preparation of cleanliness, housekeeping, and foreign materials exclusion program.
COL 6.8(3)	The COL applicant is to maintain the complete documentation of system design, construction, design modifications, field changes, and operations.
COL 6.8(4)	The COL applicant is responsible for the establishment and implementation of the Maintenance Rule program in accordance with 10 CFR 50.65.
COL 7.5(1)	The COL applicant is to provide a description of the site-specific AMI variables such as wind speed, and atmosphere stability temperature difference.
COL 7.5(2)	The COL applicant is to provide a description of the site-specific EOF.

add 

COL 7.5(3)	The COL applicant is to provide the bases document accounting for measurement uncertainties for the EOP action points.
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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.: 294-8302
SRP Section: 07.05 – Information Systems Important to Safety Application Section
Application Section: 07.05
Date of RAI Issue: 11/05/2015

Question No. 07.05-5

Provide basis for APR1400 emergency operating procedure (EOP) actions points.

10 CFR Part 50, Appendix A, General Design Criteria 13, requires, in part, instrumentation to be provided to monitor variables and systems over their anticipated ranges for normal operation, anticipated operational occurrences, and accident conditions. The SRP (NUREG-0800), Section 7.5, "Information Systems Important To Safety," Review Procedure Item 1.C, states "A basis should be provided for EOP action points that accounts for measurement uncertainties. Regulatory Guide 1.105, "Setpoints for Safety-Related Instrumentation," provides acceptable guidance for establishing these uncertainties. The staff was not able to locate the basis for the APR1400 EOP action points, although the APR1400 design certification application states conformance to the guidance. Provide the basis for the APR1400 EOP action points, or direct the staff the location in the application where the basis resides.

Response

DCD Tier 2, Subsection 13.5.2.1.3, "Emergency Operating Procedure Program" states, "The COL applicant is to provide a program for developing and implementing emergency operating procedures (COL 13.5(5))." The EOP action points are included in this and are to be determined by the COL applicant. The EOP action points developed by the COL applicant will need to account for measurement uncertainties in order to comply with SRP Section 7.5, Review Procedure Item 1.c and Regulatory Guide 1.105.

Instrument uncertainties for the APR1400 are calculated based on the methodology provided in TeR APR1400-Z-J-NR-14004-P, Rev. 0, "Uncertainty Methodology and Application for Instrumentation." The measurement uncertainties determined by the methodology are to be incorporated into the EOP action points determined by the COL applicant. COL Item 7.5(3) has been established in response to Question 07.05-4 to address this COL applicant

responsibility.

The details (such as basis, value, etc.) for all EOP action points are described in the plant-specific setpoint bases document. The document will be prepared based on the plant-specific final design data during the plant construction stage and provides the plant-specific information for the development of the EOPs. In addition, the appropriateness of the EOP action points will be verified and validated through EOP Verification & Validation process.

Impact on DCD

DCD Tier 2 Sections 7.5.2.1, 7.5.4, and 7.5.5 and Table 1.8-2 will be revised as noted in the response to Question 07.05-4 of this RAI.

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.