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.:	**RAI 315-8091, Q.18-57**
Review Section:	**18 - Human Factor Engineering**
Application Section:	**18.4 - Task Analysis**
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Question No. 18-57

Section 1.A, “Method,” of Appendix 18-A of NUREG-0800 cautions that because the time intervals described in ANSI/ANS 58.8, “Time Response Design Criteria for Safety-Related Operator Actions,” were validated using analog controls, the guidance may be not accurate for digital I&C systems.

Section 7.2, “Manual Operator Action Time Evaluation Methods,” in APR1400-Z-J-NR-14002, “Diversity and Defense-in-Depth,” Rev. 0, states, “Any operator action credited in the CCF Coping Analysis prior to 30 minutes is justified based on a reasonable HFE evaluation methodology. The starting time of operator actions is based on conservative application of HFE standards such as ANSI/ANS 58.8-1994.” This report also describes justification for operator actions credited prior to 30 minutes in the CCF Coping Analysis and includes some assumptions that are not described in the TA IP (e.g., the time to execute all steps in the standard post-trip actions [SPTAs] is based on ANSI/ANS 58.8-1994). The CCF Coping Analysis, section 5.1(j) states that no actions are credited until 30 minutes after event initiation; therefore, it isn’t clear why the Defense-in-Depth Report discusses actions credited prior to 30 minutes.

1. Align the information in Section 7.2 of APR1400-Z-J-NR-14002, “Diversity and Defense-in-Depth,” and Section 5.1(j) in APR1400-Z-A-NR-14019, “CCF Coping Analysis,” about the timing of operator actions so that the information in these reports is consistent.

2. Describe why the time intervals in ANSI/ANS 58.8-1994 are accurate for the APR1400.

3. Revise the submittal as necessary.

Response

APR1400-Z-J-NR-14002, Diversity and Defense-in-Depth (D3), is provided to meet Position 1 of the SRM on SECY-93-087. The technical report (TeR) provides the design description of the diverse actuation system (DAS) and the D3 approach for I&C systems.

APR1400-Z-A-NR-14019, CCF Coping Analysis, provides the results of the analysis performed using realistic methods for all initiating events in Chapter 15 of DCD Tier 2 concurrent with a postulated common cause failure (CCF) in the digital safety I&C systems.

Current D3 and CCF Coping Analysis TeR's describe ANSI/ANS 58.8-1994 as a conservative HFE standard for the APR1400. The contents of ANSI/ANS 58.8-1994 are based on the use of analog-type I&C equipment. However, the APR1400 is widely equipped with digitalized I&C equipment. Therefore, both the D3 and CCF Coping Analysis TeR's will be revised to delete ANSI/ANS 58.8-1994 as a reference regarding safety-related operator actions. NUREG-0800, Appendix 18-A will be used for human factor engineering guidance for the evaluation of manual operator actions.

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems (or simply 'the CCF event' hereafter), the operator will take appropriate actions to mitigate the CCF event. These operator actions will be evaluated according to NUREG-0800, Appendix 18-A (Reference 6). The important operator actions to be performed after the CCF event are explained in the applicant's response to Question 18-56 of RAI 315-8091.

Sections 3.3 and 4.3 of APR1400-Z-A-NR-14019, CCF Coping Analysis TeR, will be revised as follows:

Current description of Section 3.3:

Licensing analysis for design basis events (DBEs) does not credit any operator action until 30 minutes after event initiation. This starting time of operator actions is based on conservative application of human factor engineering (HFE) standards (Reference 2 and Reference 3). Any operator action credited in the CCF coping analysis is justified based on an evaluation using performance-based tests consistent with that described in NUREG-0711 (Reference 4).

Description is to be revised to:

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 6). However, the licensing analysis for a DBE with a postulated CCF in the safety I&C systems does not credit any operator action conservatively until 30 minutes after event initiation.

Current description of Section 4.3:

Licensing analysis for DBEs does not credit any operator action until 30 minutes after event initiation. This starting time of operator actions is based on the conservative application of HFE standards such as ANSI/ANS 58.8 (Reference 2).

Description is to be revised to:

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 6).

In addition, the CCF Coping Analysis TeR will be revised to delete References 2 through 4. Please refer to Attachment 1 to this response.

Sections 3.3.3, 7.1, and 7.2 of APR1400-Z-J-NR-14002-P, D3 TeR, will be revised as follows:

Current description of Section 3.3.3:

Licensing analysis for a DBE with a postulated CCF in the safety I&C systems does not credit any operator action conservatively until 30 minutes after event initiation. However, the operator will immediately take appropriate actions much earlier than 30 minutes to mitigate the event in a real plant situation. The time of operator actions should be justified based on an evaluation using performance-based tests consistent with that described in NUREG-0711 (Reference 12).

Description is to be revised to:

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 10). However, the licensing analysis for a DBE concurrent with a postulated CCF in the safety I&C systems does not credit any operator action conservatively until 30 minutes after event initiation.

Current description of Section 7.1:

j. It is assumed that no operator action is taken during 30 minutes after an event initiation.

Description is to be revised to:

j. In the CCF coping analysis, it is assumed conservatively that no operator action is taken during 30 minutes after an event initiation.

Current description of Section 7.2:

Licensing analysis for DBEs does not credit any operator action until 30 minutes after event initiation. Any operator action credited in the CCF coping analysis prior to 30 minutes is justified based on a reasonable HFE evaluation methodology. The starting time of operator actions is based on conservative application of HFE standards such as ANSI/ANS 58.8-1994 (Reference 11).

Description is to be revised to:

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 10). However, the licensing analysis for a DBE concurrent with a postulated CCF in the safety I&C systems does not credit any operator action conservatively until 30 minutes after event initiation.

Current description of Section 7.2, a:

a. Operators are well aware of plant conditions requiring manual reactor trip or ESF actuation and are assumed to initiate manual reactor trip consistent with response time data discussed in Appendix of ANSI/ANS 58.8-1994 (Reference 11), which indicates that the earliest time for operator action in this scenario is typically less than one minute.

Description is to be revised to:

a. Operators are well aware of plant conditions requiring manual reactor trip and ESF actuation and are assumed to initiate manual reactor trip and/or manual ESF actuation with appropriate response times. The time of operator actions are justified based on an evaluation using the methods described in NUREG-0800, Appendix 18-A (Reference 10).

Current description of Section 7.2, d:

d. The time to execute each mitigating step in the SPTAs is based on the ANSI/ANS 58.8-1994 (Reference 11), which is one of the HFE industry standards.

Description is to be revised to:

d. The time to execute each mitigating step in the SPTAs is justified based on an evaluation using the methods described in NUREG-0800, Appendix 18-A (Reference 10).

In addition, the D3 TeR will be revised to delete References 11 and 12, as indicated in Attachment 2 to this response.

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

Both CCF Coping Analysis and D3 TeR's will be revised, as indicated in Attachments 1 and 2 to this response, respectively.

3. APPLICABLE CODES AND REGULATIONS

This section describes the compliance of the CCF coping analysis with the applicable codes and regulations.

3.1 Code of Federal Regulations

- 10 CFR 50.62, “Requirements for Reduction of Risk from Anticipated Transients Without Scram”.

  The diverse protection system (DPS) and its related equipment are provided to mitigate the effects of an anticipated operational occurrence (AOO) followed by the failure of the reactor trip portion of the protection system.

- 10 CFR 52.47(a)(2)(iv) provides guideline values of radiation dose for design certification (DC) applicants.

  The offsite radiological consequences evaluated in Section 5 are within the acceptance criteria specified in this code.

3.2 Staff Requirements Memorandum (SRM)

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 6). However, the licensing analysis for a DBE with a postulated CCF in the safety I&C systems does not credit any operator action conservatively until 30 minutes after event initiation.

3.3 Standard Review Plan (SRP)

- SRP Branch Technical Position (BTP) 7-19, “Guideline for Evaluation of Diversity and Defense-in-Depth in Digital Computer-based Instrumentation and Control Systems”.

  The events in SAR Chapter 15 are evaluated and analyzed with realistic assumptions and methods. The acceptance criteria provided in this guide are used when performing the evaluation. Diverse actuation system (DAS) and control systems are credited in the evaluation since they are independent from the CCF in the safety I&C system.

- SRP Appendix 18-A, “Crediting Manual Operator Actions in Diversity and Defense-in-Depth (D3) Analyses”.

  ~~Licensing analysis for design basis events (DBEs) does not credit any operator action until 30 minutes after event initiation. This starting time of operator actions is based on conservative application of human factor engineering (HFE) standards (Reference 2 and Reference 3). Any operator action credited in the CCF coping analysis is justified based on an evaluation using performance based tests consistent with that described in NUREG-0711 (Reference 4).~~

CCF. Therefore, manual actuation of the AFWS equipment is not required. However, capability of manual actuation of the required AFWS equipment is provided as part of the DMA design. The motor-driven auxiliary feedwater (AFW) pumps are assumed to be available for manual actuation during the postulated software CCF because the steam supply to the turbine-driven AFW pump might not be assured depending on the break location. Each motor-driven pump is sized to supply full rated flow required by each steam generator.

Manual modulating control of the AFW control valve requires a hardwired manual station. One hardwired manual station is currently planned for each modulating control valve and this controller is used for the DPS operation if needed. This manual station is to be shared for the DMA control. The manual station output signal will be provided directly to the valve operator, thus bypassing ESF-CCS.

- Manual operation of safety injection system pumps and valves

  DMA-safety injection actuation signal (SIAS) switch has capability to start safety injection pumps at system level during the loss of coolant accident (LOCA). Also SI valves are opened to initiate SI flow by DMA-SIAS switch at system level. Reactor coolant pump (RCP) which is non-safety equipment is stopped by IPS flat panel display (FPD) and P-CCS. These devices are assumed available according to realistic method approach.

  In addition, selected safety injection system valves are to be closed with DMA actuation. The valves are not directly involved in the mitigation of accidents that require safety injection, but provide minor peripheral support functions during a normal plant operation such as fill, drain, leakage isolation, etc. Included valves are safety injection tank (SIT) fill and drain valves, hot leg check valve leakage line isolation valve and SIT injection line check valve leakage line isolation valves. All these valves are normally closed valves with a fail-safe mode of fail closed. It is assumed that the software failure would cause the system to fail-as-is and the normally closed valves will remain closed at the onset of the software CCF. Therefore these valves would not require to be closed manually.

The DIS is designed to provide the information necessary to monitor the critical safety functions under the

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 6).

with an initiating event.

4.3 Operator Actions

Manual operator actions can be credited as a diverse means to cope with AOOs and postulated accidents (PAs) with a CCF in the safety I&C systems as mentioned in Reference 5. If the operator actions are credited as a diverse means, the required and available operator action time should be evaluated and justified based on the HFE methodology described in Reference 6.

~~Licensing analysis for DBEs does not credit any operator action until 30 minutes after event initiation. This starting time of operator actions is based on the conservative application of HFE standards such as ANSI/ANS 58.8 (Reference 2).~~

In the CCF coping analysis for the APR1400 design, the operator actions to mitigate a DBE with a postulated CCF in the safety I&C systems have been delayed until 30 minutes after event initiation, which is considered to be conservative since the IPS or large display panel (LDP) will provide several alarms much earlier than 30 minutes after an event occurs, and the operators will ~~immediately~~ take appropriate actions based on the relevant alarm response procedures (ARPs). At about 30 minutes after an event

7. REFERENCES

Deleted.

1. APR1400-Z-J-NR-14002-P, “Diversity and Defense-in-Depth,” Revision 0, KHNP, November 2014.

2. ~~ANSI/ANS-58.8-1994, “Time Response Design Criteria for Safety-Related Operator Actions,” American Nuclear Society, August 1994.~~

Deleted.

3. ~~APG report #19, “Bridging Document between Simulator Data on Operator Response Time and ANS-58.8 Standard,” Lawrence Livermore National Laboratory, January 1992.~~

4. ~~NUREG-0711, “Human Factor Engineering Program Review Model,” Revision 3, U.S. Nuclear Regulatory Commission, November 2012.~~

Deleted.

5. 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,” Revision 6, U.S. Nuclear Regulatory Commission, July 2012.

6. NUREG-0800, Standard Review Plan, Appendix 18-A, “Crediting Manual Operator Actions in Diversity and Defense-in-Depth (D3) Analyses,” Revision 0, U.S. Nuclear Regulatory Commission, ~~November 2009.~~ April 2014.

7. APR1400-F-C-TR-12002-P, “KCE-1 Critical Heat Flux Correlation for PLUS7 Thermal Design,” Revision 0, KHNP, November 2012.

8. LD-82-001 (dated 1/6/82), “CESEC Digital Simulation of a Combustion Engineering Nuclear Steam Supply System,” Enclosure 1-P to letter from A.E. Scherer to D.G. Eisenhut, December 1981(Proprietary).

9. CEN-214(A)-P, “CETOP-D Code Structure and Modeling Methods for Arkansas Nuclear One- Unit 2,” Combustion Engineering, Inc., July 1982(Proprietary).

10. CENPD-135, “STRIKIN-II, A Cylindrical Geometry Fuel Rod Heat Transfer Program,” Combustion Engineering, Inc., April 1974(Proprietary).

11. NUREG/CR-5535(EGG-2596), “RELAP5/MOD3 Code Manual,” EG&G Idaho Inc., USA, June 1990.

12. “Verification of Simulation Results of Mixture Level Transients and Evaporation Processes in Level Measurement Systems Using Needle-shaped Probes”, A. TRAICHEL, W. KASTNER, S. SCHEFTER, V. SCHNEIDER, S. FLEISCHER, T. GOCHT, and R. HAMPEL, Proc. of Measurement techniques of stationary and transient multiphase flow, December 2000.

13. “Description of the SGNPV Digital Computer Code Used in Developing Main Steam Line Break Mass/Energy Release Data for Containment Analysis,” Nuclear Power System, Combustion Engineering, Inc., February 1988.

14. CENPD-140-A, “Description of the CONTRANS Digital Computer Code for Containment Pressure and Temperature Transient Analysis,” R. C. Mitchell, June 1976(Proprietary).

The DPS automatically initiates a reactor trip on high pressurizer pressure, high containment pressure, and turbine trip. The DPS reactor trip on turbine trip is manually enabled from MCR only if the reactor power cutback system (RPCS) is out of service.

The DPS automatically initiates a safety injection actuation signal (SIAS) on low pressurizer pressure, and an auxiliary feedwater actuation signal (AFAS) on low steam generator water level in either steam generator.

The DPS turbine trip signal is automatically generated with three seconds of time delay after the initiation of DPS reactor trip signal.

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 10). However, the licensing analysis for a DBE concurrent with a postulated CCF in the safety I&C systems does not credit any operator action conservatively until 30 minutes after event initiation.

The DIS displays parameters that monitor inadequate core cooling status, accident monitoring parameters, and parameters for emergency operation.

3.3.2 NUREG-0800, Branch Technical Position 7-19, Rev. 6, "Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems" (Reference 9)

The DAS is designed to comply with the guidance of BTP 7-19, Rev. 6. The conformance to BTP 7-19 is provided in more detail in Appendix A of this report.

3.3.3 NUREG-0800, Chapter 18-A, "Crediting Manual Operator Actions in Diversity and Defense-in-Depth (D3) Analyses" (Reference 10)

~~Licensing analysis for DBEs does not credit any operator action until 30 minutes after event initiation. This starting time of operator actions is based on conservative application of human factors engineering (HFE) standards such as ANSI/ANS 58.8-1994 (Reference 11). Any operator action credited in the CCF coping analysis is justified based on a reasonable HFE methodology consistent with that described in NUREG-0711 (Reference 12).~~

3.3.4 NUREG-0800, Section 7.8, "Diverse Instrumentation and Control Systems"

The DAS is designed to comply with the guidance provided in Section 7.8 of NUREG-0800.

3.3.5 NUREG/CR-6303, "Method for Performing Diversity and Defense-in-Depth Analysis of Reactor Protection Systems", December, 1994 (Reference 13).

The results of D3 analysis performed in accordance with the guidelines of NUREG/CR-6303 are described in Appendix C.

3.3.6 US NRC Generic Letter (GL) 85-06, "Quality Assurance Guidance for ATWS Equipment that is Not Safety-Related," 1985 (Reference 6).

The DAS is designed to meet the quality assurance guidance provided in Generic Letter 85-06.

d. Initial conditions for an event are at their nominal values. The nominal or average capacities are assumed when some systems or components are actuated during the event.

e. The postulated CCF in the digital PPS/ESF-CCS does not prevent the reactor trip on high pressurizer pressure or high containment pressure and the diverse turbine trip which are actuated by the DPS. The DPS uses digital equipment and software that are diverse from the PPS and ESF-CCS.

f. The postulated CCF in the digital PPS/ESF-CCS does not prevent the auxiliary feedwater and safety injection system actuation functions which are actuated by the DPS.

g. Hardwired diverse ESF manual actuations at the system level are provided for:

- Safety Injection
- Containment Spray
- Auxiliary Feedwater Actuation
- Main Steam Isolation
- Containment Isolation, with Letdown Isolation

h. Reactor coolant pumps (RCPs) are assumed to be normally operating if offsite power is available.

i. Offsite power is assumed to be available during the event if loss of offsite power is not the initiating event.

In the CCF coping analysis, it is assumed conservatively

j. ~~It is assumed~~ that no operator action is taken during 30 minutes after an event initiation. At 30 minutes after the event, the operators begin administrative control of the plant under the appropriate recovery procedures to achieve a hot shutdown condition. Alarms and indications are provided via equipment not affected by the postulated CCF in the digital safety I&C systems to support operators to perform a controlled cooldown of the plant.

k. A postulated CCF in similar software modules results in similar blocks failing in the same manner, i.e., similar software blocks do not fail in a random manner.

The evaluation method for the manual operator action time is described in Section 7.2 in detail. As a result of the qualitative evaluation, eight (8) events are identified that must be quantitatively analyzed;

a. Increase in feedwater flow

b. Steam line break outside containment (offsite dose)

c. Total loss of reactor coolant flow

d. Single RCP shaft seizure/break

e. CEA ejection

f. Steam generator tube rupture

g. Loss of coolant accident (LOCA)

After the occurrence of a DBE concurrent with a postulated CCF in the safety I&C systems, the operator will take appropriate actions to mitigate the CCF event. These operator actions are evaluated according to NUREG-0800, Appendix 18-A (Reference 10). However, the licensing analysis for a DBE concurrent with a postulated CCF in the safety I&C systems does not credit any operator action conservatively until 30 minutes after event initiation.

Manual operator action can be credited as a diverse means of mitigating AOOs and PAs concurrent with a postulated CCF in the safety I&C systems if the operator action time is evaluated based on the HFE guidance provided in NUREG-0800, Appendix 18-A.

~~Licensing analysis for DBEs does not credit any operator action until 30 minutes after event initiation. Any operator action credited in the CCF coping analysis prior to 30 minutes is justified based on a reasonable HFE evaluation methodology. The starting time of operator actions is based on conservative application of HFE standards such as ANSI/ANS 58.8-1994 (Reference 11).~~ Justification includes assessments of available information from the systems not affected by a postulated CCF in the safety I&C systems, the decision making process, and expected operator action steps leading to the credited action based on the emergency operating guidelines. The justification of operator actions credited prior to 30 minutes includes the following considerations:

a. Operators are well aware of plant conditions requiring manual reactor trip ~~or~~ and ESF actuation and are assumed to initiate manual reactor trip ~~consistent with response time data discussed in Appendix of ANSI/ANS 58.8-1994 (Reference 11), which indicates that the earliest time for operator action in this scenario is typically less than one minute.~~ and/or manual ESF actuation with appropriate response times. The time of operator actions to be completed are justified based on an evaluation using the methods described in NUREG-0800, Appendix 18-A (Reference 10).

c. The sequence of operator actions in response to a prompting alarm and subsequent indications is performed by the staff in the control room according to the standard post trip actions (SPTAs) in the emergency operating procedure which is initiated ~~immediately~~ after a manual reactor trip. Since it is common for operators to memorize the post trip actions during the training, this procedure is considered to be highly familiar.

d. The time to execute each mitigating step in the SPTAs is ~~based on the ANSI/ANS 58.8-1994 (Reference 11), which is one of the HFE industry standards.~~ justified based on an evaluation using the methods described in NUREG-0800, Appendix 18-A (Reference 10).

e. In order to determine the total time required for each of the manual actions credited in the evaluation, a sequential time line is constructed to sum up the time interval involved for each operator response performed in series, including the time required for the operator to recognize a CCF has occurred in the safety I&C systems.

8 References

1. APR1400-E-J-NR-14001-P, "Component Interface Module", Rev. 0, November 2014

2. APR1400-Z-A-NR-14019, "CCF Coping Analysis", Rev. 0, November 2014

3. APR1400-Z-J-NR-14001-P, "Safety I&C System", Rev. 0, November 2014

4. IEEE Std 603-1991, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations"

5. 10 CFR 50.62, "Requirements for Reduction of Risk from Anticipated Transients without Scram (ATWS) Events for Light-Water-Cooled Nuclear Power Plants"

6. Generic Letter 85-06, "Quality Assurance Guidance for ATWS Equipment that is not Safety-Related", April 1985

7. SECY-93-087, "Policy, Technical, and Licensing Issues Pertaining to Evolutionary and Advanced Light-Water Reactor (ALWR) Designs", April 1993, and the associated Staff Requirements Memorandum, July 1993

8. IEEE Std 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits"

9. NUREG-0800, "Standard Review Plan," Chapter 7, BTP 7-19, "Guidance for Evaluation of Diversity and Defense-in-Depth in Digital Computer-Based Instrumentation and Control Systems," Rev. 6

10. NUREG-0800, "Standard Review Plan," Chapter 18, Appendix 18-A, "Crediting Manual Operator Actions in Diversity and Defense-in-Depth ~~(D3)~~ Analyses" , Rev. 0, April 2014

11. ~~ANSI/ANS 58.8-1994, "Time Response Design Criteria for Safety-Related Operator Actions"~~

12. ~~NUREG-0711, "Human Factors Engineering Program Review Model", Rev. 2, February 2004~~

13. NUREG/CR-6303, "Method for Performing Diversity and Defense-in Depth Analyses of Reactor [illegible] Systems", October 1994

14. APR1400-Z-J-NR-14003-P, "Software Program Manual", Rev. 0, November 2014

15. 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"

16. APR1400 DC Quality Assurance Manual

17. APR1400-K-Q-TR-11005-N, "KHNP Quality Assurance Program Description for the APR1400 Design Certification"

18. ANSI/ANS-58.11-1995 (R2002), "Design Criteria for Safe Shutdown following Selected Design Basis Events in Light Water Reactors"

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