
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.: 177-8166
SRP Section: 08.01 – Electric Power - Introduction
Application Section: 8.1
Date of RAI Issue: 08/31/2015

Question No. 08.01-3

APR1400 DCD Table 8.1-2, "Criteria and Guidelines for Electric Power Systems," and Table 1.9-2, "APR1400 Conformance with the Standard Review Plan," states that BTP 8-8, "Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions," February 2012 is not applicable.

DCD section 8.1.3.3, "General Design Criteria, NRC Regulatory Guides, Branch Technical Positions, Generic Letters, and Industry Standards" lists BTP 8-8 and states that "The electric power system is designed to meet the following requirements of General Design Criteria (GDC), Regulatory Guides (RGs), Branch Technical Positions (BTPs), Generic Letters (GLs), and industry standards. Conformance with RGs and BTPs for electric power systems is addressed in Table 8.1-2 and Section 1.9."

DCD section 8.3.1.1 states in part that the onsite ac power system includes standby power sources, distribution systems, and auxiliary supporting systems that are provided to supply power to safety-related equipment or equipment important to safety for all normal operating and accident conditions. There are four Class 1E emergency diesel generators (EDGs) and one non-Class 1E gas turbine generator (GTG).

Standard Review Plan, NUREG-0800 states that BTP 8-8 is applicable to sections 8.2 and 8.3.1. Please clarify whether BTP 8-8 is applicable to the ARP1400 design for the Class 1E EDGs discussed in section 8.3.1.1.

If applicable provide a discussion in the appropriate DCD section describing applicability of BTP 8-8.

Response

BTP 8-8 is to provide acceptable content of Allowed Outage Time (AOT) extension requests for onsite or offsite power sources to allow on-line maintenance on EDGs that would normally be

performed during refueling outages or maintenance of offsite power source(s). KHNP confirms that BTP 8-8 is not applicable to the APR1400 as indicated in Table 8.1-2 (5 of 8). The APR1400 does not consider the extension of the AOT of the onsite EDGs and offsite power sources at this time. Consistent with RG 1.93, the maximum completion time for the EDG(s) in a Limiting Condition for Operation (LCO) is 72 hours as indicated in Technical Specification 3.8.1. This does not preclude the application of BTP 8-8 by the operating plant licensee of an APR1400 plant if it were so desired.

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.

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Application Section: 8.1
Date of RAI Issue: 08/31/2015

Question No. 08.01-6

The Commission Papers (SECY)-90-016 is listed in Table 8.1-2, but not discussed in other parts of DCD chapter 8. DCD chapter 8, Table 8.1-2 states that SECY-90-016 is applicable to DCD sections 8.2, 8.3.1, and 8.4, but applicability is not discussed in other parts of DCD chapter 8 or chapter 1.

SECY-91-078 is listed in Table 8.1-2, but not discussed in other parts of DCD chapter 8. DCD chapter 8, Table 8.1-2 states that SECY-91-078 is applicable to DCD sections 8.2, but the applicability is not discussed in other parts of DCD chapter 8 or chapter 1. SECY-91-078, DCD chapter 1, Table 1.9-7 states that APR1400 conforms to the requirements of SECY 91-078.

The guidance in Standard Review Plan (SRP) section 8.1 states in part that the DCD should discuss the applicability of the criteria and guidelines listed and include a statement to the effect that they will be implemented or are implemented in the design of the electrical power systems.

Please provide a discussion on how the APR1400 design meets the guidance in SECY 90-016 and SECY 91-078.

Response

Of the issues identified in SECY-90-016, the station blackout rule (10 CFR 50.63) is the one that is applicable to the APR1400 electrical power system design. The APR1400 has selected an alternate ac (AAC) power approach for SBO coping and the AAC source and its support systems conform to RG 1.115, as discussed in DCD Tier 2, Section 8.4. Thus, the electrical power system of the APR1400 meets the staff's recommendation in SECY-90-016.

SECY-91-078 identifies the following two issues and provides recommendations on these issues.

- Alternate Source of Power for Non-Safety Loads

- Connection of Safety Bus Offsite Power Sources through Non-safety Loads

As shown in Figure 8.1-1 (1 of 2 and 2 of 2) and also stated in DCD Subsection 8.2.1.3, two physically separate offsite power sources, referred to as the normal and alternate preferred power supplies, are provided for all non-safety loads as well as safety loads. The normal preferred power supply is provided through the unit auxiliary transformers (UATs) and the alternate preferred power supply is provided through the standby auxiliary transformers (SATs). In case the normal preferred power supply is not available, the offsite power supply is maintained for the safety and non-safety loads by automatic transfer of the safety and non-safety buses from the UATs to the SATs. This design aspect satisfactorily addresses the first issue of SECY-91-078.

With regard to the second issue of SECY-91-078, the APR1400 design complies with the staff's position as described in DCD Subsection 8.2.1.3, which states, "The APR1400 design includes two offsite circuits to each independent safety train that is supplied directly from an offsite power source with no intervening non-safety buses, thereby permitting the offsite source to supply power to safety buses regardless of failure of non-safety buses."

Further discussion on compliance of the APR1400 design with the second issue of SECY-91-078 is included in the response to RAI 16-7915 (Reference KHNP submittal MKD/NW-15-0029L, dated June 22, 2015; ML15173A091).

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.

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Docket No. 52-046

RAI No.: 177-8166
SRP Section: 08.01 – Electric Power – Introduction
Application Section: 8.1
Date of RAI Issue: 08/31/2015

Question No. 08.01-8

APR1400 DCD Table 8.1-2, "Criteria and Guidelines for Electric Power Systems," states in part that BTP 8-2, "Use of Diesel Generator Sets for Peaking," is applicable to DCD section 8.3.1. DCD section 8.1.3.3, "General Design Criteria, NRC Regulatory Guides, Branch Technical Positions, Generic Letters, and Industry Standards," and Table 1.9-2, "APR1400 Conformance with the Standard Review Plan," states that APR1400 conforms with BTP 8-2 and that the emergency diesel generator is not used for peaking service for offsite power system. The guidance in Standard Review Plan (SRP) section 8.1 states in part that the DCD should discuss the applicability of the criteria and guidelines listed and include a statement to the effect that they will be implemented or are implemented in the design of the electrical power systems.

Provide a discussion how BTP 8-2 applies to the APR1400 design, since this information is not in DCD chapter 8.

Response

The Class 1E EDGs are not used for peaking service. They provide standby power in the event of a loss of the offsite preferred power source(s). Only for periodic testing purpose, are they connected to the offsite power source, one at a time, as described in DCD Tier 2, Subsection 8.3.1.1.3.7.

Thus, the onsite emergency diesel generators (EDGs) power system of APR1400 conforms with BTP 8-2 "Use of Diesel-Generator Sets for Peaking." The conformance description with BTP 8-2 as stated above will be added in DCD Tier 2, Subsection 8.3.1.2.3, and relevant subsections and tables will also be revised to adequately include conformance with BTP 8-2 in the DCD.

Impact on DCD

DCD Tier 2, Subsection 8.3.1.2.3 will be added and Table 1.9-2 (17 of 33), Subsections 8.3.1.2 and 8.3.4 will be revised as shown in the 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, or Environmental Report.

APR1400 DCD TIER 2

Table 1.9-2 (17 of 33)

SRP Section/Title	Revision / Issue Date	Conformance or Summary Description of Deviation	DCD Tier 2 Section
8.1 – Electric Power – Introduction	Rev. 4 02/2012	The APR1400 conforms with this SRP.	8.1
8.2 – Offsite Power System	Rev. 5 05/2010	The APR1400 conforms with this SRP.	8.2
8.3.1 – AC Power Systems (Onsite)	Rev. 4 05/2010	The APR1400 conforms with this SRP.	8.3.1
8.3.2 – DC Power Systems (Onsite)	Rev. 4 05/2010	The APR1400 conforms with this SRP.	8.3.2
8.4 – Station Blackout	Rev. 1 05/2010	The APR1400 conforms with this SRP.	8.4
App. 8-A – General Agenda, Station Site Visits	Rev. 1 03/2007	Not applicable (COL)	N/A
BTP 8-1 – Requirements on Motor-Operated Valves in the ECCS Accumulator Lines	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, Table 8.1-2
BTP 8-2 – Use of Diesel Generator Sets for Peaking	Rev. 3 03/2007	The emergency diesel generator (EDG) provides backup power to the safety-related loads for safety shutdown during a loss of offsite power (LOOP). However, the EDG is not used for peaking service for offsite power system. The APR1400 conforms with this BTP.	8.1.3.3, Table 8.1-2
BTP 8-3 – Stability of Offsite Power Systems	Rev. 3 03/2007	Not applicable (COL)	N/A
BTP 8-4 – Application of the Single Failure Criterion to Manually Controlled Electrically Operated Valves	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, Table 8.1-2

8.3.1.2.3

APR1400 DCD TIER 2

- d. Control
- e. Instrumentation

If the trays are stacked, the order from top to bottom is as shown above.

Cables of each train run in separate raceways are physically separated from cables of the other trains. Separation of trains is in accordance with IEEE Std. 384, as endorsed by NRC RG 1.75. Raceways for non-Class 1E are separated from each Class 1E train A, B, C, and D in accordance with IEEE Std. 384. The raceway in the cable spreading area, main control room, and other congested areas is designed in accordance with IEEE Std. 384. The power and control wiring in control boards or panels is separated in accordance with IEEE Std. 420 (Reference 40).

Medium-voltage power cables are routed in an open-top ladder-type cable tray in a single layer with maintained spacing. The distance between adjacent cables within a tray is one-quarter the diameter of the larger cable. The cable tray fill criterion for low-voltage power cables does not exceed 30 percent of the cross-sectional area of the open-top ladder-type tray. The cable tray fill criterion for control cable does not exceed 50 percent of the cross-sectional area of the open-top ladder-type tray. Solid-bottom and solid-cover type cable trays are used for routing instrumentation cables, with an allowable fill of 50 percent of tray cross-sectional area. Cable splicing in a raceway is prohibited.

8.3.1.2 Analysis

The APR1400 Class 1E ac power system is designed to meet the requirements of GDCs 2, 4, 5, 17, 18, 33, 34, 35, 38, 41, 44, 50, and the intent of NRC RGs 1.6, 1.9, 1.32, 1.47, 1.53, 1.63, 1.75, 1.81, 1.106, 1.118, 1.153, 1.155, 1.160, and 1.204. The criteria and guidelines are shown in Table 8.1-2 and include their applicability in the electrical system design.

Add

, and BTP 8-1, 8-2, 8-4, 8-5, and 8-7

APR1400 DCD TIER 2

NRC RG 1.160 endorses Revision 4A of NUMARC 93-01 (Reference 45), which provides methods for complying with the provisions of 10 CFR 50.65 with some provisions and clarifications. Conformance with NRC RG 1.160 is addressed in Section 1.9.

NRC Regulatory Guide 1.204

NRC RG 1.204 is related to the guidelines for lightning protection of nuclear power plants.

The APR1400 onsite ac power system is designed to meet the requirements of IEEE Std. 665, IEEE Std. 666, IEEE Std. 1050, and IEEE Std. C62.23 (Reference 46), which are related to the lightning protection of nuclear power plants.

NRC Regulatory Guide 1.218

NRC RG 1.218 provides the cable design and maintenance criteria for the performance of periodic testing as part of the condition-monitoring techniques for the electric cables that are used in nuclear power plants. The inaccessible cable condition-monitoring techniques related to NRC RG 1.218 are addressed in Subsection 8.3.1.1.10.

8.3.1.3 Electrical Power System Calculations and Distribution System Studies for AC System

The analysis of load flow, voltage regulation, and short-circuit studies is performed by using ETAP, version 12.0.0N, which is qualified for nuclear power plants in accordance with 10 CFR Part 21, 10 CFR Part 50, Appendix B (Reference 47), and ASME NQA-1 (Reference 48).

8.3.1.3.1 Load Flow/Voltage Regulation Studies and Under/Overvoltage Protection

8.3.1.2.3 Conformance with Branch Technical Positions

BTP 8-2, "Use of Diesel-Generator Sets for Peaking"

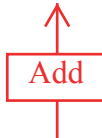
The Class 1E EDGs are not used for peaking service. They provide standby power in the event of a loss of the offsite preferred power source(s). They are connected to the offsite power source, one at a time, for periodic testing as described in DCD Tier 2, Subsection 8.3.1.1.3.7.

motor rating for Class 1E motors and 80 percent of motor rating for non-Class 1E motors.

Add

APR1400 DCD TIER 2

61. IEEE Std. C37.16-2009, "IEEE Standard for Preferred Ratings, Related Requirements, and Application Recommendations for Low-Voltage AC (635 V and below) and DC (3200 V and below) Power Circuit Breakers," Institute of Electrical and Electronics Engineers, 2009.



62. NUREG-0800, Standard Review Plan, BTP 8-1, "Requirements for Motor-Operated Valves in the ECCS Accumulator Lines," Rev. 3, March 2007.
63. NUREG-0800, Standard Review Plan, BTP 8-2, "Use of Diesel Generator Sets for Peaking," Rev. 3, March 2007.
64. NUREG-0800, Standard Review Plan, BTP 8-4, "Application of Single Failure Criterion to Manually Controlled Electrically Operated Valves," Rev. 3, March 2007.
65. NUREG-0800, Standard Review Plan, BTP 8-5, "Supplemental Guidance for Bypass and Inoperable Status Indication for Engineered Safety Features Systems," Rev. 3, March 2007.
66. NUREG-0800, Standard Review Plan, BTP 8-7, "Criteria for Alarms and Indications Associated with Diesel Generator Unit Bypassed and Inoperable Status," Rev. 3, March 2007.

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Docket No. 52-046

RAI No.: 177-8166
SRP Section: 08.01 – Electric Power – Introduction
Application Section: 8.1
Date of RAI Issue: 08/31/2015

Question No. 08.01-10

APR1400 DCD Table 8.1-2, "Criteria and Guidelines for Electric Power Systems," states in part that BTP 8-5, "Supplemental Guidance for Bypass and Inoperable Status Indication for Engineered Safety Features Systems," is applicable to DCD section 8.3.1 and 8.3.2. DCD section 8.1.3.3, "General Design Criteria, NRC Regulatory Guides, Branch Technical Positions, Generic Letters, and Industry Standards," and Table 1.9-2, "APR1400 Conformance with the Standard Review Plan," states that APR1400 conforms with BTP 8-5. The guidance in Standard Review Plan (SRP) section 8.1 states in part that the DCD should discuss the applicability of the criteria and guidelines listed and include a statement to the effect that they will be implemented or are implemented in the design of the electrical power systems.

Provide a discussion how BTP 8-5 applies to the APR1400 design, since this information is not in DCD chapter 8.

Response

As stated in DCD Tier 2, Subsection 7.5.1.3, the bypassed and inoperable status indication (BISI) for ESF components, including electric power system components, conforms with Regulatory Guide 1.47 (Rev.1), which has incorporated the staff's positions addressed in BTP 8-5.

The conformance description with BTP 8-5 will be added in DCD Tier 2, Subsection 8.3.1.2.3, and relevant subsections and tables will also be revised to adequately include conformance with BTP 8-5 in the DCD.

Impact on DCD

DCD Tier 2, Subsection 8.3.1.2.3 will be added, and Table 1.9-2 (18 of 33) will be revised as shown in the attachment. Mark-up revisions to Subsections 8.3.1.2 and 8.3.4 are included in the response to Question 08.01-8 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.

APR1400 DCD TIER 2

Table 1.9-2 (18 of 33)

SRP Section/Title	Revision / Issue Date	Conformance or Summary Description of Deviation	DCD Tier 2 Section
BTP 8-5 – Supplemental Guidance for Bypass and Inoperable Status Indication for Engineered Safety Features Systems	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, 8.3.1.2.2, 8.3.2.2.2 Table 8.1-2
BTP 8-6 – Adequacy of Station Electric Distribution System Voltages	Rev. 3 03/2007	The APR1400 conforms with this BTP with the exception of B.1. The Class 1E distribution system is separated from the offsite power system by the secondary undervoltage relay regardless of the occurrence of an SIAS.	8.1.3.3, 8.2.2.3, 8.3.1.1.2.3, 8.3.1.1.3.12, Table 8.1-2
BTP 8-7 – Criteria for Alarms and Indications Associated with Diesel-Generator Unit Bypassed and Inoperable Status	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, 8.3.1.1.3 Table 8.1-2
BTP 8-8 – Onsite (Emergency Diesel Generators) and Offsite Power Sources Allowed Outage Time Extensions	02/2012	Not applicable	N/A
9.1.1 – Criticality Safety of Fresh and Spent Fuel Storage and Handling	Rev. 3 03/2007	The APR1400 conforms with this SRP.	9.1.1
9.1.2 – New and Spent Fuel Storage	Rev. 4 03/2007	The APR1400 conforms with this SRP.	9.1.2
9.1.3 – Spent Fuel Pool Cooling and Cleanup System	Rev. 2 03/2007	The APR1400 conforms with this SRP.	9.1.3
9.1.4 – Light Load Handling System and Refueling Cavity	Rev. 4 07/2014	The APR1400 conformance with acceptance criteria 5 is not applicable for the APR1400 design certification. (APR1400 is a single unit.)	9.1.4
9.1.5 – Overhead Heavy Load Handling Systems	Rev. 1 03/2007	The APR1400 conformance with exceptions. Criterion 5 is not applicable for the APR1400 design certification. (APR1400 is a single unit.)	9.1.5

delete

add

8.3.1.2.3

APR1400 DCD TIER 2

NRC RG 1.160 endorses Revision 4A of NUMARC 93-01 (Reference 45), which provides methods for complying with the provisions of 10 CFR 50.65 with some provisions and clarifications. Conformance with NRC RG 1.160 is addressed in Section 1.9.

NRC Regulatory Guide 1.204

NRC RG 1.204 is related to the guidelines for lightning protection of nuclear power plants.

The APR1400 onsite ac power system is designed to meet the requirements of IEEE Std. 665, IEEE Std. 666, IEEE Std. 1050, and IEEE Std. C62.23 (Reference 46), which are related to the lightning protection of nuclear power plants.

NRC Regulatory Guide 1.218

NRC RG 1.218 provides the cable design and maintenance criteria for the performance of periodic testing as part of the condition-monitoring techniques for the electric cables that are used in nuclear power plants. The inaccessible cable condition-monitoring techniques related to NRC RG 1.218 are addressed in Subsection 8.3.1.1.10.

8.3.1.3 Electrical Power System Calculations and Distribution System Studies for AC System

The analysis of load flow, voltage regulation, and short-circuit studies is performed by using ETAP, version 12.0.0N, which is qualified for nuclear power plants in accordance with 10 CFR Part 21, 10 CFR Part 50, Appendix B (Reference 47), and ASME NQA-1 (Reference 48).

add

8.3.1.3.1 Load Flow/Voltage Regulation Studies and Under/Overvoltage Protection

8.3.1.2.3 Conformance with Branch Technical Positions

BTP 8-5, "Supplement Guidance for Bypass and Inoperable Status Indication for Engineered Safety Features Systems"

The Bypassed and Inoperable Status Indication for onsite power system complies with BTP 8-5 (Reference 65). Descriptions of the bypassed and inoperable status indication for engineered safety features systems are provided in Subsection 7.5.1.3.

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Docket No. 52-046

RAI No.: 177-8166
SRP Section: 08.01 – Electric Power – Introduction
Application Section: 8.1
Date of RAI Issue: 08/31/2015

Question No. 08.01-11

APR1400 DCD Table 8.1-2, "Criteria and Guidelines for Electric Power Systems," states in part that BTP 8-7, "Criteria for Alarms and Indications Associated with Diesel-Generator Unit Bypassed and Inoperable Status," is applicable to DCD section 8.3.1. DCD section 8.1.3.3, "General Design Criteria, NRC Regulatory Guides, Branch Technical Positions, Generic Letters, and Industry Standards," and Table 1.9-2, "APR1400 Conformance with the Standard Review Plan," states that APR1400 conforms with BTP 8-7. The guidance in Standard Review Plan (SRP) section 8.1 states in part that the DCD should discuss the applicability of the criteria and guidelines listed and include a statement to the effect that they will be implemented or are implemented in the design of the electrical power systems.

Provide a discussion how BTP 8-7 applies to the APR1400 design, since this information is not in DCD chapter 8.

Response

The bypassed and inoperable status (BISI) design for the EDGs conforms with BTP 8-7 "Criteria for Alarms and Indications Associated with Diesel-Generator Unit Bypassed and Inoperable Status", Position B.3 is not applicable since the EDG units of the APR1400 are not shared units. Descriptions of the system-level BISI for the plant auxiliary systems including the EDGs are provided in DCD Subsection 7.5.1.3. The conformance description with BTP 8-7 will be added in DCD Tier 2, Subsection 8.3.1.2.3 and relevant subsections and tables will be revised to adequately include conformance with BTP 8-7 in the DCD.

Impact on DCD

DCD Tier 2, Subsection 8.3.1.2.3 will be added, and Table 1.9-2 (18 of 33) and Subsection 7.5.1.3 will be revised as shown in the attachment. Mark-up revisions to Subsections 8.3.1.2 and 8.3.4 are included in the response to Question 08.01-8 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.

APR1400 DCD TIER 2

Table 1.9-2 (18 of 33)

SRP Section/Title	Revision / Issue Date	Conformance or Summary Description of Deviation	DCD Tier 2 Section
BTP 8-5 – Supplemental Guidance for Bypass and Inoperable Status Indication for Engineered Safety Features Systems	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, 8.3.1.2.2, 8.3.2.2.2 Table 8.1-2
BTP 8-6 – Adequacy of Station Electric Distribution System Voltages	Rev. 3 03/2007	The APR1400 conforms with this BTP with the exception of B.1. The Class 1E distribution system is separated from the offsite power system by the secondary undervoltage relay regardless of the occurrence of an SIAS.	8.1.3.3, 8.2.2.3, 8.3.1.1.2.3, 8.3.1.1.3.12, Table 8.1-2
BTP 8-7 – Criteria for Alarms and Indications Associated with Diesel-Generator Unit Bypassed and Inoperable Status	Rev. 3 03/2007	The APR1400 conforms with this BTP.	8.1.3.3, 8.3.1.1.3 Table 8.1-2
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9.1.1 – Criticality Safety of Fresh and Spent Fuel Storage and Handling	Rev. 3 03/2007	The APR1400 conforms with this SRP.	9.1.1
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7.5.1.3, 8.1.3.3,
8.3.1.2.3,
Table 8.1.2

APR1400 DCD TIER 2

- l. Emergency diesel generator area HVAC system
- m. Control room HVAC system
- n. Electrical and I&C equipment areas HVAC system
- o. Fuel handling area HVAC system
- p. Auxiliary building controlled area HVAC system
- q. Reactor containment building purge system



7.5.1.4 Alarm System

The alarm system alerts the operators by means of visual and audible signals of abnormal conditions that require operator action.

The alarm system is designed to perform the following functions:

- a. Alerting the operators to off-normal conditions that require the operator to take action
- b. Guiding the operators to the appropriate response
- c. Assisting the operators in determining and maintaining an awareness of the state of the plant and its systems or functions

Reliability

The alarm system is reliable based on following features:

- a. The alarm system is implemented in both the IPS and QIAS-N. Alarms that are used for all operating modes including normal, AOOs, and PAs are provided in redundant operator workstation consoles by the IPS. The IPS has redundant alarm servers. An important alarm list is shown on the QIAS-N displays on the safety console.
- b. The IPS is configured by diverse hardware and software from the QIAS-N.

Add

The BISI design for the EDGs is described in Subsection 8.3.1.2.3.

APR1400 DCD TIER 2

NRC RG 1.160 endorses Revision 4A of NUMARC 93-01 (Reference 45), which provides methods for complying with the provisions of 10 CFR 50.65 with some provisions and clarifications. Conformance with NRC RG 1.160 is addressed in Section 1.9.

NRC Regulatory Guide 1.204

NRC RG 1.204 is related to the guidelines for lightning protection of nuclear power plants.

The APR1400 onsite ac power system is designed to meet the requirements of IEEE Std. 665, IEEE Std. 666, IEEE Std. 1050, and IEEE Std. C62.23 (Reference 46), which are related to the lightning protection of nuclear power plants.

NRC Regulatory Guide 1.218

NRC RG 1.218 provides the cable design and maintenance criteria for the performance of periodic testing as part of the condition-monitoring techniques for the electric cables that are used in nuclear power plants. The inaccessible cable condition-monitoring techniques related to NRC RG 1.218 are addressed in Subsection 8.3.1.1.10.

8.3.1.3 Electrical Power System Calculations and Distribution System Studies for AC System

The analysis of load flow, voltage regulation, and short-circuit studies is performed by using ETAP, version 12.0.0N, which is qualified for nuclear power plants in accordance with 10 CFR Part 21, 10 CFR Part 50, Appendix B (Reference 47), and ASME NQA-1 (Reference 48).

8.3.1.3.1 Load Flow/Voltage Regulation Studies and Under/Overvoltage Protection

8.3.1.2.3 Conformance with Branch Technical Positions

BTP 8-7, "Criteria for Alarms and Indications Associated with Diesel-Generator Unit Bypassed and Inoperable Status"

The bypassed and inoperable status indication(BISI) design for the EDGs conforms to the recommendations of BTP 8-7, except the position number 3. The EDG units of APR1400 are not shared with other units. Descriptions of the system-level BISI for the plant auxiliary systems including EDGs are provided in Subsection 7.5.1.3.

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