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.:	**316-8305**
SRP Section:	**SRP 17.04**
Application Section:	**17.4**
Date of RAI Issue:	**11/17/2015**

Question No. 17.04-1

SRP Chapter 17.4, Revision 1, Section II, "Acceptance Criteria" states, "… an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations." The staff reviewed APR1400 DCD Section 17.4, "Reliability Assurance Program," and found that the DCD Table 1.9-2 referenced SRP Chapter 17.4, Revision 1, but the information seems to follow the guidance provided in SRP Chapter 17.4, Revision 0. For example, APR1400 DCD Section 17.4 discusses a) essential elements of RAP instead of programmatic controls and processes for RAP in the operations phase, and b) development/integration of operational RAP (O-RAP), which is not included in the SRP guidance. Therefore, in order for the staff to reach an assurance finding on the conformance to SRP Chapter 17.4 regarding program adequacy, please provide details of a RAP program that follows the guidance in SRP Chapter 17.4, Revision 1 or an alternative to the SRP acceptance criteria, and revise the APR1400 DCD Section 17.4 accordingly.

Response – (Rev. 3)

A revision to DCD Section 17.4 was submitted to the NRC. Subsequently, the NRC staff requested several clarifications on the revision and asked additional questions during follow-up conference calls. The questions and clarifications are addressed in the RAP notebook (APR1400-K-P-NR-013903-P, Rev. 3), Appendix A.6.

Revised DCD Section 17.4, Table 17.4-1 and Table 3.2-1 based on the NRC feedback and the PRA update results, are provided in Attachments 1, 2, and 3, respectively.

Impact on DCD

DCD Section 17.4, Table 17.4-1 and Table 3.2-1 will be revised as discussed above.

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 Technical/Topical/Environmental Reports.

17.4 Reliability Assurance Program

This section presents the design reliability assurance program (RAP) for the APR1400.

17.4.1 Introduction

The RAP is implemented according to the Commission's direction provided in the Staff Requirements Memorandum (SRM) dated June 28, 1995, for Item E, the Reliability Assurance Program (RAP), of SECY-95-132, "A Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Designs" (Reference 1). The RAP applies to the systems, structures, and components (SSCs), both safety-related and non-safety-related that are identified as risk-significant (or significant contributors to plant safety). The SSCs within the scope of the RAP, referred to in this chapter as within-scope SSCs, are identified by a combination of probabilistic, deterministic, or other methods of analysis, including information obtained from sources such as the probabilistic risk assessment (PRA), severe accident evaluations, industry operating experience, and expert panels.

The RAP provides reasonable assurance of the following:

a. A plant is designed, constructed, and operated in a manner that is consistent with the risk insights and key assumptions (e.g., SSC design, reliability, and availability) from the probabilistic, deterministic, and other methods of analysis used to identify and prioritize risk.

b. The RAP SSCs do not degrade to an unacceptable level of reliability, availability, or condition during plant operation.

c. The frequency of transients that challenge these SSCs is minimized.

d. These SSCs will function reliably when challenged.

The RAP is implemented in two stages. The first stage, the design reliability assurance program (D-RAP), encompasses reliability assurance activities that occur before initial fuel load. The second stage comprises the reliability assurance activities conducted during the operations phase of the plant's license. This DCD only describes the first stage.

The second stage, the operations RAP (O-RAP), is not within the scope of the design certification and will be addressed during the COL application stage.

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The D-RAP ensures that the plant is designed and constructed in a manner that is consistent with the risk insights and key assumptions (e.g., SSC design, reliability, and availability) from the probabilistic, deterministic, and other methods of analysis used to identify and quantify risk. Therefore, the key features of the D-RAP include the following:

a. Programmatic controls that ensure the risk insights and key assumptions are consistent with the plant design and construction. These programmatic controls address organization responsibilities, design control activities, procedures and instructions, records, corrective action and assessment plans, and that the list of D-RAP SSCs is appropriately developed, maintained, and communicated to the appropriate organizations.

b. Quality assurance (QA) programs related to design and construction activities (e.g., design, procurement, fabrication, construction, inspection, and testing activities) to safety-related SSCs are established through Title 10 of the Code of Federal Regulations (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." The QA requirements are specified in Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants." SRP Section 17.5, Part V, "Nonsafety-Related SSC Quality Controls," addresses QA controls for RAP SSCs that are not safety-related.

17.4.2 RAP Implementation

Phase 1 of the design RAP includes the initial identification of SSCs in the program, implementation of the aspects applicable to design efforts, and the definition of the scope, requirements, and implementation options included in the later phases.

The D-RAP is implemented as follows, in compliance with NUREG-0800 (Reference 5):

17.4.2.1 Development

The RAP identifies risk-significant SSCs and provides key assumptions and risk insights for aspects of plant operation, maintenance, and performance monitoring to provide reasonable assurance of safe, reliable plant operation or to mitigate plant transients or other events that could present a risk to the public. Risk-significant SSCs are identified using the PRA, deterministic evaluation or other methods of analysis, including industry experience, and the input of the expert panel.

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The D-RAP process is implemented in three phases.

a. Phase 1 (Design Certification) During this phase, system information is collected and a system model is developed. The designer, Korea Hydro & Nuclear Power Co., Ltd. (KHNP), is responsible for Phase 1. The system information and model are used as input to a design phase PRA and review of external events.

Phase 1 provides reasonable assurance that the reactor design meets the purposes specified above through the design, procurement, fabrication, construction, and preoperational testing activities and programs. The results of these activities are provided to an expert panel that identifies risk-significant SSCs using deterministic, probabilistic, and other methods.

b. Phase 2 (Site Specific) During this phase, the RAP process is applied to the plant site-specific information and the site-specific SSCs and APR1400 design SSCs are combined into one list.

c. Phase 3 (Final pre-operation). During the last phase of the RAP, the procurement, fabrication, construction, and preoperational testing are implemented. The site-specific list of SSCs is provided as input to the RAP during the operations phase, which addresses plant operation and maintenance activities. This phase provides reasonable assurance that the reliability of the SSCs within the scope of the RAP is maintained during plant operations.

Phases 2 and 3 are the responsibility of the COL applicant. Additional details are provided in Subsection 17.4.3 (COL 17.4(1)).

17.4.2.2 Programmatic Controls

a. Organization

KHNP has established the following positions to ensure effective design and configuration control throughout the DC process:

The Project Manager of the APR1400 project is responsible for establishing and implementing the RAP. The Project Manager or designated representative is responsible for providing reasonable assurance that all affected organizations are aware of the D-RAP, its purposes and requirements.

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The Manager of Plant Safety is responsible for providing reasonable assurance of overall plant safety in the design, including the use of the PRA results and risk insights in the D-RAP implementation.

The Manager of QA is responsible for providing reasonable assurance that the QA program is implemented properly, which includes design control, procedures and instructions, records, corrective actions and audits pertaining to the D-RAP.

The Managers of Design Engineering are responsible for implementing the RAP and providing reasonable assurance that the APR1400 design is consistent with the identified risk-significant SSCs and the associated key assumptions and risk insights from the PRA.

The risk management organization is responsible for requesting design engineering to review key assumptions in the PRA and to incorporate the comments to provide reasonable assurance that the key assumptions are realistic and achievable. The risk management organization is also responsible for providing the related inputs to RAP in the design process by participating in the design change process. The risk management organization is also responsible for being involved in the design review. Changes are therefore identified for potential D-RAP impact.

Configuration control is established by the risk management organization, which maintains the list of risk-significant SSCs for the RAP and the associated key assumptions and risk insights from the PRA. The list and changes are approved by an expert panel, and the panel provides the information to design engineering and QA staff working on the APR1400 project.

The risk management organization provides reasonable assurance that the design engineering organizations are provided with the list of risk-significant RAP SSCs and the associated key assumptions and risk insights from the PRA, which are addressed in Section 19.1. The design engineering organization reviews the list of risk-significant RAP SSCs and associated key assumptions and risk insights from the PRA. The design engineering organization compares this information to the design activities and provides feedback to the risk management organization to achieve reasonable assurance that the risk-significant SSCs and the key assumptions and risk insights from the PRA are reasonably incorporated into the

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design, construction, and operational activities. This action ensures an acceptable level of quality control.

The APR1400 Project Manager or designated representative prepares the procedures and instructions used to implement the RAP. The Project Manager or representative is responsible for the development, verification, and implementation and for providing reasonable assurance that all affected organizations are aware of the RAP.

b. Records

RAP-related records include the following:

1) List of risk-significant SSCs

2) Expert panel meeting minutes/summaries

Other QA program records are maintained in accordance with the QA Program for the APR1400 (Reference 2).

c. Corrective Action

The activities associated with the RAP that are determined to be in error, deficient, or nonconforming are processed through the corrective action program (CAP), which supports the quality assurance procedure.

d. Audits

Audit plans include a consideration of sampling the implementation of the D-RAP and its procedures to evaluate effectiveness. Audits consider several key aspects of the D-RAP including the identification of risk-significant SSCs and whether the key assumptions and risk insights from PRA are reasonably incorporated in the design, construction and operational activities.

17.4.2.3 SSC Identification

During the APR1400 design phase, risk-significant SSCs are identified for inclusion in the RAP. A list of risk-significant SSCs is developed and controlled as design input for consideration during the design phase. The list of risk-significant SSCs is initially based

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on the results of the PRA and the expert panel. For further information on the PRA, refer to Section 19.1. In addition to PRA input, information from U.S. industry operating experience is considered in the identification of risk-significant SSCs. The list of risk-significant SSCs identified during the design phase is updated after the plant-specific PRA results are developed.

The PRA evaluates the APR1400 design response to a spectrum of initiating events to provide reasonable assurance that plant damage has a low frequency and that risk to the public is minimized. The risk-significant SSCs including both safety-related and non-safety-related SSCs for the APR1400 design are identified for the design organization.

The PRA is used to identify risk-significant SSCs, based on risk achievement worth (RAW) and Fussell-Vesely (FV) importance. Risk-significant SSCs are identified with importance criteria of FV greater than 0.005 and RAW greater than 2. In the APR1400 D-RAP, these criteria have been applied to both single-failure basic events and common cause failure (CCF) basic events. A RAW value of 20 was conservatively selected to reflect the fact that the common cause RAW measures the failure of two or more trains, including the higher likelihood of failure of the second train from common causes, as described in NEI 00-04 (Reference 4). Risk-significant SSCs identified by a RAW greater than 2 for single-failure basic events sufficiently cover the risk-significant SSCs identified by a RAW greater than 20 for common cause basic events. Component-based FVs are also estimated and used to identify risk-significant SSCs. The RAW and FV criteria are applied to the results of each risk hazard model separately, not to the combined results. For the seismic margin analysis (SMA), risk-significant SSCs are identified according to the approach provided by NEI 00-04.

Engineering judgment based on the PRA key assumptions and results is used for:

1) SSCs for which RAW/FV values have not been quantified,

2) SSCs whose RAW/FV results do not exceed the importance criteria

Risk significance is identified by engineering judgment from the following points of view:

1) Contribution to required mitigation functions during the accident

2) Similarity of the impact of failure with other risk-significant SSCs

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3) Impact on risk-significant human actions or signals

4) Potential contribution of un-modeled components

5) Potential impact of conservative modeling

For severe accident management SSCs, SSCs that are required to meet the requirements of 10 CFR are evaluated, and key SSCs are identified as risk-significant SSCs (e.g. cavity flooding system isolation valves).

A third source in the RAP process for identifying risk-significant SSCs is the use of an expert panel consisting of representatives from design engineering, PRA, and other qualified individuals in operations and maintenance who are independent of the PRA group. The expert panel also reviews the categorization of SSCs determined to be non-risk significant based on quantified PRA results (e.g., technical adequacy of the basis used in the categorization, review of defense-in-depth implications, review of safety margin implications). As part of the RAP process, the PRA analytical results, operating experience, and an expert panel process are combined to develop a comprehensive list of risk-significant SSCs.

For SSCs modeled in the PRA models, the failure modes of SSCs that can impact accident mitigative functions are represented by basic events in fault tree models. The dominant failure modes are determined from PRA models. For SSCs that are not modeled in PRA, dominant failure modes are based on SSCs that have a similar impact on the accident mitigation. The expert panel considers dominant failure modes in order to reflect industry operating experience.

The expert panel is responsible for the final selection of the SSCs included in the RAP. The expert panel consists of a minimum of four people and includes at least one person with experience in design engineering, PRA, operations and maintenance, and QA. Industry operating experience and the expert panel are part of the deterministic approach and other processes. Engineering judgment is used in considering the addition of SSCs to the RAP. Qualifications of the voting members of the expert panel are defined in the Expert Panel Implementing Procedure for APR1400 Reliability Assurance Program and are as follows:

1) Minimum of 6 years of experience in the nuclear industry.

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2) Minimum of 4 years of experience in a relevant discipline such as engineering or operations.

The SSCs included in the design phase are listed in Table 17.4-1. The boundaries for the RAP SSCs listed in the table are defined as follows:

1) The SSC boundaries are verified as consistent with the SSCs in the corresponding sections of the DCD.

2) Each SSC boundary is specific to the component and/or structure under consideration and does not include any supporting or backup SSCs.

3) The SSC boundary modeled in the PRA is consistent with the SSC boundary definition used in the APR1400 PRA (refer to Section 19.1), which is consistent with the available generic failure data.

Phase 1 RAP activities provide reasonable assurance that the key assumptions and risk insights from PRA, as identified in Section 19.1, are appropriately reflected in Table 17.4-1.

17.4.2.4 QA Controls

The non-safety-related RAP SSCs are subjected to appropriate QA controls as described in Section 17.5.

17.4.2.5 ITAAC Development

Tier 1 inspections, tests, analyses and acceptance criteria (ITAAC) for the COL D-RAP are proposed to provide reasonable assurance that the plant is designed and constructed in a manner that is consistent with the key assumptions and risk insights for risk-significant SSCs. The list of risk-significant SSCs for ITAAC is prepared by introducing the plant's site-specific information to the list shown in Table 17.4-1 in Phase 2 of the RAP. The ITAAC is established to provide reasonable assurance that the APR1400 design has been subjected to the applicable reliability assurance activities for all risk-significant within-scope SSCs when the COL is issued (COL 17.4(2)).

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17.4.3 Operations Phase

17.4.3.1 Objective

Once operation commences, the RAP ensures that the reliability and availability of SSCs are maintained commensurate with their risk significance. This phase is implemented through regulatory requirements for SSCs, including (1) the maintenance rule program established per 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," (2) the QA program for safety-related SSCs established per Appendix B to 10 CFR Part 50, (3) QA controls for nonsafety-related SSCs established in accordance with Part V of SRP Section 17.5, and (4) the inservice inspection, inservice testing, surveillance testing, and maintenance programs. Prior to initial fuel load, the COL licensee identifies dominant failure modes and integrates the RAP into operational programs. During the operations phase of the plant, performance and condition monitoring are implemented to provide reasonable assurance that these SSCs do not degrade to an unacceptable level of reliability, availability, or condition.

17.4.3.2 Integration

The APR1400 RAP serves as a source for other administrative and operational programs. Certain risk-significant SSCs identified in the RAP may be included in existing operational programs such as Technical Specifications surveillance requirements and provide reasonable assurance that the reliability values assumed in the PRA are maintained throughout the plant life.

During the operations phase, the RAP implements measures that yield continual improvements in the PRA through the plant's existing programs for maintenance or QA. Implementation of the Maintenance Rule requirements in 10 CFR 50.65 (Reference 3) is an example of how the plant could address the enhanced treatment of certain SSCs during the operations phase. COL applicant responsibilities are listed in Subsection 17.4.4 (COL 17.4(3)).

17.4.3.3 Operating Experience

Consideration and use of operating experience is vital to the objective of the RAP. Operating experience is considered along with various PRA analytical and importance measures when developing a comprehensive risk analysis. The expert panel considers SSC operating history and industry operating experience when assessing SSC risk

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significance. For example, operating experience indicates that the reliability of motor-driven and turbine-driven pumps may be different.

A review of operating experience may reveal conditions in which previous failures of SSCs in similar design applications have led to functional failures of SSCs. The review of operating experience is not limited to hardware failure but also extends to situations in which human performance led to functional failures of SSCs with a similar system design. For example, the APR1400 design improves SSC reliability by eliminating required operator actions to switch from injection to recirculation, which is an improvement relative to conventional PWRs.

17.4.4 Combined License Information

The COL applicant responsibilities during the license application phase, and prior to the initial fuel load, are delineated in NUREG-0800. These responsibilities are not addressed in detail during the APR1400 design phase. The following paragraphs briefly summarize these D-RAP responsibilities on a preliminary basis.

COL 17.4(1) The COL applicant is to develop and implement Phases 2 and 3 of the design RAP, including QA requirements. In Phase 2, the plant's site-specific information is subjected to the D-RAP process, and the site-specific risk-significant SSCs are combined with the Phase 1 (design) risk-significant SSCs into one list for the plant. Phase 2 is performed during the COL application phase and updated/maintained during the COL license holder phase. In Phase 3, procurement, fabrication, construction, and test specifications for the SSCs within the scope of the D-RAP provide reasonable assurance that key assumptions, such as equipment reliability, are realistic and achievable. The QA requirements are implemented at this time. Phase 3 is performed during the COL license holder phase and prior to initial fuel loading.

COL 17.4(2) The COL applicant is to propose a method for incorporating the objectives of the reliability assurance program into other programs for design or operational errors that degrade non-safety-related, risk-significant SSCs.

COL 17.4(3) The COL applicant to develop and implement the RAP in the operations phase in which RAP activities are integrated into the existing operational program (e.g., Maintenance Rule, surveillance testing, inservice inspection,

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inservice testing, QA). The RAP in the operations phase also includes the process for providing corrective actions for design and operational errors that degrade non-safety-related SSCs within the scope of the RAP. A description of the proposed method for developing and integrating the operational RAP into operating plant programs (e.g., Maintenance Rule, quality assurance) is to be performed during the COL application phase. The development/integration of the O-RAP is performed during the COL license holder phase and prior to initial fuel loading. All SSCs identified as risk-significant within the scope of the design RAP are categorized as high-safety-significant (HSS) within the scope of the initial Maintenance Rule. Integration of reliability assurance activities into existing operational programs also addresses the establishment of:

a. Reliability performance goals for risk-significant SSCs consistent with the existing maintenance and quality assurance processes on the basis of information from the D-RAP. For example, implementation of the Maintenance Rule per Regulatory Guide 1.160 is one acceptable method for establishing performance goals if SSCs are categorized as HSS within the scope of the Maintenance Rule program.

b. Performance and condition monitoring requirements to provide reasonable assurance that risk-significant SSCs do not degrade to an unacceptable level during plant operations.

17.4.5 References

1. SECY 95-132, "Policy and Technical Issues Associated with the Regulatory Treatment of Non-Safety Systems (RTNSS) in Passive Plant Design," U.S. Nuclear Regulatory Commission, May 1995.

2. APR1400-K-Q-TR-11005-NP, "KHNP Quality Assurance Program Description (QAPD) for the APR1400 Design Certification," Rev. 5, KHNP, September 2014.

3. 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," U.S. Nuclear Regulatory Commission.

4. NEI 00-04, "10 CFR 50.69, SSC Categorization Guideline," Rev. 0, Nuclear Energy Institute, 2005.

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5. NUREG-0800, Standard Review Plan, Section 17.4, “Reliability Assurance Program,” Rev. 1, U.S. Nuclear Regulatory Commission, May 2014.

6. 10 CFR 52.47(b)(1), “Contents of Applications; Additional Technical Information,” 2015.

7. 10 CFR 52.80(a), “Contents of Applications; Additional Technical Information,” 2015.

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Table 17.4-1 (1 of 34)

Risk-Significant Within-Scope RAP SSCs

Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
1	AF	TP01A	Fails to Start Fails to Run	Auxiliary Feedwater Turbine-Driven Pump 1A	Level 1, Level 2, Flood, Fire, Seismic
2	AF	TP01B	Fails to Start Fails to Run	Auxiliary Feedwater Turbine-Driven Pump 1B	Level 1, Level 2, Flood, Fire, Seismic
3	AF	MDP02A	Fails to Start Fails to Run	Auxiliary Feedwater Motor-Driven Pump 2A	Level 1, Fire, Seismic
4	AF	MDP02B	Fails to Start Fails to Run	Auxiliary Feedwater Motor-Driven Pump 2B	Level 1, Fire, Seismic
5	AF	CV1003A	Fails to Open	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Check Valve	Level 1, Level 2, Fire
6	AF	CV1003B	Fails to Open	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Check Valve	Level 1, Level 2, Fire
7	AF	CV1004A	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Check Valve	Level 1, Level 2, Fire
8	AF	CV1004B	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Check Valve	Level 1, Level 2, Fire
9	AF	CV1007A	Fails to Open	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Check Valve	Level 1, Level 2, Fire
10	AF	CV1007B	Fails to Open	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Check Valve	Level 1, Level 2, Fire
11	AF	CV1008A	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Check Valve	Level 1, Level 2, Fire
12	AF	CV1008B	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Check Valve	Level 1, Level 2, Fire
13	AF	CV1012A	Fails to Open	Auxiliary Feedwater Motor-Driven Pump 2A Mini-flow Line Check Valve	Level 1, Level 2, Fire
14	AF	CV1012B	Fails to Open	Auxiliary Feedwater Motor-Driven Pump 2B Mini-flow Line Check Valve	Level 1, Level 2, Fire
15	AF	CV1014A	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1A Mini-flow Line Check Valve	Level 1, Fire

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Table 17.4-1 (2 of 34)

Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
16	AF	CV1014B	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1B Mini-flow Line Check Valve	Level 1, Fire
17	AF	MV043	Fails to Open Fails to Closed	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Isolation Valve	Level 1, Level 2, Fire
18	AF	MV044	Fails to Open Fails to Closed	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Isolation Valve	Level 1, Level 2, Fire
19	AF	MV045	Fails to Open Fails to Closed	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Isolation Valve	Level 1, Level 2
20	AF	MV046	Fails to Open Fails to Closed	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Isolation Valve	Level 1, Level 2
21	AF	SOV0035	Fails to Control Spuriously Closed	Auxiliary Feedwater Motor-Driven Pump 2A Discharge Modulation Valve	Level 2, Fire
22	AF	SOV0036	Fails to Control Spuriously Closed	Auxiliary Feedwater Motor-Driven Pump 2B Discharge Modulation Valve	Level 2, Fire
23	AF	SOV0037	Fails to Control Spuriously Closed	Auxiliary Feedwater Turbine-Driven Pump 1A Discharge Modulation Valve	Level 1
24	AF	SOV0038	Fails to Control Spuriously Closed	Auxiliary Feedwater Turbine-Driven Pump 1B Discharge Modulation Valve	Level 1
25	AF	78-15D -AF-X	Break	Auxiliary Feedwater System Piping in Room 078-A15D	Flood
26	AT	AOV009	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1A Turbine Steam Supply Isolation Valve	Level 1, Level 2
27	AT	AOV010	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1B Turbine Steam Supply Isolation Valve	Level 1, Level 2
28	AT	CV1020A	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1A Turbine Steam Supply Check Valve	Level 1, Level 2
29	AT	CV1020B	Fails to Open	Auxiliary Feedwater Turbine-Driven Pump 1B Turbine Steam Supply Check Valve	Level 1, Level 2

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Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
30	AX	AFWST	Rupture	Auxiliary Feedwater Storage Tank	Expert Panel
31	AX	CV1600	Fails to Open	Demineralized Water Line Check Valve	Level 1, Level 2
32	CA	CV1023	Fails to Open	Condenser Vacuum System - Containment Isolation Valve	LPSD Fire Level 2
33	CC	MP01A	Fails to Start Fails to Run	Component Cooling Water Pump 1A	Level 1, Level 2, Fire, Seismic
34	CC	MP01B	Fails to Start Fails to Run	Component Cooling Water Pump 1B	Level 1, Level 2, Fire, Seismic
35	CC	MP02A	Fails to Start Fails to Run	Component Cooling Water Pump 2A	Level 1, Level 2, Fire, Seismic
36	CC	MP02B	Fails to Start Fails to Run	Component Cooling Water Pump 2B	Level 1, Level 2, Fire, Seismic
37	CC	HE01A	Fails while operating	Component Cooling Water Heat Exchanger 1A	Level 1, Level 2, Fire, Seismic
38	CC	HE01B	Fails while operating	Component Cooling Water Heat Exchanger 1B	Level 1, Level 2, Fire, Seismic
39	CC	HE02A	Fails while operating	Component Cooling Water Heat Exchanger 2A	Level 1, Level 2, Fire, Seismic
40	CC	HE02B	Fails while operating	Component Cooling Water Heat Exchanger 2B	Level 1, Level 2, Fire, Seismic
41	CC	HE03A	Fails while operating	Component Cooling Water Heat Exchanger 3A	Level 1, Level 2, Fire, Seismic

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Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
42	CC	HE03B	Fails while operating	Component Cooling Water Heat Exchanger 3B	Level 1, Level 2, Fire, Seismic
43	CC	CV1001	Fails to Open	Component Cooling Water Pump 1A Discharge Check Valve	Level 1, Level 2, Fire
44	CC	CV1002	Fails to Open	Component Cooling Water Pump 1B Discharge Check Valve	Level 1, Level 2, Fire
45	CC	CV1003	Fails to Open	Component Cooling Water Pump 2A Discharge Check Valve	Level 1, Level 2, Fire
46	CC	CV1004	Fails to Open	Component Cooling Water Pump 2B Discharge Check Valve	Level 1, Level 2, Fire
47	CC	MV021	Fails to Remain Open	Component Cooling Water Heat Exchanger 1A Discharge Valve	Expert Panel
48	CC	MV022	Fails to Remain Open	Component Cooling Water Heat Exchanger 1B Discharge Valve	Expert Panel
49	CC	MV023	Fails to Remain Open	Component Cooling Water Heat Exchanger 2A Discharge Valve	Expert Panel
50	CC	MV024	Fails to Remain Open	Component Cooling Water Heat Exchanger 2B Discharge Valve	Expert Panel

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
51	CC	MV025	Fails to Open	Component Cooling Water Heat Exchanger 3A Discharge Valve	Expert Panel
52	CC	MV026	Fails to Open	Component Cooling Water Heat Exchanger 3B Discharge Valve	Expert Panel
53	CC	MV027	Fails to Open	Component Cooling Water Heat Exchanger Bypass Valve	Expert Panel
54	CC	MV028	Fails to Open	Component Cooling Water Heat Exchanger Bypass Valve	Expert Panel
55	CC	MV097	Fails to Open	Containment Spray Heat Exchanger 1A Component Cooling Water Inlet Valve	Level 1, Level 2
56	CC	MV098	Fails to Open	Containment Spray Heat Exchanger 1B Component Cooling Water Inlet Valve	Level 1, Level 2
57	CC	MV131	Fails to Open	Essential Chiller 2A Component Cooling Water Outlet Valve	Level 1, Fire
58	CC	MV132	Fails to Open	Essential Chiller 2B Component Cooling Water Outlet Valve	Level 1, Fire
59	CC	MV143	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire
60	CC	MV144	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire
61	CC	MV145	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire
62	CC	MV146	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire
63	CC	MV147	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire
64	CC	MV148	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
65	CC	MV149	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire
66	CC	MV150	Fails to Close	Component Cooling Water Non-Safety Load Line Isolation Valve	Level 1, Level 2, Fire
67	CC	MV181	Fails to Open	Emergency Diesel Generator 1C Component Cooling Water Inlet Valve	Level 1, Level 2, Fire
68	CC	MV182	Fails to Open	Emergency Diesel Generator 1D Component Cooling Water Inlet Valve	Level 1, Level 2, Fire
69	CC	MV191	Fails to Open	Emergency Diesel Generator 1A Component Cooling Water Inlet Valve	Level 1, Level 2, Fire
70	CC	MV192	Fails to Open	Emergency Diesel Generator 1B Component Cooling Water Inlet Valve	Level 1, Level 2, Fire
71	CC	MV351	Fails to Open	Shutdown Cooling Heat Exchanger 1A Component Cooling Water Inlet Valve	LPSD
72	CC	MV352	Fails to Open	Shutdown Cooling Heat Exchanger 1B Component Cooling Water Inlet Valve	LPSD
73	CC	MV383	Fails to Open	Essential Chiller 1A Component Cooling Water Outlet Valve	Expert Panel
74	CC	MV384	Fails to Open	Essential Chiller 1B Component Cooling Water Outlet Valve	Expert Panel
75	CC	TK01A	Rupture	Component Cooling Water Surge Tank 1A	Level 1, Level 2, Flood, Fire
76	CC	TK01B	Rupture	Component Cooling Water Surge Tank 1B	Level 1, Level 2, Flood, Fire
77	CD	TK01	Rupture	Condensate Deaerator Storage Tank A	Level 1
78	CD	TK02	Rupture	Condensate Deaerator Storage Tank B	Level 1
79	CS	PP01A	Fails to Start Fails to Run	Containment Spray Pump 1A	Level 1, Level 2, Fire, Seismic

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Table 17.4-1 (7 of 34)

Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
80	CS	PP01B	Fails to Start Fails to Run	Containment Spray Pump 1B	Level 1, Level 2, Fire, Seismic
81	CS	HE01A	Fails while operating	Containment Spray Heat Exchanger 1A	Level 1, Level 2, Seismic
82	CS	HE01B	Fails while operating	Containment Spray Heat Exchanger 1B	Level 1, Level 2, Seismic
83	CS	HE02A	Fails while operating	Containment Spray Mini-flow Line Heat Exchanger 2A	Seismic
84	CS	HE02B	Fails while operating	Containment Spray Mini-flow Line Heat Exchanger 2B	Seismic
85	CS	CV1001	Fails to Open	Containment Spray Pump 1A Discharge Check Valve	Level 1
86	CS	CV1002	Fails to Open	Containment Spray Pump 1B Discharge Check Valve	Level 1
87	CS	CV1007	Fails to Open	Containment Spray Heat Exchanger 1A Discharge Check Valve	Level 1, Level 2
88	CS	CV1008	Fails to Open	Containment Spray Heat Exchanger 1B Discharge Check Valve	Level 1, Level 2
89	CS	MV001	Fails to Open	Containment Spray Heat Exchanger 1A Discharge Isolation Valve	Level 1, Level 2
90	CS	MV002	Fails to Open	Containment Spray Heat Exchanger 1B Discharge Isolation Valve	Level 1, Level 2
91	CS	MV003	Fails to Open	Containment Spray Heat Exchanger 1A Discharge Isolation Valve	Level 1, Level 2
92	CS	MV004	Fails to Open	Containment Spray Heat Exchanger 1B Discharge Isolation Valve	Level 1, Level 2
93	CV	PP03	Fails to Start Fails to Run	Auxiliary Charging Pump	Level 1, Level 2, Seismic
94	CV	CV334	Fails to Open	Auxiliary Charging Pump Discharge Check Valve	Level 1
95	CV	CV189	Fails to Open	In-Containment Refueling Water Storage Tank Return Line Check Valve	Level 1, Level 2

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Table 17.4-1 (8 of 34)

Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
96	CV	MV509	Fails to Open	In-Containment Refueling Water Storage Tank Return Line Isolation Valve (Normally Closed)	Level 1, Level 2
97	CV	MV553	Fails to Open	In-Containment Refueling Water Storage Tank Return Line Isolation Valve (Normally Open)	Level 1, Level 2
98	CV	VV126	Fails to Open	In-Containment Refueling Water Storage Tank Refill Line Manual Isolation Valve	Level 1, Level 2
99	CV	VV649	Fails to Open	In-Containment Refueling Water Storage Tank Refill Line Manual Isolation Valve	Level 1, Level 2
100	CV	TK02	Rupture	Boric Acid Storage Tank	Level 1
101	CV	AV505, AV523, AV561	Fails to Close	Chemical and Volume Control System - Containment Isolation Valve	LPSD Fire Level 2
102	CV	AV506, AV522, AV560	Fails to Close	Chemical and Volume Control System - Containment Isolation Valve	Expert Panel
103	DA	AACTG	Fails to Start Fails to Run	Alternate Alternating Current Gas Turbine Generator	SBO, Level 1, Level 2, Seismic
104	DA	PP01	Fails to Start Fails to Run	Alternate Alternating Current Fuel Oil Transfer Pump	SBO, Fire
105	DA	PP02	Fails to Start Fails to Run	Alternate Alternating Current Fuel Oil Transfer Pump	SBO, Fire
106	DA	CV1005	Fails to Open	Alternate Alternating Current Fuel Oil Transfer Pump Discharge Check Valve	SBO, Expert Panel
107	DA	CV1007	Fails to Open	Alternate Alternating Current Fuel Oil Transfer Pump Discharge Check Valve	SBO, Expert Panel
108	DA	TK01	Rupture	Alternate Alternating Current Fuel Oil Storage Tank	SBO, Expert Panel
109	DA	TK02	Rupture	Alternate Alternating Current Fuel Oil Day Tank	SBO, Expert Panel

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Table 17.4-1 (9 of 34)

Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
110	DC	BC01A	Fails to Operate	Class 1E 125 V Direct Current Battery Charger 1A	Level 1, Level 2, Seismic
111	DC	BC01B	Fails to Operate	Class 1E 125 V Direct Current Battery Charger 1B	Level 1, Level 2, Seismic
112	DC	BC01C	Fails to Operate	Class 1E 125 V Direct Current Battery Charger 1C	Level 1, Level 2, Seismic
113	DC	BC01D	Fails to Operate	Class 1E 125 V Direct Current Battery Charger 1D	Level 1, Level 2, Seismic
114	DC	BC02A	Fails to Operate	Class 1E 125 V Direct Current Standby Battery Charger 2A	Level 1, Seismic
115	DC	BC02B	Fails to Operate	Class 1E 125 V Direct Current Standby Battery Charger 2B	Level 1, Seismic
116	DC	BC02C	Fails to Operate	Class 1E 125 V Direct Current Standby Battery Charger 2C	Level 1, Seismic
117	DC	BC02D	Fails to Operate	Class 1E 125 V Direct Current Standby Battery Charger 2D	Level 1, Seismic
118	DC	BT01A	Fails to Provide Output	Class 1E 125 V Direct Current Battery 1A	Level 1, Level 2, Fire, Seismic
119	DC	BT01B	Fails to Provide Output	Class 1E 125 V Direct Current Battery 1B	Level 1, Level 2, Fire, Seismic
120	DC	BT01C	Fails to Provide Output	Class 1E 125 V Direct Current Battery 1C	Level 1, Level 2, Fire, Seismic
121	DC	BT01D	Fails to Provide Output	Class 1E 125 V Direct Current Battery 1D	Level 1, Level 2, Fire, Seismic

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Table 17.4-1 (10 of 34)

Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
122	DC	MC01A	Fails to Operate	Class 1E 125 V Direct Current Bus 1A	Level 1, Level 2, Flood, Fire, Seismic
123	DC	MC01B	Fails to Operate	Class 1E 125 V Direct Current Bus 1B	Level 1, Level 2, Flood, Fire, Seismic
124	DC	MC01C	Fails to Operate	Class 1E 125 V Direct Current Bus 1C	Level 1, Level 2, Flood, Fire, Seismic
125	DC	MC01D	Fails to Operate	Class 1E 125 V Direct Current Bus 1D	Level 1, Level 2, Flood, Fire, Seismic
126	DC	MC01M	Fails to Operate	Non-Class 1E 250 V Direct Current Bus 1M	Level 1, Level 2
127	DC	MC01N	Fails to Operate	Non-Class 1E 250 V Direct Current Bus 1N	Level 1, Level 2
128	DE	AV006	Fails to Close	Radioactive Drain System - Containment Isolation Valve	Level 2
129	DE	MV005	Fails to Close	Radioactive Drain System - Containment Isolation Valve	LPSD Fire Level 2
130	DG	EDG A	Fails to Start Fails to Run	Emergency Diesel Generator A	Level 1, Level 2, LPSD, Fire, Seismic
131	DG	EDG B	Fails to Start Fails to Run	Emergency Diesel Generator B	Level 1, Level 2, LPSD, Fire, Seismic
132	DG	EDG C	Fails to Start Fails to Run	Emergency Diesel Generator C	Level 1, Level 2, LPSD, Fire, Seismic

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Table 17.4-1 (11 of 34)

Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
133	DG	EDG D	Fails to Start Fails to Run	Emergency Diesel Generator D	Level 1, Level 2, LPSD, Fire, Seismic
134	DO	PP01A	Fails to Start Fails to Run	Diesel Fuel Oil Transfer Pump 1A	Level 1, Level 2, Seismic
135	DO	PP01B	Fails to Start Fails to Run	Diesel Fuel Oil Transfer Pump 1B	Level 1, Level 2, Seismic
136	DO	PP01C	Fails to Start	Diesel Fuel Oil Transfer Pump 1C	Level 1, Level 2, Seismic
137	DO	PP01D	Fails to Run	Diesel Fuel Oil Transfer Pump 1D	Level 1, Level 2, Seismic
138	DO	PP02A	Fails to Start	Diesel Fuel Oil Transfer Pump 2A	Level 1, Level 2, Seismic
139	DO	PP02B	Fails to Run	Diesel Fuel Oil Transfer Pump 2B	Level 1, Level 2, Seismic
140	DO	PP02C	Fails to Start	Diesel Fuel Oil Transfer Pump 2C	Level 1, Level 2, Seismic
141	DO	PP02D	Fails to Run	Diesel Fuel Oil Transfer Pump 2D	Level 1, Level 2, Seismic
142	DO	CV1005A	Fails to Open	Diesel Fuel Oil Transfer Pump 1A Discharge Check Valve	Level 1, Level 2, Fire
143	DO	CV1005B	Fails to Open	Diesel Fuel Oil Transfer Pump 1B Discharge Check Valve	Level 1, Level 2, Fire
144	DO	CV1005C	Fails to Open	Diesel Fuel Oil Transfer Pump 1C Discharge Check Valve	Level 1, Level 2, Fire

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Table 17.4-1 (12 of 34)

Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
145	DO	CV1005D	Fails to Open	Diesel Fuel Oil Transfer Pump 1D Discharge Check Valve	Level 1, Level 2, Fire
146	DO	CV1007A	Fails to Open	Diesel Fuel Oil Transfer Pump 2A Discharge Check Valve	Level 1, Level 2, Fire
147	DO	CV1007B	Fails to Open	Diesel Fuel Oil Transfer Pump 2B Discharge Check Valve	Level 1, Level 2, Fire
148	DO	CV1007C	Fails to Open	Diesel Fuel Oil Transfer Pump 2C Discharge Check Valve	Level 1, Level 2, Fire
149	DO	CV1007D	Fails to Open	Diesel Fuel Oil Transfer Pump 2D Discharge Check Valve	Level 1, Level 2, Fire
150	DO	LS3025A	Fails to Operate	Diesel Fuel Oil Day Tank Level Switch	Fire
151	DO	LS3025B	Fails to Operate	Diesel Fuel Oil Day Tank Level Switch	Fire
152	DO	LS3025C	Fails to Operate	Diesel Fuel Oil Day Tank Level Switch	Fire
153	DO	LS3025D	Fails to Operate	Diesel Fuel Oil Day Tank Level Switch	Fire
154	DO	TK01A	Rupture	Diesel Fuel Oil Storage Tank A	Level 1, Level 2, Fire, Seismic
155	DO	TK01B	Rupture	Diesel Fuel Oil Storage Tank B	Level 1, Level 2, Fire, Seismic
156	DO	TK01C	Rupture	Diesel Fuel Oil Storage Tank C	Level 1, Level 2, Fire, Seismic
157	DO	TK01D	Rupture	Diesel Fuel Oil Storage Tank D	Level 1, Level 2, Fire, Seismic
158	DP	HS071A	Fails to Operate	Diverse Protection System Manual Trip Push Button	ATWS, Expert Panel
159	DP	HS071B	Fails to Operate	Diverse Protection System Manual Trip Push Button	ATWS, Expert Panel

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Table 17.4-1 (13 of 34)

Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
160	DP	PLC1	Fails to Operate	Diverse Protection System Signal Processor	ATWS, Expert Panel
161	DP	PLC2	Fails to Operate	Diverse Protection System Signal Processor	ATWS, Expert Panel
162	FP	055-05 -FP-X	Break	4 in and 6 in Fire Protection System piping in stairwell 055-A05D	Flood
163	FP	78-01D -FP-M	Break	4 to 8 in Fire Protection System piping in room 078-A01D	Flood
164	FP	78-10C -FP-M	Break	4 to 8 in Fire Protection System piping in room 078-A10C	Flood
165	FP	78-19A -FP-M	Break	2.5 to 8 in Fire Protection System piping in room 078-A19A	Flood
166	FP	78-19A -FP-X	Break	2.5 to 8 in Fire Protection System piping in room 078-A19A	Flood
167	FP	78-19B -FP-X	Break	1 to 8 in Fire Protection System piping in room 078-A19B	Flood
168	FP	78-31A -FP-M	Break	4 in and 8 in Fire Protection System piping in room 078-A31A	Flood
169	FP	78-31A -FP-X	Break	4 in and 8 in Fire Protection System piping in room 078-A31A	Flood
170	FP	78-44B -FP-X	Break	2 to 8 in Fire Protection System piping in room 078-A44B	Flood
171	FP	100-10B -FP-X	Break	3 in and 8 in Fire Protection System piping in room 078-A10B	Flood
172	FP	100-20A -FP-X	Break	2.5 in to 12 in Fire Protection System piping in room 100-A20A	Flood

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Table 17.4-1 (14 of 34)

Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
173	FP	100-22A-FP-X	Break	4 in and 6 in Fire Protection System piping in room 100-A22A	Flood
174	FP	100-37B-FP-X	Break	2.5 in to 4 in Fire Protection System piping in room 100-A37B	Flood
175	FP	120-11B-FP-X	Break	8 in Fire Protection System piping in room 120-A11B	Flood
176	FP	137-09C-FP-X	Break	4 to 8 in Fire Protection System piping in room 137-A09C	Flood
177	FP	137-13B-FP-M	Break	1 in and 1.5 in Fire Protection System piping in room 137-A13B	Flood
178	FP	137-29B-FP-X	Break	4 to 8 in Fire Protection System piping in room 137-A29B	Flood
179	FW	CV1026	Fails to Open	Startup Feedwater Pump Discharge Check Valve	Level 1
180	FW	MP07	Fails to Start Fails to Run	Startup Feedwater Pump	Level 1, Level 2
181	FW	MV093	Fails to Open	Startup Feedwater Pump Discharge Isolation Valve	Level 1
182	FW	ZV058	Fails to Open	Startup Feedwater Pump Discharge Stop Check Valve	Level 1
183	GW	SV002	Fails to Close	Gaseous Radwaste System - Containment Isolation Valve	Level 2
184	GW	-	Fails to Operate	Key SSCs in Gaseous Waste Management System	Expert Panel
185	HG	PAR	Fails to Operate	Passive Autocatalytic Recombiners	Level 2
186	HG	Igniter	Fails to Operate	Hydrogen Igniters	Expert Panel
187	IP	IN01A	Fails to Operate	Class 1E 120 V Alternating Current Inverter 1A	Level 1, Level 2, Fire, Seismic

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
188	IP	IN01B	Fails to Operate	Class 1E 120 V Alternating Current Inverter 1B	Level 1, Level 2, Fire, Seismic
189	IP	IN01C	Fails to Operate	Class 1E 120 V Alternating Current Inverter 1C	Level 1, Level 2, Fire, Seismic
190	IP	IN01D	Fails to Operate	Class 1E 120 V Alternating Current Inverter 1D	Level 1, Level 2, Fire, Seismic
191	IW	CFS Valves - MV001/ 002 /003/004	Fails to Open	Cavity Flooding System Isolation Valves	Level 2
192	MS	MSIV-EV011, EV012, EV013, EV014	Fails to Close	Main Steam Isolation Valves	Level 1, Level 2
193	MS	MSSV-1301/ 1303/ 1305/ 1307/ 1309/ 1302/ 1304/ 1306/ 1308/ 1310/ 1311/ 1313/ 1315/ 1317/ 1319/ 1312/ 1314/ 1316/ 1318/ 1320	Fails to Open	Main Steam Safety Valves	Level 1, Level 2

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
194	MS	AOV109/ 110	Fails to Open	Auxiliary Feedwater Pump Turbine Steam Supply Valves	Level 1, Level 2
195	NB	SW01M	Fails to Operate	Non-1E 4.16 kV Switchgear	Level 1, Level 2
196	NB	SW02N	Fails to Operate	Non-1E 4.16 kV Switchgear	Level 1, Level 2
197	NB	SW03N-F2	Fails to Operate	Non-1E 4.16 kV Switchgear Circuit Breaker	Level 1, Level 2
198	NB	SW03N-G2	Fails to Operate	Non-1E 4.16 kV Switchgear Circuit Breaker	Level 1, Level 2
199	NG	LC05N	Fails to Operate	Non-1E 480 V Load Center	Level 1, Level 2
200	NG	LC10M	Fails to Operate	Non-1E 480 V Load Center	Level 1, Level 2
201	NG	TR05N	Fails to Operate	Non-1E 480 V Load Center Transformer	Level 1, Level 2
202	NG	TR10M	Fails to Operate	Non-1E 480 V Load Center Transformer	Level 1, Level 2
203	NH	MC03M	Fails to Operate	Non-1E 480 V Motor Control Center	Level 1, Level 2
204	NH	MC20N	Fails to Operate	Non-1E 480 V Motor Control Center	Level 1, Level 2
205	NP	SW02N	Fails to Operate	Non-1E 13.8 kV Switchgear Bus	Level 1
206	NP	TR02M	Fails to Operate	Standby Auxiliary Transformer	Fire
207	NP	TR02N	Fails to Operate	Standby Auxiliary Transformer	Fire

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Table 17.4-1 (17 of 34)

Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
208	PF	SW01A	Fails to Operate	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
209	PF	SW01B	Fails to Operate	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
210	PF	SW01C	Fails to Operate	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
211	PF	SW01D	Fails to Operate	Class 1E 4.16 kV Switchgear	Level 1, Level 2, Flood, Seismic
212	PF	SW01A-H2	Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire
213	PF	SW01B-H2	Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire
214	PF	SW01C-C2	Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire
215	PF	SW01D-G2	Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Unit Auxiliary Transformer)	Level 1, Level 2, Fire

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Table 17.4-1 (18 of 34)

Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
216	PF	SW01A-A2	Fails to Close Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire
217	PF	SW01B-A2	Fails to Close Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire
218	PF	SW01C-A2	Fails to Close Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire
219	PF	SW01D-J2	Fails to Close Fails to Open	Class 1E 4.16 kV Switchgear Circuit Breaker (Standby Auxiliary Transformer)	Fire
220	PF	SW01A-G2	Fails to Close	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2
221	PF	SW01B-B2	Fails to Close	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2
222	PF	SW01C-E2	Fails to Close	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2
223	PF	SW01D-D2	Fails to Close	Class 1E 4.16 kV Switchgear Circuit Breaker (Alternate Alternating Current)	Level 1, Level 2
224	PG	LC01A	Fails to Operate	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic
225	PG	LC01B	Fails to Operate	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
226	PG	LC01C	Fails to Operate	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic
227	PG	LC01D	Fails to Operate	Class 1E 480 V Load Center	Level 1, Level 2, Flood, Fire, Seismic
228	PG	LC02	Fails to Operate	Class 1E 480 V Load Center	Level 1, Seismic
229	PG	LC02A	Fails to Operate	Class 1E 480 V Load Center	Fire
230	PG	LC02B	Fails to Operate	Class 1E 480 V Load Center	Fire
231	PG	LC02C	Fails to Operate	Class 1E 480 V Load Center	Fire
232	PG	LC02D	Fails to Operate	Class 1E 480 V Load Center	Fire
233	PG	TR01A	Fails to Operate	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic
234	PG	TR01B	Fails to Operate	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic
235	PG	TR01C	Fails to Operate	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic
236	PG	TR01D	Fails to Operate	Class 1E 480 V Load Center Transformer	Level 1, Level 2, Flood, Fire, Seismic
237	PG	TR02A	Fails to Operate	Class 1E 480 V Load Center Transformer	Fire
238	PG	TR02B	Fails to Operate	Class 1E 480 V Load Center Transformer	Fire
239	PG	TR02C	Fails to Operate	Class 1E 480 V Load Center Transformer	Fire

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
240	PG	TR02D	Fails to Operate	Class 1E 480 V Load Center Transformer	Fire
241	PH	MC01A	Fails to Operate	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic
242	PH	MC01B	Fails to Operate	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic
243	PH	MC01C	Fails to Operate	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic
244	PH	MC01D	Fails to Operate	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic
245	PH	MC02A	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
246	PH	MC02B	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
247	PH	MC02C	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
248	PH	MC02D	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
249	PH	MC03A	Fails to Operate	Class 1E 480V Motor Control Center	Fire, Seismic
250	PH	MC03B	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
251	PH	MC03C	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
252	PH	MC03D	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
253	PH	MC04C	Fails to Operate	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
254	PH	MC04D	Fails to Operate	Class 1E 480 V Motor Control Center	Level 1, Level 2, Fire, Seismic
255	PH	MC05A	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
256	PH	MC05B	Fails to Operate	Class 1E 480 V Motor Control Center	Fire, Seismic
257	PS	AV031, AV032, AV033, AV034	Fails to Close	Process Sampling System - Containment Isolation Valve	LPSD Fire Level 2
258	RC	MV 130/131, MV 132/133, MV 134/135, MV 136/137	Fails to Open	POSRV Pilot Valves	Seismic
259	RC	POSRVs V200, V201, V202, V203	Fails to Open	Pressurizer Pilot Operated Safety Relief Valves	Level 1, Level 2, Seismic
260	RC	PT102 A/B/C/D	Fails to Operate	Pressurizer Low Pressure Transmitters	Fire
261	RG	SOV 410/412	Fails to Close	Pressurizer Gas Vent Line Isolation Valves	Expert Panel
262	RG	SOV 411/413	Fails to Close	Pressurizer Gas Vent Line Isolation Valves	Expert Panel
263	RG	SOV 415/417	Fails to Close	Reactor Vessel Gas Vent Line Isolation Valves	Expert Panel
264	RG	SOV 414/416	Fails to Open	Reactor Vessel Gas Vent Line Isolation Valves	Expert Panel
265	RG	SOV418	Fails to Open	Reactor Vessel Gas Vent Line Reactor Drain Tank Discharge Isolation Valve	Expert Panel

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
266	RG	SOV 419/420	Fails to Open	Reactor Vessel Gas Vent Line In-Containment Refueling Water Storage Tank Discharge Isolation Valves	Expert Panel
267	RP	TCB-A1/B1/C1/D1	Fails to Open	Reactor Trip Circuit Breakers A1/B1/C1/D1	Level 1, ATWS
268	RP	TCB-A2/B2/C2/D2	Fails to Open	Reactor Trip Circuit Breakers A2/B2/C2/D2	Level 1, ATWS
269	SI	CV100	Fails to Open	Safety Injection Pump 2A/2C In-Containment Refueling Water Storage Tank Return Line Check Valve	Level 1, Level 2, Fire
270	SI	CV101	Fails to Open	Safety Injection Pump 2B/2D In-Containment Refueling Water Storage Tank Return Line Check Valve	Level 1, Level 2, Fire
271	SI	CV113	Fails to Open	Safety Injection Pump 2D Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
272	SI	CV123	Fails to Open	Safety Injection Pump 2B Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
273	SI	CV133	Fails to Open	Safety Injection Pump 2C Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
274	SI	CV143	Fails to Open	Safety Injection Pump 2A Injection Line Check Valve	Level 1, Level 2, LPSD, Fire
275	SI	CV157	Fails to Open	Containment Spray Pump 1A In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Level 2, Fire
276	SI	CV158	Fails to Open	Containment Spray Pump 1B In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Level 2, Fire

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
277	SI	CV159	Fails to Open	Shutdown Cooling Pump 1A In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Fire
278	SI	CV160	Fails to Open	Shutdown Cooling Pump 1B In-Containment Refueling Water Storage Tank Suction Line Check Valve	Level 1, Fire
279	SI	CV168	Fails to Open	Shutdown Cooling Heat Exchanger 1B Discharge Line Check Valve	Expert Panel
280	SI	CV178	Fails to Open	Shutdown Cooling Heat Exchanger 1A Discharge Line Check Valve	Expert Panel
281	SI	CV217	Fails to Open	Safety Injection Line Check Valve - DVI Nozzle 1B	Level 1, Level 2, LPSD, Fire
282	SI	CV227	Fails to Open	Safety Injection Line Check Valve - DVI Nozzle 2B	Level 1, Level 2, LPSD, Fire
283	SI	CV237	Fails to Open	Safety Injection Line Check Valve - DVI Nozzle 2A	Level 1, Level 2, LPSD, Fire
284	SI	CV247	Fails to Open	Safety Injection Line Check Valve - DVI Nozzle 1A	Level 1, Level 2, LPSD, Fire
285	SI	CV404	Fails to Open	Safety Injection Pump 2A Discharge Check Valve	Level 1, Level 2, Fire
286	SI	CV405	Fails to Open	Safety Injection Pump 2B Discharge Check Valve	Level 1, Level 2, Fire
287	SI	CV446	Fails to Open	Safety Injection Pump 2D Discharge Check Valve	Level 1, Level 2, Fire
288	SI	CV424	Fails to Open	Safety Injection Pump 2A Mini-flow Line Check Valve	Level 1, Level 2, Fire
289	SI	CV426	Fails to Open	Safety Injection Pump 2B Mini-flow Line Check Valve	Level 1, Level 2, Fire
290	SI	CV448	Fails to Open	Safety Injection Pump 2D Mini-flow Line Check Valve	Level 1, Level 2, Fire

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
291	SI	CV451	Fails to Open	Safety Injection Pump 2C Mini-flow Line Check Valve	Level 1, Level 2, Fire
292	SI	CV540	Fails to Open	Safety Injection Pump 2D Discharge Check Valve	Level 1, LPSD, Fire
293	SI	CV541	Fails to Open	Safety Injection Pump 2B Discharge Check Valve	Level 1, LPSD, Fire
294	SI	CV542	Fails to Open	Safety Injection Pump 2C Discharge Check Valve	Level 1, LPSD, Fire
295	SI	CV543	Fails to Open	Safety Injection Pump 2A Discharge Check Valve	Level 1, LPSD, Fire
296	SI	CV568	Fails to Open	Shutdown Cooling Pump 1A Discharge Check Valve	Level 1, Fire
297	SI	CV569	Fails to Open	Shutdown Cooling Pump 1B Discharge Check Valve	Level 1, Fire
298	SI	PP01A	Fails to Start Fails to Run	Shutdown Cooling Pump 1A	Level 1, Level 2, LPSD, Fire, Seismic
299	SI	PP01B	Fails to Start Fails to Run	Shutdown Cooling Pump 1B	Level 1, Level 2, LPSD, Fire, Seismic
300	SI	HE01A	Fails to Operate	Shutdown Cooling Heat Exchanger 1	LPSD, Seismic
301	SI	HE01B	Fails to Operate	Shutdown Cooling Heat Exchanger 2	LPSD, Seismic
302	SI	HE02A	Fails to Operate	Shutdown Cooling Mini-flow Line Heat Exchanger 1	Seismic
303	SI	HE02B	Fails to Operate	Shutdown Cooling Mini-flow Line Heat Exchanger 2	Seismic
304	SI	PP02A	Fails to Start Fails to Run	Safety Injection Pump 2A	Level 1, Level 2, LPSD, Fire, Seismic

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
305	SI	PP02B	Fails to Start Fails to Run	Safety Injection Pump 2B	Level 1, Level 2, LPSD, Fire, Seismic
306	SI	PP02C	Fails to Start Fails to Run	Safety Injection Pump 2C	Level 1, Level 2, LPSD, Fire, Seismic
307	SI	PP02D	Fails to Start Fails to Run	Safety Injection Pump 2D	Level 1, Level 2, LPSD, Fire, Seismic
308	SI	MV616	Fails to Open	Safety Injection Pump 2D Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire
309	SI	MV626	Fails to Open	Safety Injection Pump 2B Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire
310	SI	MV636	Fails to Open	Safety Injection Pump 2C Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire
311	SI	MV646	Fails to Open	Safety Injection Pump 2A Discharge Isolation Valve	Level 1, Level 2, LPSD, Fire
312	SI	MV302	Fails to Open	Safety Injection Pump 2A/2C Mini-flow Line Isolation Valve	Fire
313	SI	MV303	Fails to Open	Safety Injection Pump 2B/2D Mini-flow Line Isolation Valve	Fire
314	SI	MV395	Fails to Open	Safety Injection Pump 2A/2C Mini-flow Line Isolation Valve	Fire
315	SI	MV308	Fails to Open	In-Containment Refueling Water Storage Tank Suction Line Isolation Valve	LPSD Level 2
316	SI	MV309	Fails to Open	In-Containment Refueling Water Storage Tank Suction Line Isolation Valve	LPSD Level 2
317	SX	PP01A	Fails to Start Fails to Run	Essential Service Water Pump 1A	Level 1, Level 2, Fire, Seismic

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
318	SX	PP01B	Fails to Start Fails to Run	Essential Service Water Pump 1B	Level 1, Level 2, Fire, Seismic
319	SX	PP02A	Fails to Start Fails to Run	Essential Service Water Pump 2A	Level 1, Level 2, Fire, Seismic
320	SX	PP02B	Fails to Start Fails to Run	Essential Service Water Pump 2B	Level 1, Level 2, Fire, Seismic
321	SX	CV1001	Fails to Open	Essential Service Water Pump 1A Discharge Check Valve	Level 1, Level 2, Fire
322	SX	CV1002	Fails to Open	Essential Service Water Pump 1B Discharge Check Valve	Level 1, Level 2, Fire
323	SX	CV1003	Fails to Open	Essential Service Water Pump 2A Discharge Check Valve	Level 1, Level 2, Fire
324	SX	CV1004	Fails to Open	Essential Service Water Pump 2B Discharge Check Valve	Level 1, Level 2, Fire
325	SX	FT01A, FT01B, FT02A, FT02B, FT03A, FT03B	Fails to Operate	Essential Service Water Debris Filters	Level 1, Level 2, Fire, LPSD Fire, LPSD Fire Level 2
326	SX	MV071	Fails to Open	Ultimate Heat Sink Cooling Tower 1A Discharge Line Control Valve	Level 1, Level 2
327	SX	MV072	Fails to Open	Ultimate Heat Sink Cooling Tower 1A Discharge Line Bypass Valve	Level 1, Level 2
328	SX	MV073	Fails to Open	Ultimate Heat Sink Cooling Tower 1B Discharge Line Control Valve	Level 1, Level 2
329	SX	MV074	Fails to Open	Ultimate Heat Sink Cooling Tower 1B Discharge Line Bypass Valve	Level 1, Level 2
330	SX	AH01A	Fails to Run	Ultimate Heat Sink Cooling Tower Fan 1A	Level 1, Level 2, Fire
331	SX	AH01B	Fails to Run	Ultimate Heat Sink Cooling Tower Fan 1B	Level 1, Level 2, Fire

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
332	SX	AH02A	Fails to Start Fails to Run	Ultimate Heat Sink Cooling Tower Fan 2A	Level 1, Level 2, Fire
333	SX	AH02B	Fails to Start Fails to Run	Ultimate Heat Sink Cooling Tower Fan 2B	Level 1, Level 2, Fire
334	VD	HV12A	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant A	Level 1, Level 2, LPSD, Fire, Seismic
335	VD	HV12B	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant B	Level 1, Level 2, LPSD, Fire, Seismic
336	VD	HV12C	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant C	Level 1, Level 2, LPSD, Fire, Seismic
337	VD	HV12D	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant D	Level 1, Level 2, LPSD, Fire, Seismic
338	VD	HV13A	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant A	Level 1, Level 2, LPSD, Fire, Seismic
339	VD	HV13B	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant B	Level 1, Level 2, LPSD, Fire, Seismic
340	VD	HV13C	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant C	Level 1, Level 2, LPSD, Fire, Seismic
341	VD	HV13D	Fails to Start Fails to Run	Emergency Diesel Generator Room Emergency Cubicle Cooler - Quadrant D	Level 1, Level 2, LPSD, Fire, Seismic

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
342	VK	Y1301A	Fails to Open	Auxiliary Building Controlled Area I Emergency Core Cooling System Equipment Room Air Cleaning Unit Exhaust Damper	Seismic
343	VK	Y1301B	Fails to Open	Auxiliary Building Controlled Area II Emergency Core Cooling System Equipment Room Air Cleaning Unit Exhaust Damper	Seismic
344	VO	HV31A	Fails to Run	Essential Chiller 1A Room Cubicle Cooler	Level 1, Level 2
345	VO	HV31B	Fails to Run	Essential Chiller 1B Room Cubicle Cooler	Level 1, Level 2
346	VO	HV32A	Fails to Start Fails to Run	Essential Chiller 2A Room Cubicle Cooler	Level 1, Level 2
347	VO	HV32B	Fails to Start Fails to Run	Essential Chiller 2B Room Cubicle Cooler	Level 1, Level 2
348	VO	HV33A	Fails to Start Fails to Run	Auxiliary Feedwater Motor-Driven Pump 2A Room Cubicle Cooler	Level 1, Level 2, Fire
349	VO	HV33B	Fails to Start Fails to Run	Auxiliary Feedwater Motor-Driven Pump 2B Room Cubicle Cooler	Level 1, Level 2, Fire
350	VO	TE085A	Fails to Operate	Auxiliary Feedwater Motor-Driven Pump 2A Room Temperature Transmitter	Level 1, Level 2, Fire
351	VO	TE086B	Fails to Operate	Auxiliary Feedwater Motor-Driven Pump 2B Room Temperature Transmitter	Level 1, Level 2, Fire
352	VQ	2014/2016 /2024	Fails to Close	Reactor Containment Building Purge System – Leak Rate Test Line Valves	Level 2, LPSD Fire Level 2
353	WM	VV1201A	Fails to Open	Raw Water Pump Supply Isolation Manual Valve	Level 1, Level 2
354	WM	VV1205	Fails to Open	Raw Water Pump Discharge Isolation Manual Valve	Level 1, Level 2
355	WM	VV1220	Fails to Open	Raw Water Pump Discharge Isolation Manual Valve	Level 1, Level 2

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Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
356	WM	VV1700	Fails to Open	Raw Water Pump Discharge Isolation Manual Valve	Level 1, Level 2
357	WO	PP01A	Fails to Run	Essential Chilled Water Pump 1A	Level 1, Level 2, Fire, Seismic
358	WO	PP01B	Fails to Run	Essential Chilled Water Pump 1B	Level 1, Level 2, Fire, Seismic
359	WO	PP02A	Fails to Start Fails Run	Essential Chilled Water Pump 2A	Level 1, Level 2, Fire, Seismic
360	WO	PP02B	Fails to Start Fails to Run	Essential Chilled Water Pump 2B	Level 1, Level 2, Fire, Seismic
361	WO	CV1010A	Fails to Open Fails to Close	Essential Chilled Water Pump 1A Discharge Check Valve	Level 1, Fire
362	WO	CV1010B	Fails to Open Fails to Close	Essential Chilled Water Pump 1B Discharge Check Valve	Level 1, Fire
363	WO	CV1014A	Fails to Open Fails to Close	Essential Chilled Water Pump 2A Discharge Check Valve	Level 1, Fire
364	WO	CV1014B	Fails to Open Fails to Close	Essential Chilled Water Pump 2B Discharge Check Valve	Level 1, Fire
365	WO	CH01A	Fails to Start Fails to Run	Essential Chiller 1A (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire
366	WO	CH01B	Fails to Start Fails to Run	Essential Chiller 1B (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire
367	WO	CH02A	Fails to Start Fails to Run	Essential Chiller 2A (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire
368	WO	CH02B	Fails to Start Fails to Run	Essential Chiller 2B (includes evaporator, compressor, condenser and associated piping)	Level 1, Level 2, Fire

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Index	System [1]	SSC ID	Failure Mode	SSC Description	Within-Scope Basis [2]
369	WO	TK01A	Rupture	Essential Chilled Water Compression Tank 1A	Level 1, Level 2, Flood, Fire
370	WO	TK01B	Rupture	Essential Chilled Water Compression Tank 1B	Level 1, Level 2, Flood, Fire
371	WO	TK02A	Rupture	Essential Chilled Water Air Separator Tank 2A	Level 1, Level 2, Flood, Fire
372	WO	TK02B	Rupture	Essential Chilled Water Air Separator Tank 2B	Level 1, Level 2, Flood, Fire
373	FP	-	Fails to Start Fails to Run	Fire Protection Pumps and Associated SSCs	Fire Protection, Expert Panel
374	Light Load Handling System	-	Fails to Operate	Key SSCs in Light Load Handling System	Expert Panel
375	Liquid Waste Management System	-	Fails to Operate	Key SSCs in Liquid Waste Management System	Expert Panel
376	Control Room HVAC System	-	Fails to Operate	Main Control Room Air Handling Units and Air Cleaning Unit	Expert Panel
377	Emergency Containment Spray Backup System	-	Fail to Operate	Key SSCs in Emergency Containment Spray Backup System	LPSD Level 2, LPSD Fire Level 2
378	VG	ESW Pump Room Cooling	Fails to Operate	Key SSCs in Essential Service Water Pump Room Cooling Function	Level 1, Fire, Seismic, LPSD Fire Level 2

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Index	System (1)	SSC ID	Failure Mode	SSC Description	Within-Scope Basis (2)
379	VU	AAC Building Cooling	Fails to Operate	Key SSCs in Alternate Alternating Current Building Cooling Function	SBO, Expert Panel, LPSD Fire, LPSD Fire Level 2
380	EF-Group Controller	PA03A, PA03B, PA03C, PA03D, PA06C, PA06D	Fails to Operate	Group Controller (Engineered Safety Function Actuation System)	LPSD Fire, LPSD Fire Level 2
381	PE-Loop Controller	LX01A, LX02B, LX03A, LX03B, LX03C, LX03D, LX04A, LX04B, LX05A, LX05B	Fails to Operate	Loop Controller (Engineered Safety Feature - Component Control System)	LPSD Fire, LPSD Fire Level 2
382	PE-Loop Controller	LX06A, LX06B, LX09B, LX10A, LX10B	Fails to Operate	Loop Controller (Engineered Safety Feature - Component Control System)	LPSD Fire Level 2
383	-	-	Fails to Integrity	Containment Building	Expert Panel
384	-	-	Fails to Isolate	Containment Equipment Hatch	Level 2
385	-	-	Fails to Operate	Remote Shutdown Console	Expert Panel

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(1) System codes table

System Codes	System Description
AF	Auxiliary Feedwater System
AT	Auxiliary Feedwater Pump Turbine System
AX	Auxiliary Feedwater Storage and Transfer System
CA	Condenser Vacuum System
CC	Component Cooling Water System
CD	Condensate System
CS	Containment Spray System
CV	Chemical and Volume Control System
DA	Alternate Alternating Current Gas Turbine Generator
DC	Direct Current Distribution System
DE	Radioactive Drain System
DG	Emergency Diesel Generator System
DO	Diesel Fuel Oil Transfer System
DP	Diverse Protection System
EF	Engineered Safety Function Actuation System
FP	Fire Protection System
FW	Feedwater System
GW	Gaseous Waste Management System
HG	Containment Hydrogen Control System
IP	Instrument Power System
IW	In-Containment Water Storage System
MS	Main Steam System
NB	Non Class 1E 4.16KV System
NG	Non Class 1E 480V Load Center System
NH	Non Class 1E 480V Motor Control Center & Low Voltage System
NP	13.8KV Power System
PE	Engineered Safety Feature - Component Control System
PF	Class 1E 4.16KV System
PG	Class 1E 480V Load Center System

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System Codes	System Description
PH	Class 1E 480V Motor Control Center & Low Voltage System
PS	Process Sampling System
RC	Reactor Coolant System
RG	Reactor Coolant Gas Vent System
RP	Reactor Protection System
SI	Safety Injection/Shutdown Cooling System
SX	Essential Service Water System
VD	Emergency Diesel Generator Area Heating, Ventilation, and Air conditioning System
VG	ESW Intake Structure/CCW heat Exchanger Building Heating, Ventilation, and Air conditioning System
VK	Auxiliary Building Controlled Area Heating, Ventilation, and Air conditioning System
VO	Auxiliary Building Clean Area Heating, Ventilation, and Air conditioning
VQ	Reactor Containment Building Purge System
VU	Miscellaneous Building Heating, Ventilation, and Air conditioning System
WM	Makeup Demineralizer System
WO	Essential Chilled Water System

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(2) Codes table for scope basis explanations.

Scope Basis	Description
Level 1	Results of Level 1 PRA at full power
Level 2	Results of Level 2 PRA at full power
LPSD	Results of Low Power and Shutdown Level 1 PRA
Flood	Results of Level 1 Internal Flooding PRA
Fire	Results of Level 1 Internal Fire PRA
Seismic	Results of Seismic Margin Analysis (based on qualitative analysis)
Expert Panel	Decision made by the RAP expert panel
ATWS	Per 10 CFR 50.62 and Generic Letter 85-06, "Quality Assurance Guidance for ATWS Equipment That Is Not Safety-Related"
Fire Protection	Per 10 CFR 50.48 and Regulatory Position 1.7, "Quality Assurance," in RG 1.189, "Fire Protection for Operating Nuclear Power Plants"
SBO	Per 10 CFR 50.63 and Regulatory Position 3.5, "Quality Assurance and Specific Guidance for SBO Equipment That Is Not Safety-Related," and Appendix A, "Quality Assurance Guidance for Non-Safety Systems and Equipment," in RG 1.155, "Station Blackout"

Note: Risk criteria for Level 1, Level 2, LPSD, Flood and Fire PRAs are as follows:

FV > 0.005 for independent basic events,
RAW > 2.0 for independent basic events, or
RAW > 20 for common cause events.

1. SX (including UHS) and VG are parts of the conceptual design information (CDI), and the within scope SSCs applicability will follow the conditions specified in Section 1.8.
2. Potential within scope SSCs associated with loss of large area (LOLA) and aircraft impact assessment (AIA) described in Sections 19.4 and 19.5 are not included in this table.

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17.4 Reliability Assurance Program Guidance

17.4.1 Overview

The APR1400 Reliability Assurance Program (RAP) identifies Systems, Structures and Components (SSCs) that are risk-significant, or significant contributors to plant safety. This determination is based upon a review of all available quantitative (PRA) and qualitative information about each SSC. These risk-significant components are tabled on the RAP list, which is issued to the Design Engineering, Operations, Maintenance and Quality Assurance departments. These organizations utilize the RAP list of risk-significant SSCs to provide reasonable assurance of the following:

- The APR1400 is designed, constructed, and operated in a manner that is consistent with the risk insights and key assumptions (e.g., SSC design, reliability, and availability) from the probabilistic, deterministic, and other methods of analysis used to identify and quantify risk.
- The RAP SSCs do not degrade to an unacceptable level of reliability, availability or condition during plant operations.
- The frequency of transients that challenge these SSCs is minimized.
- These SSCs will function reliably when challenged.

This section describes the RAP as it has been established for the design phase of the APR1400, and identifies those program elements that will be developed in the Combined License phase.

17.4.2 Reliability Assurance Program Scope, Stages, and Goals

Scope. The APR1400 Reliability Assurance Program identifies *risk-significant* components for the departments that are tasked to achieve the RAP objectives summarized above. The RAP scope includes all plant Systems, Structures and Components that have been identified by the RAP Expert Panel as risk-significant, based upon a review of all available quantitative and qualitative risk information. This information is presented in the RAP list (Table 17.4-1).

Stages. The RAP is implemented in two stages. The first stage, the Design Reliability Assurance Program (D-RAP), encompasses the reliability assurance activities that occur before initial fuel load. The D-RAP is applicable during the APR1400 design certification, licensing and plant construction. The second stage comprises the reliability assurance activities conducted during the operations phase of the plant's license.

construction phase.

Goals. The goal of the RAP during the design stage is to ensure that the reactor design meets the purposes identified in Section 17.4.1 above, through the reactor design, procurement, fabrication, construction and preoperational testing activities and programs.

The goal of the RAP during the operations stage is to ensure that the reliability of the SSCs within the RAP scope (i.e., all risk-significant components) is maintained.

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17.4.3 Reliability Assurance Program Implementation

17.4.3.1 Description

The RAP is implemented in three phases. These include the following:

- Design certification (DC)
- Combined License (COL) application, including construction
- Operation

phase

phase

phase

applicant

Once the COL phase is complete and fuel load commences, the RAP ends and its functions are assumed by specific plant programs such as the Maintenance Rule.

During the design phase, the APR1400 designer, Korea Hydro & Nuclear Power Co., Ltd. (KHNP), implemented the Design Reliability Assurance Program. At the same time, KHNP developed and updates the quantitative probabilistic risk model and generates importance statistics for all modeled components. These results were provided to the Expert Panel, which supplemented the quantitative PRA results with all available qualitative information and established the RAP scope of components. The RAP list of risk-significant components is maintained, updated and issued to all interfacing organizations, each of which has a role in achieving the RAP goals. As a design certification activity, this phase is the responsibility of KHNP.

17.4.3.2 Programmatic Controls

17.4.3.2.1 Organizations

The D-RAP is implemented by the following departments:

- The Design Engineering department holds the lead responsibility for implementing the Reliability Assurance Program. Duties include RAP oversight and the issuance of the RAP SSC list to impacted organizations.
- The Risk Management department includes the Probabilistic Risk Analysis staff, which maintains the PRA model and provides risk input for the Reliability Assurance Program. The PRA engineer also provides risk input during design reviews.
- The Operations department participates in the Expert Panel's duties and minimizes RAP component unavailability.
- The Site Engineering department provides system engineering expertise for the Expert Panel.
- The Maintenance department participates in the Expert Panel's duties, ensures that RAP component maintenance is effective and unavailability is minimized.
- The Safety Engineering department provides safety analysis expertise for the Expert Panel.
- The Quality Assurance department participates in the Expert Panel's duties. The QA department focuses on RAP components in audits and other activities.

All organizations are expected to proactively identify new issues and concerns that may affect the RAP scope and impact any aspect of plant design and operation.

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17.4.3.2.2 Design Control

Plant changes and D-RAP updates. Proposed design changes include a risk review to ensure that reliability is reasonably optimized and risk significance is minimized.

The Reliability Assurance Program evaluates plant changes also. Following each PRA model update, the PRA engineer reviews the new importance statistics for all modeled components. These results are provided to the Expert Panel. The Panel supplements the PRA input with qualitative insights in order to update the RAP scope.

The scope may be reviewed, between PRA model updates, if warranted by important design changes or new information. Interim reviews may be requested by any member of the Expert Panel. Interim reviews are entirely qualitative, pending a PRA model update when applicable.

RAP Scope Update Notifications. Following each revision of the RAP list, the Expert Panel provides a timely, written update to all interfacing organizations.

Quality Controls. Section 19.1.2 of the APR1400 Design Certification Document (Reference 11) discusses PRA model quality, including personnel qualification requirements, procedures and corrective action. This text summarizes the PRA model quality bases as required by SRP Sections 19.0 (Reference 12) and 17.4 (Reference 13). These quality controls govern PRA model revisions, quantification and the generation of the importance measures that are used as key input data for the RAP risk classification. Issues are tracked by the Corrective Action Program.

Configuration Control. The RAP list of risk-significant components is established and maintained by the Expert Panel. Potential changes include both the scope of systems, structures and components, as well as their dominant failure modes.

17.4.3.2.3 Implementing Procedures

The Reliability Assurance Program is implemented via procedures which control the following:

- RAP duties and responsibilities.
- Expert Panel activities.
- Design changes.
- Risk Management.
- Inspections and audits.

17.4.3.2.4 Corrective Action Program

The Corrective Action Program (CAP) is a web-based reporting and tracking system. It is used to document any D-RAP activities that are determined to be in error, deficient, or nonconforming. CAP issues are tracked to resolution and documented.

"A" (4/36)

17.4.3.2.5 Records

Required RAP documentation includes the following:

- Panel membership requirements and qualifications
- Component Risk Significance Evaluation sheets
- RAP Scope Table
- Expert Panel meeting minutes
- Design change request reviews
- General quality requirements, design control, personnel training and qualification

17.4.3.2.6 Audits

Reference 1 describes the APR1400 Quality Assurance program in general, and Section 18 specifically addresses audit requirements. Section 18.1 notes that, in general, the audit requirements for all programs include, at a minimum, verification of compliance and effectiveness of implementation of internal rules, procedures (e.g., design, procurement, surveillance, and test), regulations, programs for training, retraining, qualification, and corrective actions, including associated record keeping. During the early portions of the APR1400 DC activities, audits will focus on areas including, but not limited to, design control, procurement, and corrective action. The scope of the audit is determined by the quality status and safety importance of the activities being performed. Management addresses all audit findings and initiates corrective action where indicated.

All applicable QA program elements are audited at least once a year. Additional audits may be performed as deemed necessary by management.

These audits are the responsibility of KHNP during the design certification phase. The responsibility transfers to the COL applicant during the Combined License phase.

17.4.3.3 RAP SSC Identification

The process for identifying RAP systems, structures and components typically begins with a PRA review of importance statistics following model revision. A review can also be initiated at the request of any Expert Panel member. This review includes all available APR1400 PRA models: internal events, fire and flood; at full power and shutdown; Level 1 (core damage) and Level 2 (large, offsite radionuclide release). The PRA staff identifies potentially risk-significant components and their failure modes. The PRA criteria for consideration include the Risk Achievement Worth (RAW > 2) and the Fussell-Vesely (FV > 0.005) for individual components. If at least one train meets any of these criteria, all redundant trains are retained for further evaluation.

In addition, the PRA Engineer reviews common cause failures (CCFs) with a RAW>20. If the individual components in these CCFs are not RAP list candidates already, then these SSCs are added to the list for Expert Panel review as potentially risk-significant.

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The PRA staff provides the list of recommendations for risk-significant components to the Expert Panel. The PRA representative provides interpretations and background information as needed to support the Expert Panel's classification process.

The Expert Panel supplements the quantitative PRA input with the following qualitative information, when available:

- PRA model assumptions and limitations
- Qualitative risk analyses (e.g., seismic margins analyses, etc.)
- Deterministic safety analyses
- Root cause analyses
- Failure modes & effects analyses
- Severe accident evaluations
- Operating experience (e.g., industry LERs, etc.)
- SSC risk significance at other, similar plants
- Expert Panel judgment

All available quantitative and qualitative sources of information are considered during the review process. The panel reviews these sources and classifies each SSC as risk-significant or low risk. All risk-significant components are placed on the RAP list in Table 17.4-1.

The Expert Panel (1) can designate a component as risk-significant even if the PRA engineer did not make that recommendation; or (2) can designate components as low risk, even if the PRA engineer recommended it as risk-significant.

The panel also evaluates components that are not modeled. These determinations are solely qualitative. The RAP scope therefore includes SSCs that are not modeled in the PRA.

The panel revisits the RAP scope following each revision of the PRA model. If prompt action is warranted, the panel shall review design changes between PRA model updates, and perform an interim, qualitative evaluation until new PRA model results are available.

Certain passive components, such as pipes or electrical cables, are omitted from the review process. These SSCs are generally associated with an active, risk-significant component, such as a pump or a valve, which is included within the RAP scope. The reliability of the passive components is typically much higher than that for an active component. In addition, the passive component reliability implicitly falls under the "umbrella" of its corresponding, active risk-significant component. Therefore these passive components are omitted from the RAP scope.

17.4.3.4 Expert Panel

The RAP Expert Panel organization, qualifications and duties are defined in Reference 8. The panel includes personnel with experience in PRA, safety analysis, operations, maintenance, design engineering and systems engineering. These disciplines are selected to ensure that the panel membership breadth of experience will be sufficient to properly evaluate SSC risk significance.

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The panel membership consists of the following:

- RAP Coordinator
- PRA Engineer
- Safety Engineer (provides safety analysis expertise)
- Operations representative
- Maintenance representative
- Design Engineer
- Site Engineer (provides system engineering expertise)
- Quality Assurance representative

Each member must have at least 6 years of nuclear industry experience. Except for the RAP Coordinator, all members must also have a minimum of 4 years of position-specific experience. The RAP Coordinator must meet this qualification for at least one specific discipline. All members are trained by the PRA Engineer on importance measures.

17.4.3.5 RAP Scope

Components within the D-RAP scope are listed in Table 17.4-1. This list includes the following information:

- List of RAP systems, structures and components (SSCs), including identification numbers and descriptions
- Basis for inclusion, including the analysis or evaluation (e.g., internal events or fire) that resulted in the risk-significant classification
- Dominant Failure Modes

Component boundaries are not reproduced in the RAP list. SSC boundaries have been defined in the DCD Section 19.1, Table 19.1-15.

The RAP list of risk-significant components and their DFMs is revisited following each PRA model revision. The scope, or any part thereof, can also be re-evaluated between model revisions if new information is obtained concerning design changes, modeling assumptions or possible errors.

17.4.3.6 Dominant Failure Modes (DFMs)

In addition to the list of components, Table 17.4-1 also lists the Dominant Failure Modes for each SSC. A failure mode is “dominant” if it is a basis for a risk-significant classification. For example, the DFMs for a specific valve might include a failure-to-open if that valve is required to open to perform a risk-significant function. These failure modes may be based upon quantitative PRA results or qualitative reviews.

The PRA model itself has been designed to be in conformance with the PRA quality requirements of Reference 19. These requirements include a comprehensive scope of initiating events, systems, components and failure modes in order to ensure that plant risk is effectively

analyzed and quantified. These failure modes (e.g., a standby pump start in a risk-significant system would typically be included, as would any necessary valve re-alignments, etc.) are analyzed as a starting point in identifying the *Dominant Failure Modes*. Most DFMs will be identified in this manner. Additional DFMs can be identified by Expert Panel judgment.

DFMs are reviewed following each PRA model update, or upon request by any Expert Panel member.

17.4.3.7 QA Associated with Design Activities

The Quality Assurance (QA) program for the APR1400 design certification is described in Reference 1. The QA program is based on the requirements of Reference 3 and other, applicable regulatory documents or guides.

The overall QA program is described in Section 2 of Reference 1 and Design Control is specifically addressed in Section 3. The Reliability Assurance Program is not explicitly addressed but the RAP design activities fall under the general oversight of Section 3. See also DCD Sections 17.1, 17.2 & 17.3.

Appropriate QA controls for the nonsafety-related RAP SSCs are addressed in Section 17.5 and COL 17.4(2).

The APR1400 design process controls design inputs, outputs, changes, interfaces, records, and organizational interfaces.

Section 3.1 of Reference 1 notes that design processes ensure that items and activities under QA control are suitable for their intended application, consistent with their effect on safety. The extent of the design verification required is a function of the importance to safety.

Section 3.2 of Reference 1 requires that important design steps, including input sources, are documented.

Part III of Reference 1 specifically addresses quality control for non-safety related components. It notes, for example, that "The specific program controls…are targeted at those characteristics...that render the SSC a significant contributor to plant safety." Risk-significant SSCs that are non-safety related will be subject to augmented quality requirements, above and beyond those for non-safety related, low risk SSCs. These requirements include corrective actions for potential design and pre-operational errors that could degrade the SSCs.

17.4.3.8 ITAAC

Inspections, Tests, Analysis and Acceptance Criteria (ITAAC) are developed to meet multiple requirements, including the Design RAP. The ITAAC requirements verify the as-built configuration and performance characteristics of SSCs as identified in Tier 1 design descriptions. The ITAAC is described in Reference 14. DCD Sections 14.3.2.13 and 2.13 specifically address

the Design Reliability Assurance Program. The D-RAP ITAAC requirements ensure that the various test requirements of the ITAAC reflect the latest available list of RAP components.

All RAP components are addressed by the ITAAC to ensure that their performance is consistent with the key assumptions and risk insights that resulted in their classification.

17.4.3.9 The RAP During the COL Applicant Phase

During this phase, the Combined License applicant assumes RAP responsibilities. The RAP procedures are reviewed to ensure that they remain applicable. The COL applicant updates the RAP list of risk-significant SSCs and their DFMs with site-specific design information. The RAP list is then distributed to the affected organizations.

The COL applicant is also responsible for describing how it will integrate reliability assurance activities into existing programs (e.g., Maintenance Rule, surveillance testing, ISI, IST, maintenance and QA). Program procedures are developed for the operation phase, at which time the RAP functions will be assumed by the regulatory programs identified below. Procedures are developed to ensure that maintenance will be timely and effective for RAP equipment. QA procedures are developed for appropriate oversight of these programs.

17.4.3.10 The RAP During the Operations Phase

Once construction ends and the initial fuel load begins, the RAP also ends. However, its functions are assumed by specific operational programs including the Maintenance Rule, surveillance testing, ISI, IST, maintenance and quality assurance.

17.4.4 Reliability Assurance Program Information Included in the COL Application

The Combined License applicant shall provide the following in Chapter 17 of the safety analysis report:

COL 17.4(1) - An updated description of the D-RAP to include relevant site- and plant-specific information (e.g., design, program, procedural, and organizational information). This includes identifying the SSCs within the scope of the plant-specific RAP (i.e., the RAP SSCs identified in the DC, updated using COL site- and plant-specific information) and establishing the programmatic controls of D-RAP to be applied during the COL design and construction activities prior to initial fuel load.

COL 17.4(2) - Appropriate QA controls for the nonsafety-related RAP SSCs in accordance with the provisions in Part V, "Nonsafety-Related SSC Quality Controls," of SRP Section 17.5. This includes providing corrective actions for potential design and pre-operational errors that could degrade nonsafety-related RAP SSCs. These controls are not applicable to SSCs that are not on the RAP list.

COL 17.4(3) - The process for integrating the RAP into operational programs (e.g., maintenance rule program, QA program, inservice inspection, inservice testing, surveillance

testing, and maintenance programs). The process should also address the (1) establishment of reliability, availability, or condition performance goals for the RAP SSCs, (2) establishment of performance and condition monitoring requirements to provide reasonable assurance that RAP SSCs do not degrade to an unacceptable level of reliability, availability, or condition during plant operations, (3) for nonsafety-related RAP SSCs, establishment of QA controls for activities during the operations phase in accordance with the provisions in Part V of SRP Section 17.5, and (4) consideration of dominant failure modes of RAP SSCs in meeting the objectives of the RAP during plant operation.

17.4.5 References

1. APR1400-K-Q-TR-11005-NP, Rev. 4, "KHNP Quality Assurance Program Description (QAPD) for the APR1400 Design Certification," March 2014.

2. 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," U.S. Nuclear Regulatory Commission.

3. 10 CFR Part 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," U.S. Nuclear Regulatory Commission.

4. NUREG-0800, Standard Review Plan, Section 17.5, Rev. 0, "Quality Assurance Program Description – Design Certification, Early Site Permit and New License Applicants," U.S. Nuclear Regulatory Commission, March 2007.

5. NUMARC 93-01, Rev. 4a, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," April 2011.

6. Regulatory Guide 1.160, Rev. 3, Monitoring the Effectiveness of Maintenance at Nuclear Power Plants, May 2012.

7. KHNP Procedure DC-DG-03-09, "Implementation of the Reliability Assurance Program (RAP)."

8. KHNP Procedure DC-DG-03-10, "Expert Panel Roles and Responsibilities."

9. KHNP Procedure DC-DG-03-11, "Risk Significance Determination of RAP SSCs."

10. KHNP Procedure DC-DG-03-24, "Risk Management Procedure."

11. APR1400-K-X-FS-14002-P, APR1400 Design Control Document Tier 2, Chapter 19, Rev. 1, "Probabilistic Risk Assessment and Severe Accident Evaluation," March 2017.

12. NUREG-0800, Standard Review Plan, Section 19.0, "Probabilistic Risk Assessment and Severe Accident Evaluation for New Reactors," Rev. 3, U.S. Nuclear Regulatory Commission, December 2015.

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13. NUREG-0800, Standard Review Plan, Section 17.4, “Reliability Assurance Program,” Rev. 1, U.S. Nuclear Regulatory Commission, May 2014.

14. APR1400-K-X-FS-14002-NP, APR1400 Design Control Document Tier 2, Chapter 14, Rev. 1, “Verification Programs,” March 2017.

15. KHNP Procedure DC-DG-03-01, “Design Change Control.”

16. KHNP Procedure DC-DG-16-01, “Corrective Action Program.”

17. KHNP Procedure DC-DG-03-05, “Technical Audit at Supplier’s Facility.”

18. KHNP Procedure DC-DG-03-23, “Implementation of Severe Accident Mitigation Design Alternatives.”

19. ASME/ANS RA-S-2009, Addenda to ASME/ANS RA-S-2008, “Standard for Level 1/Large Early Release Frequency Probabilistic Risk for Nuclear Power Plant Applications,” 2009.

Table 17.4-1 (1 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
Motor-Driven Auxiliary Feedwater Pump trains				
AF	PP02A/B	Motor-Driven Pumps	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD:	Test & Maintenance Fail to start Fail to run
MDP Normal Discharge to Steam Generators				
AF	CV1003A/B	Motor-Driven Pump Discharge Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FLD Level 2 SD:	Fail to open
AF	SOV0035/0036	Motor-Driven Pump Discharge Modulation Solenoid-Operated Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: IE Level 2 SD:	Spurious closure Fail to operate
AF	MV043/044	Motor-Driven Pump Discharge Isolation Motor-Operated Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: FLD Level 2 AP: IE, FLD Level 2 SD:	Spurious operation Fail to open Fail to close
AF	CV1007A/B	Motor-Driven Pump Discharge Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FLD Level 2 SD:	Fail to open
MDP Recirculation Discharge				
AF	CV1012A/B	Motor-Driven Pump Mini-flow Line Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FLD Level 2 SD:	Fail to open
Turbine-Driven Auxiliary Feedwater Pump trains				
AF	~~TP01A/B~~	Turbine-Driven Pumps	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE Level 2 AP: IE, FIRE, FLD Level 2 SD:	Test & Maintenance Fail to start Fail to run
TDP Normal Discharge to Steam Generators				

PP01A/B

Expert Panel : seismic

Table 17.4-1 (2 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
AF	CV1004A/B	Turbine-Driven Pump Discharge Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE Level 2 AP: Level 2 SD:	Fail to open
AF	SOV0037/0038	Turbine-Driven Pump Discharge Modulation Valves	Expert Panel	Spurious closure
AF	MV045/046	Turbine-Driven Pump Discharge Isolation Motor-Operated Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: IE, FIRE, FLD Level 2 SD:	Spurious operation Fail to open Fail to close
AF	CV1008A/B	Turbine-Driven Pump Discharge Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE Level 2 AP: Level 2 SD:	Fail to open
TDP Recirculation Discharge				
AF	CV1014A/B	Turbine-Driven Pump Mini-flow Line Check Valves	Level 1 AP: IE Level 1 SD: IE Level 2 AP: Level 2 SD:	Fail to open
Steam Supply to the Turbine-Driven AF Pumps				
AT	CV1020A/B	AF Turbine-Driven Pump Steam Supply Check Valves	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD:	Fail to open
AT	AV009/010	AF Turbine-Driven Pump Steam Supply Isolation Air-Operated Valves	Level 1 AP: IE, FLD Level 1 SD: Level 2 AP: IE Level 2 SD:	Fail to open
Auxiliary Feedwater Storage & Transfer Normal Suction to AF Pumps				
AX	TK01A/B	Auxiliary Feedwater Storage Tanks	Expert Panel	Leak or rupture
Alternate AF suction from CST				
AX	CV1630	CST Suction Check Valve	Expert Panel	Fail to open
AX	CV1628/1629	CST Suction Check Valves	Level 1 AP: FIRE Level 1 SD:	CCF to open

Table 17.4-1 (3 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 2 AP: Level 2 SD:	
AF Tank Refill				
AX	CV1600	Demineralized Water Common Header Check Valve	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: Level 2 SD:	Fail to open
Condenser Vacuum				
CA	CV1023	Containment Isolation Check Valve	Level 1 AP: Level 1 SD: Level 2 AP: Level 2 SD: FIRE	Fail to close
Component Cooling				
CC	TK01A/B	Component Cooling Water Surge Tanks	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE Level 2 SD: IE, FIRE	Leak or rupture
CC	V1121/1122/1123/1124	CC Pump Suction Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
CC	PP01A/B PP02A/B	Component Cooling Water Pumps	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
CC	CV1001/1002/ 1003/1004	Component Cooling Water Pump Discharge Check Valves	Level 1 AP: IE Level 1 SD: FLD Level 2 AP: FIRE, FLD Level 2 SD:	Fail to open Fail to close
CC	V1007/1008/1009/1010	CC Pump Discharge Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure

System

System

Expert Panel : seismic

Table 17.4-1 (4 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
CC	V1013/1014	HE Header Inlet Isolation Manual Valves	Expert Panel	Spurious closure
CC	HE01A/B HE02A/B	Component Cooling Water Heat Exchangers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Loss of heat transfer
CC	HE03A/B	Component Cooling Water Heat Exchangers	Expert Panel (should be same as HE01A/B & HE02A/B)	Loss of heat transfer
CC	V1211/1212	HE01A/B Outlet Manual Valves	Level 1 AP: IE Level 1 SD: Level 2 AP: IE Level 2 SD:	Spurious closure
CC	MV021/022/023 MV024/025/026	Component Cooling Water Heat Exchanger Discharge Motor-Operated Valves	Expert Panel	Fail to operate
CC	MV027/028	Component Cooling Water Heat Exchanger Bypass Motor-Operated Valves	Expert Panel	Fail to operate
Various CC Loads				
CC	MV097/098	CS Heat Exchanger 1A/1B CC Inlet Motor-Operated Valves	Level 1 AP: IE Level 1 SD: Level 2 AP: IE, FLD Level 2 SD:	Fail to open
CC	MV131/132	Essential Chiller 2A/B CC Outlet Motor-Operated Valves	Level 1 AP: FLD Level 1 SD: FLD Level 2 AP: FLD Level 2 SD:	Fail to open
CC	MV143/145/147/149 MV144/146/148/150	Non-Safety Load Supply and Return Isolation Motor-Operated Valves	Level 1 AP: IE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FLD Level 2 SD: IE, FIRE	CCF to close
CC	MV181/182 MV191/192	EDG CC Inlet Motor-Operated Valves	Level 1 AP: IE Level 1 SD: IE, FLD Level 2 AP: FIRE Level 2 SD: IE, FIRE	Fail to open

Table 17.4-1 (5 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
CC	MV351/352	Shutdown Cooling Heat Exchanger 1A/B CC Inlet Motor-Operated Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD: IE	Fail to open
CC	MV383/384	Essential Chiller 1A/1B CC Outlet Motor-Operated Valves	Expert Panel	Fail to operate
CC	V1261/1262	Essential Water Chiller Condenser CH02A/B Inlet Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
CC	V1263/1264	Essential Water Chiller Condenser CH02A/B Outlet Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
CC	V1281/1282 V1291/1292	DG 01A/B/C/D Outlet Manual Valves	Level 1 AP: IE Level 1 SD: IE, FLD Level 2 AP: Level 2 SD: FIRE	Spurious closure
Containment Spray System				
CS	PP01A/B	Containment Spray Pumps	Level 1 AP: IE, FLD Level 1 SD: IE Level 2 AP: IE, FLD Level 2 SD: IE	Test & Maintenance Fail to start CCF to run
CS	CV1001/1002	Containment Spray Pump Discharge Check Valves	Level 1 AP: IE, FLD Level 1 SD: IE Level 2 AP: IE Level 2 SD:	CCF to open
CS	HE01A/B	Containment Spray Heat Exchangers	Level 1 AP: IE Level 1 SD: Level 2 AP: IE, FLD Level 2 SD:	Loss of heat transfer Test & Maintenance
CS	MV001/002	Containment Spray Heat Exchanger Discharge Isolation Motor-Operated Valves	Level 1 AP: IE Level 1 SD:	Spurious closure

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B

CC	V1561/1562	Essential Water Chiller Condenser CH01A/B Iutlet Manual Valves	Expert Panel (similar to CH02A/B valve)	Spurious closure
CC	V1563/1564	Essential Water Chiller Condenser CH01A/B Outlet Manual Valves	Expert Panel (similar to CH02A/B valve)	Spurious closure

Pumping Device Connections Water Source

Table 17.4-1 (6 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 2 AP: IE Level 2 SD:	
CS	MV003/004	Containment Spray Heat Exchanger Discharge Isolation Motor-Operated Valves	Level 1 AP: IE Level 1 SD: Level 2 AP: IE, FLD Level 2 SD:	Fail to open
CS	CV1007/1008	Containment Spray Heat Exchanger Discharge Check Valves	Level 1 AP: IE Level 1 SD: Level 2 AP: IE Level 2 SD:	Fail to open
CS	~~ECSBS~~	Key Components in Emergency Containment Spray Backup System (ECSBS) (10)	Expert Panel ~~(per DCD 19.3)~~	Fail to operate
CS Mini-flow Recirculation				
CS	HE02A/B	Containment Spray Mini-flow Line Heat Exchangers	Level 1 AP: IE Level 1 SD: Level 2 AP: IE, FLD Level 2 SD:	Test & Maintenance
Chemical & Volume Control				
CV	CV189	IRWST Return Line Check Valve	Level 1 AP: Level 1 SD: Level 2 AP: Level 2 SD: FIRE	Fail to open
CV	AV505/506	Containment Isolation RCP to VCT AOVs	Level 1 AP: Level 1 SD: Level 2 AP: FLD Level 2 SD: FIRE	Fail to close
CV	AV522/523	Regenerative HX outlet AOVs	Expert Panel	Fail to close
CV	AV560/561	Reactor Drain Tank outlet AOVs	Expert Panel	Fail to close
Alternate AC Diesel Generator				
DA	TK01	AAC Fuel Oil Storage Tank	Expert Panel	Leak or rupture
DA	PP01/02	AAC Fuel Oil Transfer Pumps	Expert Panel	Test & Maintenance Fail to start

System

(SBO)

(SBO)

Table 17.4-1 (7 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			(SBO)	Fail to run
DA	CV1005/1007	AAC Fuel Oil Transfer Pump Discharge Check Valves	Expert Panel (SBO)	Fail to open
DA	TK02	AAC Fuel Oil Day Tank	Expert Panel	Leak or rupture
DA	AACTG	AAC Gas Turbine Generator	Level 1 AP: IE, FIRE Level 1 SD: IE Level 2 AP: IE, FIRE Level 2 SD: IE	Test & Maintenance Fail to run
DC Buses & Batteries				
DC	BC01A/B/C/D BC02A/B/C/D	Class 1E 125V DC Battery Chargers	Level 1 AP: IE, FIRE Level 1 SD: Level 2 AP: IE Level 2 SD:	Fail to operate
DC	BT01A/B/C/D	Class 1E 125V DC Batteries	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to operate
DC	MC01A/B/C/D	Expert Panel : seismic Class 1E 125V DC Buses	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to operate
DC	MC01M/01N	Non-Class 1E 250V DC Buses	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD:	Fail to operate
Radioactive Drains		System		
DE	AV006	Radioactive Drain System - Containment Isolation Valve	Level 1 AP: Level 1 SD: Level 2 AP: FIRE, FLD Level 2 SD: IE, FIRE	Fail to close
DE	MV005	Radioactive Drain System - Containment Isolation Valve	Expert Panel	Fail to close
Emergency Diesel Generators				

Table 17.4-1 (8 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
DG	~~EDG A/B/C/D~~	Emergency Diesel Generators, including the day tanks (DO TK02A/B/C/D)	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
DG	SEQ A/B/C/D	DG Load Sequencers	Level 1 AP: IE, FIRE Level 1 SD: IE, FLD Level 2 AP: IE, FIRE Level 2 SD: IE, FIRE	Fail to operate
Diesel Fuel Oil Transfer System				
DO	TK 01A/B/C/D	Diesel Fuel Oil Storage Tanks	Level 1 AP: Level 1 SD: IE, FLD Level 2 AP: Level 2 SD: FIRE	Leak or rupture
DO	LS3025A/B/C/D	Fuel Oil Tank Level Switches	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD: IE	Fail to operate
DO	V1002A/B/C/D V1009A/B/C/D V1010A/B/C/D	FOTP Suction Manual Valves	Level 1 AP: IE Level 1 SD: IE, FLD Level 2 AP: Level 2 SD: FIRE	Spurious closure
DO	PP01A/B/C/D PP02A/B/C/D	Diesel Fuel Oil Transfer Pumps	Level 1 AP: IE, FIRE Level 1 SD: IE, FLD Level 2 AP: IE Level 2 SD: IE, FIRE	CCF to start CCF to run
DO	CV1005A/B/C/D CV1007A/B/C/D	FOTP Discharge Manual Valves	Level 1 AP: IE, FIRE Level 1 SD: IE Level 2 AP: Level 2 SD:	CCF to open
DO	V1015A/B/C/D V4011A/B/C/D	FOTP Discharge Manual Valves	Level 1 AP: IE Level 1 SD: IE, FLD Level 2 AP: Level 2 SD: FIRE	Spurious closure

DG A/B/C/D

Expert Panel : seismic

Table 17.4-1 (9 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

Fire Protection System

Add C

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
Diverse Protection System				
DP	HS071A/B	Diverse Protection System Manual Trip Push Buttons	ATWS, Expert Panel	Fail to operate
DP	PLC1/PLC2	Diverse Protection System (DPS) Signal Processors	ATWS, Expert Panel	Fail to operate
~~Fire Protection~~				
FP		Fire barriers between rooms:	Level 1 AP: FIRE Level 1 SD: FIRE Level 2 AP: FIRE Level 2 SD: FIRE	Barrier Failure
	F000-ADGD & F100-A06D	Diesel Generator room D and General access area at 100' D		
	F078-AGAC & F078-AGAD	General access areas 78' C and 78' D		
	F100-A06D & F100-AGAC	General access areas 100' D and 100' C		
	F120-A05D & F120-AGAD	Electrical equipment room 120' D and general access area 120' D		
	F120-AGAC & F120-AGAD	General access areas 120' C and 120' D		
	F137-A02D & F157-AMCR	Electrical equipment room 137' D and Main control room		
Feedwater				
FW	V1025	Startup Feedwater Pump Suction Valve	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD:	Spurious closure
FW	PP07	Startup Feedwater Motor-Driven Pump	Level 1 AP: IE Level 1 SD: Level 2 AP: IE Level 2 SD:	Test & Maintenance Fail to start Fail to run
FW	CV1026	Startup Feedwater Pump Discharge Check Valve	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD:	Fail to open
FW	CV058	Startup Feedwater Pump Discharge Stop Check Valve	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD:	Fail to open
FW	MV093	Startup Feedwater Pump Discharge Isolation Motor-Operated Valve	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD:	Fail to open
Gaseous Radwaste				

System

System

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Table 17.4-1 (10 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
GW	SV002	Gaseous Radwaste System - Containment Isolation Valve	Level 1 AP: Level 1 SD: Level 2 AP: FIRE, FLD Level 2 SD: IE, FIRE	Fail to open
GW	MV001	Containment Isolation Valve	Level 1 AP: Level 1 SD: Level 2 AP: Level 2 SD: FIRE	Fail to close
~~GW~~	~~-~~	~~Key SSCs in Gaseous Waste Management System~~	~~Expert Panel~~	~~Integrity failure~~
Hydrogen Control				
HG	HI01 through 10	Hydrogen Igniters	Expert Panel	Fail to operate
HG	PARs	Passive Autocatalytic Recombiners	Level 1 AP: Level 1 SD: Level 2 AP: Level 2 SD: IE, FIRE	Fail to operate
Instrument Power (120 VAC) System				
IP	IN01A/B/C/D	Class 1E 120V AC Inverters	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: IE, FIRE, FLD Level 2 SD:	Test & Maintenance Fail to operate
~~In-Containment Refueling Water Storage Tank System~~				
IW	HVT trash racks	In-containment Refueling Water Storage Tank (IRWST) Holdup Volume Tank (HVT) trash racks	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Plugged
~~Main Steam System~~				
MS	ADV101/102/103/104	Main Steam Atmospheric Dump Valves	Level 1 AP: IE Level 1 SD: FIRE Level 2 AP: IE Level 2 SD:	CCF to open
MS	SV1301 through 1320	Main Steam Safety Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD:	CCF to open

Delete

Replace D

System

(mechanical, electrical or I&C faults)

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D

IW	HVT trash racks ST01A/B/C/D	In-containment Refueling Water Storage Tank (IRWST) Holdup Volume Tank (HVT) trash racks IRWST sump strainers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE Expert Panel (confirms both racks and strainers)	Plugged
Note: In earlier versions of the RAP notebook, the IW strainers were classified as risk significant. However, the September 2017 panel designated the coarse filtration trash racks as risk significant, but excluded the fine filtration strainers. Upon subsequent review of the strainer design report, the November 2017 panel determined that both the trash racks and the sump strainers should be designated as risk significant. PRA has an action to clarify the description of the associated basic event.				

Table 17.4-1 (11 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 2 AP: IE Level 2 SD:	
MS	MSIV011/012/013/014	Main Steam Isolation Valves	Level 1 AP: IE Level 1 SD: Level 2 AP: IE Level 2 SD:	Fail to close
MS	AV109/110	Auxiliary Feedwater Pump Turbine Steam Supply Air-Operated Valves	Level 1 AP: IE, FLD Level 1 SD: Level 2 AP: IE Level 2 SD:	Fail to open
Non-Class 1E 4.16 kV System				
NB	SW01M	Non-1E 4.16KV Switchgear	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: Level 2 SD:	Fail to operate
Non-Class 1E 480V Load Center System				
NG	LC05N/10M	Non-1E 480V Load Centers	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: Level 2 SD:	Fail to operate
NG	TR05N/10M	Non-1E 480V Load Center Transformers	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: Level 2 SD:	Fail to operate
Non-Class 1E 480V MCC & Low Voltage System				
NH	MC03M/20N	Non-1E 480V MCCs	Level 1 AP: IE, FIRE Level 1 SD: Level 2 AP: Level 2 SD:	Fail to operate
13.8 kV Power System				

Table 17.4-1 (12 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
NP	SW02N	Non-1E 13.8 kV Switchgear for FW PP07	Level 1 AP: IE Level 1 SD: Level 2 AP: Level 2 SD:	Fail to operate
NP	TR01/02/03	Main Transformers	Level 1 AP: IE, FLD Level 1 SD: IE, FIRE Level 2 AP: IE, FLD Level 2 SD: IE, FIRE	Fail to operate
NP	TR01M/01N	Unit Auxiliary Transformers	Level 1 AP: IE, FLD Level 1 SD: IE, FIRE Level 2 AP: IE, FLD Level 2 SD: IE, FIRE	Fail to operate
NP	TR02M/02N	Standby Auxiliary Transformers	Level 1 AP: FIRE, FLD Level 1 SD: FIRE Level 2 AP: FIRE, FLD Level 2 SD: FIRE	Test & Maintenance Fail to operate
NP	IPB43000A	Iso-Phase Bus	Level 1 AP: IE, FLD Level 1 SD: IE, FIRE Level 2 AP: IE, FLD Level 2 SD: IE, FIRE	Fail to operate
I&C Equipment Rm & Computer Room Panels & Cabinets				
PA	PA06C/D	~~ESF CCS Loop Controllers~~	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to operate
ESF Component Control System				
PE	LX01A/B/C/D LX02C/D LX05A/B	Analog Input Modules	Level 1 AP: IE, FIRE Level 1 SD: FLD Level 2 AP: IE, FLD Level 2 SD:	Fail to operate
PE	LX03D	Digital Input Module	Level 1 AP: Level 1 SD: FLD Level 2 AP:	Fail to operate

(listed as EF in the last RAP list)

Digital Output Modules (PA06C/D branches 01/02/03/04)
Primary Loop Controller (PA06C/D)

(All PE component were identified as LOOP CONTROLLERS in the last RAP list revision)

Table 17.4-1 (13 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 2 SD:	
PE	LX001A/B/C/D LX02B/D LX03C/D LX04B LX05A/B/C/D LX08A LX09B	Digital Output Modules	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to operate
PE	LX01A/B/C/D LX02B/D LX03A/B/C/D LX04B LX05A/B/C/D LX08A LX09B	Primary Loop Controllers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to operate
Class 1E 4.16 kV Subsystem				
PF	SW01A/B/C/D	Class 1E 4.16 kV Switchgear	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to operate
PF	SW01A/B-A2	Class 1E 4.16 kV Switchgear PCB from SAT	Level 1 AP: FIRE, FLD Level 1 SD: FLD Level 2 AP: FIRE, FLD Level 2 SD:	Fail to close
PF	SW01A-H2 SW01B-H2 SW01C-C2 SW01D-G2	Class 1E 4.16 kV Switchgear PCB (UAT)	Level 1 AP: IE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FLD Level 2 SD: IE, FIRE	Fail to open
Class 1E 480V Load Center Subsystem				

Table 17.4-1 (14 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
PG	LC01A/B/C/D	Class 1E 480V Load Centers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to operate
PG	TR01A/B/C/D	Class 1E 480V Load Center Transformers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to operate
Class 1E 480V MCC & Low Voltage Subsystem				
PH	MC01A/B/C/D	Class 1E 480V Motor Control Centers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: FIRE	Fail to operate
PH	MC02A/B/C/D	Class 1E 480V Motor Control Centers	Level 1 AP: FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: FLD Level 2 SD: FIRE	Fail to operate
PH	MC03A/B/C/D	Class 1E 480V Motor Control Centers	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD: FIRE	Fail to operate
PH	MC04A/B/C/D	Class 1E 480V Motor Control Centers	Level 1 AP: IE, FIRE Level 1 SD: FLD Level 2 AP: Level 2 SD:	Fail to operate
PH	MC05A/B	Class 1E 480V Motor Control Centers	Level 1 AP: Level 1 SD: IE, FLD Level 2 AP: Level 2 SD: FIRE	Fail to operate
Process-Component Control System				
PO	LX-54/58/70	P-CCS Loop Controllers	Level 1 AP: IE, FLD Level 1 SD: Level 2 AP:	Fail to operate

Table 17.4-1 (15 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 2 SD:	
Plant Protection				
PP	-	BPM, GC, LC, LCL application software and Operating system software	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	CCF to operate
Reactor Coolant System				
RC	SRV200/201/202/203	Pressurizer Pilot-Operated Safety Relief Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: IE, FIRE, FLD Level 2 SD:	Fail to open Fail to close
RC	MV130/131/132/133 134/135/136/137	POSRV Pilot Motor-Operated Valves	Level 1 AP: FIRE, FLD Level 1 SD: Level 2 AP: FIRE, FLD Level 2 SD:	Fail to open
RC	INV01A/B/C/D	Inverters for Motor Operated POSRVs	Level 1 AP: FIRE, FLD Level 1 SD: FIRE, FLD Level 2 AP: Level 2 SD:	Fail to operate
RC	PP01A/B PP02A/B	RC Pump trip circuits	Expert Panel	Fail to operate
Reactor Coolant Gas Vent System				
RG	SOV410/411/412/413	Pressurizer Gas Vent Line Isolation Solenoid-Operated Valves	Expert Panel	Fail to operate
RG	SOV414/415/416/417	Reactor Vessel Gas Vent Line Isolation Solenoid-Operated Valves	Expert Panel	Fail to open
RG	SOV418	Reactor Vessel Gas Vent Line RDT Discharge Isolation Solenoid-Operated Valve	Expert Panel	Fail to operate
RG	SOV419/420	Reactor Vessel Gas Vent Line IRWST Discharge Isolation Solenoid-Operated Valves	Expert Panel	Fail to operate
Reactor Protection System				

System

Add E

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E

RC		Core Exit Thermocouples	Expert Panel	Fail to operate
RC	LT 40 LET 41	Shutdown Level Transmitters LT 40 (spool piece) LET 41 (ultrasonic level measurement)	Expert Panel	Fail to operate

Table 17.4-1 (16 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
RP	PA14A/B/C/D	Plant Protection System Cabinets (Analog input modules Bistable process modules Digital output modules Protection relays)	Level 1 AP: IE Level 1 SD: Level 2 AP: IE Level 2 SD:	CCF to operate
RP	SW01A/B/C/D	Reactor Trip Switchgear (UV/shunt trip devices)	Level 1 AP: IE Level 1 SD: Level 2 AP: IE Level 2 SD:	CCF to energize
RP	TCB A-1/B-1/C-1/D-1 TCB A-2/B-2/C-2/D-2	Reactor Trip Circuit Breakers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE Level 2 AP: IE, FIRE, FLD Level 2 SD:	CCF to open
Safety Injection Normal Suction and Discharge				
SI	CV157/158	IRWST Suction Check Valves	Level 1 AP: IE, FLD Level 1 SD: IE Level 2 AP: IE Level 2 SD:	CCF to open
SI	MV304/305/308/309	IRWST Suction MOVs to SI/SC Pumps	Level 1 AP: FIRE Level 1 SD: IE, FLD Level 2 AP: Level 2 SD: IE, FIRE	Spurious closure
SI	V130/131/402/470	Safety Injection Pump Suction Manual Valves	Level 1 AP: FIRE Level 1 SD: IE, FLD Level 2 AP: Level 2 SD: IE	Spurious closure
SI	PP02A/B/C/D	Safety Injection Pumps	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
SI	CV404/405/434/446	Safety Injection Pump Discharge Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE	Fail to open

Table 17.4-1 (17 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 2 SD: IE, FIRE	
SI	V435/447/476/478	Safety Injection Pump Discharge Manual Valves	Level 1 AP: IE, FIRE Level 1 SD: IE, FIRE, FLD Level 2 AP: Level 2 SD: IE	Spurious closure
SI	MV616/626/636/646	Safety Injection Pump Discharge Isolation Motor-Operated Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE Level 2 SD: IE, FIRE	Fail to open
SI	CV113/123/133/143	Safety Injection Pump 2A/B/C/D Injection Line Check Valves	Level 1 AP: FIRE Level 1 SD: IE, FIRE, FLD Level 2 AP: Level 2 SD: IE, FIRE	Fail to open
SI	CV540/541/542/543	Safety Injection Pump Discharge Check Valves	Level 1 AP: FIRE Level 1 SD: IE, FIRE, FLD Level 2 AP: Level 2 SD: IE, FIRE	Fail to open
SI	CV217/227/237/247	Safety Injection Line DVI Nozzle Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE Level 2 SD: IE, FIRE	Fail to open
Safety Injection Recirculation to IRWST				
SI	CV424/426/448/451	Safety Injection Mini-flow Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: IE Level 2 SD:	Fail to open
SI	V410/411/412/413	Safety Injection Pump Mini-flow Line Manual Valves	Level 1 AP: FIRE Level 1 SD: Level 2 AP: Level 2 SD:	Spurious closure
SI	MV302/303	Safety Injection Pump 2A/B/C/D Mini-flow Line Isolation Motor-Operated Valves	Level 1 AP: Level 1 SD: Level 2 AP: FIRE	Spurious closure

Table 17.4-1 (18 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 2 SD:	
SI	CV100/101	Safety Injection Pump 2A/B/C/D IRWST Return Line Check Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: IE, FIRE Level 2 SD:	Fail to open
Shutdown Cooling Subsystem				
SDC Alternate Suction from IRWST				
SI	CV159/160	IRWST Suction Check Valves	Level 1 AP: IE, FLD Level 1 SD: IE Level 2 AP: IE Level 2 SD:	CCF to open
SDC Pump Suction and Discharge				
SI	PP01A/B	Shutdown Cooling Pumps	Level 1 AP: IE, FLD Level 1 SD: IE, FLD Level 2 AP: Level 2 SD:	CCF to start Fail to run
SI	CV568/569	Shutdown Cooling Pump Discharge Check Valves	Level 1 AP: Level 1 SD: IE, FLD Level 2 AP: IE Level 2 SD:	Fail to open
SI	HE01A/B	Shutdown Cooling Heat Exchangers	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Loss of heat transfer
SI	CV168/178	Shutdown Cooling Heat Exchanger Discharge Check Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Fail to open
Shutdown Cooling Mini-flow Lines				
SI	HE02A/B	Shutdown Cooling Mini-flow Line Heat Exchangers	Expert Panel	Loss of heat transfer
SDC Recirculation to IRWST				
SI	MV395	Shutdown Cooling Pump PP01A Mini-flow Isolation	Level 1 AP: IE, FIRE	Spurious closure

Table 17.4-1 (19 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
		Valve (the redundant valve opposite 395 is manual valve 959)	Level 1 SD: Level 2 AP: Level 2 SD:	
SI	V959	Shutdown Cooling Pump PP01B Mini-flow Isolation Valve (the redundant valve opposite V959 is motor-operated valve MV395)	Level 1 AP: IE, FIRE Level 1 SD: Level 2 AP: FIRE Level 2 SD:	Spurious closure
Essential Service Water System				
SX[9]	PP01A/B PP02A/B	Essential Service Water Pumps	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
SX[9]	CV1001/1002/ 1003/1004	Essential Service Water Pump 1A/B & 2A/B Discharge Check Valves	Level 1 AP: IE Level 1 SD: FLD Level 2 AP: FLD Level 2 SD:	Fail to open Fail to close
SX[9]	MV045/046/047/048	Essential Service Water Pump Discharge Motor-Operated Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
SX[9]	FT01A/B FT02A/B FT03A/B	Essential Service Water Debris Filters	Level 1 AP: IE, FIRE, FLD Level 1 SD: FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: FIRE	CCF plugging
SX[9]	~~HV~~071/072/073/074 MV	Ultimate Heat Sink Cooling Tower Control Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: FIRE	Fail to open Spurious closure
SX[9]	~~HV~~075/076/077/078 MV	Ultimate Heat Sink Cooling Tower Line Bypass Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FLD Level 2 SD: IE, FIRE	Spurious opening

Table 17.4-1 (20 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
SX[9]	AH01A/B AH02A/B	Ultimate Heat Sink Cooling Tower Fans	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
Control Room HVAC System				
VC	AH01A/B AH02A/B HV01A/B AU01A/B	Main Control Room Air Handling Units (AHs), Chillers (HVs) and Air Cleaning Units (AUs)	Expert Panel	Fail to operate
Emergency Diesel Generator Area HVAC System				
VD	HV12A/B/C/D HV13A/B/C/D	~~EDG~~ DG Room Emergency Cubicle Coolers	Level 1 AP: IE Level 1 SD: IE, FLD Level 2 AP: IE, FIRE Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
ESW Intake Structure/CCHX Bldg HVAC System				
VG[7]	AH01A/B AH02A/B	ESW Pump Room Supply Fans	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
VG[7]	Y1011A/B	ESW Pump Room Fans 2A/B - Exhaust Dampers	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Fail to open
Auxiliary Building Controlled Area HVAC System				
VK	HV13A/B HV14A/B	CC Pump Cubicle Coolers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
Delete VK	Y1301A/B	Auxiliary Building ECCS Equipment Room ACU Exhaust Dampers	Seismic	Fail to operate
Auxiliary Building Clean Area HVAC System				
VO	HV31A/B	Essential Chiller 1A/B Room Coolers	Level 1 AP: IE, FIRE, FLD	Fail to start

Table 17.4-1 (21 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
			Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to run
VO	HV32A/B	Essential Chiller 2A/B Room Coolers	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start CCF to run
VO	HV33A/B	Auxiliary Feedwater Motor-Driven Pump 2A/B Room Coolers	Level 1 AP: IE, FIRE, FLD Level 1 SD: FLD Level 2 AP: IE, FIRE, FLD Level 2 SD:	Test & Maintenance Fail to start Fail to run
Delete		**Miscellaneous Building HVAC System (AAC GTG)**		
VU	-	Key SSCs in Alternate AC Building Cooling Function	Expert Panel / SBO	Fail to operate
		Makeup Demineralizer System		
WM	V1201A	Raw Water Pump Supply Isolation Manual Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: Level 2 SD:	Spurious closure
WM	V1205A/1220/1700	Raw Water Pump Discharge Isolation Manual Valves	Level 1 AP: IE, FIRE, FLD Level 1 SD: Level 2 AP: Level 2 SD:	Spurious closure
		Essential Chilled Water System		
WO	V1008A/B	Quadrant Return Header Isolation Manual Valves	Expert Panel	Spurious closure
WO	TK01A/B	Essential Chilled Water Compression Tanks	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Leak or rupture
WO	TK02A/B	Essential Chilled Water Air Separator Tanks	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FIRE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Leak or rupture

Table 17.4-1 (22 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
WO	V1009A/B V1013A/B	ECW Pumps 01A/B & 02A/B Suction Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
WO	PP01A/B PP02A/B	Essential Chilled Water Pumps	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
WO	CV1010A/B CV1014A/B	ECW Pump Discharge Check Valves	Level 1 AP: IE Level 1 SD: FLD Level 2 AP: FIRE Level 2 SD:	Fail to open
WO	V1012A/B V1016A/B	ECS Pump Discharge Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
WO	V1019A/B V1023A/B	Essential Chiller 01A & B and 02A & B Inlet Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
WO	CH01A/B CH02A/B	Essential Chilled Water Chillers (includes evaporator, compressor, condenser and associated piping)	Level 1 AP: IE, FIRE, FLD Level 1 SD: IE, FLD Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Test & Maintenance Fail to start Fail to run
WO	V1020A/B V1024A/B	Essential Chiller 01A&B and 02A & B Outlet Manual Valves	Level 1 AP: Level 1 SD: FLD Level 2 AP: Level 2 SD:	Spurious closure
WO	~~V1019A/B~~ ~~V1020A/B~~ V1027A/B V1028A/B	Quadrant Header Supply Isolation Manual Valves	Expert Panel	Spurious closure
Turbine Generator Building Closed Cooling Water System				

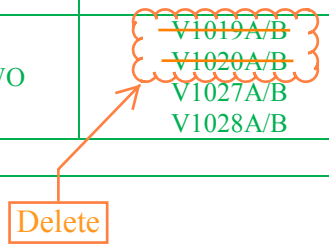

Table 17.4-1 (23 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

System[1]	SSC ID(s)[2]	SSC Description	Risk Significance Basis[3], [4], [5]	Dominant Failure Modes[6], [7]
WT	TK01	Turbine Generator Building Closed Cooling Water Tank	Level 1 AP: IE Level 1 SD: Level 2 AP: IE Level 2 SD:	Leak or rupture
WT	PP01/02	Turbine Generator Building Closed Cooling Water Pumps	Level 1 AP: FIRE Level 1 SD: Level 2 AP: Level 2 SD:	Test & Maintenance
WT	PT04	PP01 & 02 Pump Discharge PT Interlock	Level 1 AP: FLD Level 1 SD: Level 2 AP: Level 2 SD:	Fails to operate
Liquid Radwaste System				
WV	-	Key SSCs in Liquid Waste Management System	Expert Panel	Integrity failure
Miscellaneous				
	-	~~Key SSCs in Lighting System~~	Expert Panel	Fail to operate
		Containment Building	Expert Panel	Integrity failure
-	-	Containment Equipment Hatch	Level 1 AP: Level 1 SD: Level 2 AP: IE, FIRE, FLD Level 2 SD: IE, FIRE	Fail to close
-	-	Remote Shutdown Console (RSC)	Expert Panel	Fail to operate

Delete

Control Room Emergency Lighting
Remote Shutdown Console Emergency Lighting

NOTES:

(1) System codes are defined below.

(2) In some cases, additional SSCs may have been added below by symmetry; i.e., if at least one train or division was risk significant but did not list the redundant trains, then those trains may have been added to the current RAP list. These are not specifically identified for purposes of brevity.

(3) AP = Full power, SD = Low Power & Shutdown, IE = Internal Events, FLD = Internal Flooding, FIRE = Internal Fires.

(4) Individual components are included if any modeled basic event (a failure event or a maintenance unavailability) has a Risk Achievement Worth (RAW) > 2, or a Fussell-Vesely (FV) > 0.005, for at least one redundant train, for any of the available AP or SD analyses of Internal Events, Fire or Flood initiating events, for Level 1 (CDF) or Level 2 (LRF). Components are also included if they are part of a Common Cause Failure (CCF) event with a RAW > 20. If

(2) In some cases, additional SSCs may have been added by symmetry; i.e., if at least one train or division met the PRA importance criteria but the redundant trains did not, then those trains may have been added to the current RAP list. These are not specifically identified for purposes of brevity.

Table 17.4-1 (24 of 26)
Reliability Assurance Program Systems, Structures & Components[8]

the basis is listed as the "Expert Panel" then the SSC has been included on the basis of professional judgment or another qualitative consideration. By definition, all SSCs within the RAP scope have been designated as risk-significant by the RAP Expert Panel

(5) Due to PRA model changes, the individual bases for risk-significance may have changed. These changes are not identified. However, if individual rows of SSCs have been added or deleted, these are identified in Tables 2 and 3 below.

(6) All run, run-first-hour, run-after-first-hour and load-and-run failure events are listed as "Fail to run" in this column.

(7) Battery failures between tests or following an initiating event are both classified as "Fail to operate" in this column.

(8) Potential RAP SSCs associated with loss of large area (LOLA) and aircraft impact assessment (AIA) described in DC Sections 19.4 and 19.5 are not included in this table.

(9) The SX (including UHS) and VG systems are parts of the conceptual design information (CDI), and the SSC applicability will follow the conditions specified in DC Section 1.8.

Replace F

System Codes:

AF - Auxiliary Feedwater System	NR – Ex-Core Neutron Flux Monitoring System
AP – Auxiliary Power System	NT – Nitrogen System
AS – Auxiliary Steam System	OT – Bearing Oil Transfer and Purification System
AT – Auxiliary Feedwater Pump Turbine System	PA – I&C Equipment Rm & Computer Room Panels & Cabinets
AX – Auxiliary Feedwater Storage and Transfer System	PC – Containment Isolation System
CA – Condenser Vacuum System	PE – ESF Component Control System
CC – Component Cooling Water System	PF – Class 1E 4.16 kV System
CD – Condensate System	PG – Class 1E 480V Load Center System
CF – Chemical Feed System	PH – Class 1E 480V MCC & Low Voltage System
CL – Chlorination System	PO – Process-Component Control System
CM – Containment Monitoring System	PP – Plant Protection
CO – Carbon Dioxide System	PR – Radiation Monitoring System
CP – Condensate Polishing System	PX – Primary Laundry System
CS – Containment Spray System	PS – Process Sampling System
CT – Condensate Transfer System	RC – Reactor Coolant System
CV – Chemical and Volume Control System	RG – Reactor Coolant Gas Vent System
CW – Circulating Water System	RP – Reactor Protection System
DA – AAC Gas Turbine Generator System	SI – Safety Injection/Shutdown Cooling System
DC – DC Distribution System	ST – Sanitary Water Transfer System
DE – Radioactive Drain System	SW – Travelling Screen and Screen Wash System
DG – Emergency Diesel Generator System	SX – Essential Service Water System
DM – Miscellaneous Building Drain System	TA – Main Turbine and Auxiliary System
DO – Diesel Fuel Oil Transfer System	VB – Compound Building HVAC System

(10) The ECSBS design has not been finalized. However, the function has been qualitatively determined to be risk significant.

Table 17.4-1 (25 of 26)

Replace F

Reliability Assurance Program Systems, Structures & Components[8]

System Codes:	
DP – Diverse Protection System	VC – Control Room HVAC System
DT – Turbine Generator Building Drain System	VD – Emergency Diesel Generator Area HVAC System
DV – FW Heater Miscellaneous Drains & Vents System	VE – Electrical and I&C Equipment Areas HVAC System
EA – Breathing Air System	VF – Fuel Handling Area HVAC System
ED – Non-radioactive Equipment Vents & Drains System	VG – ESW Intake Structure/CCHX Bldg HVAC System
EF – Engineering Safety Features Actuation System	VH – CW Pump Building HVAC System
ES – Extraction Steam System	VJ – Cold Machine Shop HVAC System
FC – Spent Fuel Pool Cooling and Cleanup System	VK – Auxiliary Building Controlled Area HVAC System
FO – Fuel Oil System	VN – Water Treatment & Chlorination Bldg HVAC System
AP – Fire Protection System	VO – Auxiliary Building Clean Area HVAC System
FT – Feedwater Pump Turbine System	VP – Reactor Containment Building HVAC System
FW – Feedwater System	VQ – Reactor Containment Building Purge System
GW – Gaseous Waste Management System	VT – Turbine Generator Building HVAC System
HD – Heater Drain System	VU – Miscellaneous Building HVAC System (AAC GTG)
HG – Containment Hydrogen Control System	WD – Domestic Water System
HY – Hydrogen System	WH – Turbine Generator Building Open Cooling Water System
IA – Instrument Air System	WI – Plant Chilled Water System
IP – Instrument Power System	WL – Raw Water System
IW – In-Containment Water Storage System	WM – Makeup Demineralizer System
MP – Main Power System	WN – Nonpoint Source Pollution Abatement System
MS – Main Steam System	WO – Essential Chilled Water System
NB – Non Class 1E 4.16 kV System	WT – Turbine Generator Building Closed Cooling Water System
NG – Non Class 1E 480V Load Center System	WV – Liquid Radwaste System
NH – Non Class 1E 480V MCC & Low Voltage System	WW – Wastewater Treatment System
NP – 13.8 kV Power System	WX – Solid Radwaste System
	WY – Radioactive Laundry System
Component Codes:	
AACTG – Alternate AC Turbine Generator	LS – Level Switch
AD – Air Dryer	MC – Motor Control Center (bus)
ADV – Atmospheric Dump Valve	MSIV – Main Steam Isolation Valve
AH – Air Handler (fan)	MV – Motor-Operated Valve
AV – Air-Operated Valve	PP – Motor-Driven Pump
BC – Battery Charger	RV – Relief Valve
BT – DC Battery	SEQ – Diesel Generator Load Sequencer

Table 17.4-1 (26 of 26)

Reliability Assurance Program Systems, Structures & Components[8]

Replace F

System Codes:	
CH – Chillers	SW – Switchgear
CV – Check Valves	SOV – Solenoid-Operated Valve
DA – Deaerator	SRV – Pilot-Operated Safety Relief Valve
EDG – Emergency Diesel Generator (or DG)	SV – Safety Valve
FT – Filter	TCB – Trip Circuit Breaker
HE – Heat Exchanger	TE – Temperature Element or Transmitter
HOV – Hydraulically-Operated Valve	TK – Tank
HV – Chillers or Coolers	TP – Turbine-Driven Pump
IN – Inverter LC – Load Center (bus)	TR – Transformer
IPB – Iso-Phase Bus	V – Manual Valve
	Y – Damper

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F (1/2)

System Codes:

AF - Auxiliary Feedwater System
AT – Auxiliary Feedwater Pump Turbine System
AX – Auxiliary Feedwater Storage and Transfer
System CA – Condenser Vacuum System
CC – Component Cooling Water System
CS – Containment Spray System
CV – Chemical and Volume Control System
DA – Alternate AC Diesel Generator System
DC – DC Distribution System
DE – Radioactive Drain System
DG – Emergency Diesel Generator System
DO – Diesel Fuel Oil Transfer System
DP – Diverse Protection System
FP – Fire Protection System
FW – Feedwater System
GC – Group Controller Cabinet
GW – Gaseous Radwaste System
HG – Containment Hydrogen Control System
IP – Instrument Power System
IW – In-Containment Water Storage System
LX – Loop Controller Cabinet
MS – Main Steam System
NB – Non Class 1E 4.16 kV System
NG – Non Class 1E 480V Load Center System
NH – Non Class 1E 480V MCC & Low Voltage System
NP – 13.8 kV Power System
PA – I&C Equipment Room Panel
PE – ESF Component Control System
PF – Class 1E 4.16 kV System
PG – Class 1E 480V Load Center System
PH – Class 1E 480V MCC & Low Voltage System
PO – Process-Component Control System
RC – Reactor Coolant System
RG – Reactor Coolant Gas Vent System
RP – Reactor Protection System
SI – Safety Injection/Shutdown Cooling System
SX – Essential Service Water System
VC – Control Room HVAC System
VD – Emergency Diesel Generator Area HVAC System
VG – ESW Pump Building/CCW HX Building HVAC System
VK – Auxiliary Building Controlled Area HVAC System
VO – Auxiliary Building Clean Area HVAC System
VU – Miscellaneous Building HVAC System
WM – Makeup Demineralizer System
WO – Essential Chilled Water System
WT – Turbine Generator Building Closed Cooling Water
System WV – Liquid Radwaste System

Component Codes:

ADV – Atmospheric Dump Valve
AH – Air Handler (fan)
AV – Air-Operated Valve
BC – Battery Charger
BT – DC Battery
CH (or HV) – Chillers or Coolers
MC – Motor Control Center (bus)
MSIV – Main Steam Isolation Valve
MV – Motor-Operated Valve
PP – Pump
PT – Pressure Transmitter
RV – Relief Valve

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F (2/2)

CV – Check Valves	SEQ – Diesel Generator Load Sequencer
DG – Emergency Diesel	SW – Switchgear
Generator FT – Filter	SOV – Solenoid-Operated Valve
HE – Heat Exchanger	SRV – Pilot-Operated Safety Relief
HS - Handswitch	Valve SV – Safety Valve
HV (or CH) – Chillers or Coolers	TA – Turbine
IN – Inverter	TCB – Trip Circuit Breaker
IPB – Iso-Phase Bus	TK – Tank
LC – Load Center (bus)	TR – Transformer
LIS – Level Indicating Switch	V – Manual Valve
	Y – Damper

Table 1.8-2 (33 of 38)

Item No.	Description
COL 17.1(1)	The COL applicant is to establish and implement a QA program that is applicable to site-specific design activities during the plant construction and operation phases.
COL 17.2(1)	The COL applicant is to establish and implement a QA program that is applicable to site-specific design activities during the plant construction and operation phases.
COL 17.3(1)	The COL applicant is to establish and implement a QA program that is applicable to site-specific design activities during the plant construction and operation phases.
~~COL 17.4(1)~~	~~The COL applicant is to develop and implement Phases 2 and 3 of the design RAP, including QA requirements. In Phase 2, the plant's site-specific information is subjected to the D-RAP process, and the site-specific risk-significant SSCs are combined with the Phase 1 (design) risk-significant SSCs into one list for the plant. Phase 2 is performed during the COL application phase and updated/maintained during the COL license holder phase. In Phase 3, procurement, fabrication, construction, and test specifications for the SSCs within the scope of the D-RAP provide reasonable assurance that key assumptions, such as equipment reliability, are realistic and achievable. The QA requirements are implemented at this time. Phase 3 is performed during the COL license holder phase and prior to initial fuel loading.~~
~~COL 17.4(2)~~	~~The COL applicant is to propose a method for incorporating the objectives of the reliability assurance program into other programs for design or operational errors that degrade non-safety-related, risk-significant SSCs.~~
~~COL 17.4(3)~~	~~The COL applicant to develop and implement the RAP in the operations phase in which RAP activities are integrated into the existing operational program (e.g., Maintenance Rule, surveillance testing, inservice inspection, inservice testing, QA). The RAP in the operations phase also includes the process for providing corrective actions for design and operational errors that degrade non-safety-related SSCs within the scope of the RAP. A description of the proposed method for developing and integrating the operational RAP into operating plant programs (e.g., Maintenance Rule, quality assurance) is to be performed during the COL application phase. The development/integration of the O-RAP is performed during the COL license holder phase and prior to initial fuel loading. All SSCs identified as risk-significant within the scope of the design RAP are categorized as high-safety-significant (HSS) within the scope of the initial Maintenance Rule. Integration of reliability assurance activities into existing operational programs also addresses the establishment of: a. Reliability performance goals for risk-significant SSCs consistent with the existing maintenance and quality assurance processes on the basis of information from the D-RAP. For example, implementation of the Maintenance Rule per Regulatory Guide 1.160 is one acceptable method for establishing performance goals if SSCs are categorized as HSS within the scope of the Maintenance Rule program. b. Performance and condition monitoring requirements to provide reasonable assurance that risk-significant SSCs do not degrade to an unacceptable level during plant operations.~~
COL 17.5(1)	The COL applicant is to establish and implement a QA program that is applicable to site-specific design activities related to the plant construction and operation phases.
COL 17.6(1)	The COL applicant is to provide in its Final Safety Analysis Report a description of the Maintenance Rule program and a plan for implementing it to meet the requirements of 10 CFR 50.65.

Replaced with "A" in next page

"A"

COL 17.4(1)	The APR1400 application will update the description of the D-RAP to include relevant site- and plant-specific information (e.g., design, program, procedural, and organizational information). This includes identifying the SSCs within the scope of the plant-specific RAP (i.e., the RAP SSCs identified in the DC, updated using COL site- and plant-specific information) and establishing the programmatic controls of D-RAP to be applied during the COL design and construction activities prior to initial fuel load.
COL 17.4(2)	The APR1400 application will specify appropriate QA controls for the non-safetyrelated RAP SSCs in accordance with the provisions in Part V, "Non-safety-Related SSC Quality Controls," of SRP Section 17.5. This includes providing corrective actions for potential design and pre-operational errors that could degrade non-safety-related RAP SSCs.
COL 17.4(3)	The APR1400 application will propose a process for integrating the RAP into operational programs (e.g., maintenance rule program, QA program, inservice inspection, inservice testing, surveillance testing, and maintenance programs). The process should also address the (1) establishment of reliability, availability, or condition performance goals for the RAP SSCs, (2) establishment of performance and condition monitoring requirements to provide reasonable assurance that RAP SSCs do not degrade to an unacceptable level of reliability, availability, or condition during plant operations, (3) for non-safety-related RAP SSCs, establishment of QA controls for activities during the operations phase in accordance with the provisions in Part V of SRP Section 17.5, and (4) consideration of dominant failure modes of RAP SSCs in meeting the objectives of the RAP during plant operation.

Table 3.2-1 (9 of 86)

SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
8) Non-essential supply and return piping between the valve CC-146 and CC-148 in the auxiliary building of the division II	AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
9) Non-essential supply and return piping in the compound building of the division II	CPB	NNS	D	ASME B31.1-2010	N/A	III	
10. CD – Condensate							
a. Piping in auxiliary bldg.	AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
b. Condenser, condensate pumps, tanks, valves, strainers	TGB	NNS	D	ASME B31.1-2010	N/A	III	
c. Deaerator storage tank	TGB	NNS	D	ASME Sec. VIII -2007 with 2008 addenda	~~A~~ N/A	III	~~(3)(e)~~ Delete
d. Feedwater Heaters	TGB	NNS	D	ASME Sec. VIII -2007 with 2008 addenda	N/A	III	
e. Other piping	TGB	NNS	D	ASME B31.1-2010	N/A	III	
11. CE – Control Element Assembly Drive							
a. Control element drive mechanism	RCB	SC-1	A	ASME Sec. III NB -2007 with 2008 addenda	Yes	I	
1) Pressure housing assembly	RCB	SC-1	A	ASME Sec. III NB -2007 with 2008 addenda	Yes	I	
2) Motor assembly	RCB	SC-2	B	N/A	Yes	I	(N-10)
3) Extension shaft assembly	RCB	SC-2	B	N/A	Yes	I	(N-10)
b. Reactor trip switchgear	RCB	SC-3	N/A	IEEE-603-1991	Yes	I	
c. Rod drive motor generator set	RCB	NNS	N/A	N/A	N/A	III	

Table 3.2-1 (19 of 86)

SSC Identification	Location[(2)]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[(3)]	Seismic Category	Remarks
6) Boric acid supply (BAST to VCT/charging pump suction)	Yard, AB	SC-3	C	ASME Sec. III ND-2007 with 2008 addenda	Yes	I	
7) Reactor makeup water supply (RMWT to CV-186 inlet)	Yard, AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
8) BAMP to IRWST isolation valve CV-553	AB, RCB	NNS	D	ASME B16.34 - 2009	A	II	(3)(d), ~~(3)(e)~~
9) BABT to BAST isolation valve CV-126	AB	NNS	D	ASME B16.34 - 2009	~~A~~	III	~~(3)(e)~~
21. CW – Circulating Water							
a. [[CW pumps]]	CWPH	NNS	D	HI Standards – 2010	N/A	III	
b. Butterfly valves	TGB, CWPH	NNS	D	AWWA C504-2010	N/A	III	
c. Condenser tube cleaning system components	TGB	NNS	D	ASME B31.1-2010	N/A	III	
d. Circulating water pump lube water booster pumps	CWPH	NNS	D	HI Standards-2010	N/A	III	
e. [[Makeup pumps]]	Yard	NNS	D	HI Standards-2010	N/A	III	
f. [[Blowdown pumps]]	Yard	NNS	D	HI Standards-2010	N/A	III	
g. [[Cooling towers (including cooling tower fans)]]	Yard	NNS	D	ASME PTC 23-2003	N/A	III	
h. Piping and valves	TGB, CWPH, Yard	NNS	D	ASME B31.1-2010	N/A	III	

Delete

Delete

N/A

Table 3.2-1 (26 of 86)

SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
30. EF – Engineered Safety Feature Actuation System	AB	SC-3	N/A	IEEE-323-2003 IEEE-344-2004 IEEE-379-2000 IEEE-603-1991 IEEE-7-4.3.2-2003	Yes	I	
31. EM – Seismic Monitoring	AB, RCB, CPB, CCWHXB	NNS	N/A	IEEE-344-2004	A	I	(9)
32. ER – Emergency Response Facility							
a. TSC Console	AB	NNS	N/A	N/A	A	II	(3)(d), (5)
b. Panels and displays in EOF	Outside of plant	NNS	N/A	N/A	N/A	III	
33. ET – Auxiliary Transformer							
a. Standby aux. transformers	Yard	NNS	N/A	N/A	A	III	(3)(e)
b. Unit aux. transformers	Yard	NNS	N/A	N/A	~~N/A~~	III	
34. FC – Spent Fuel Pool Cooling and Cleanup						A	(10)
a. Spent fuel pool cooling heat exchangers	AB	SC-3	C	ASME Sec. III ND-2007 with 2008 addenda	Yes	I	
b. Spent fuel pool cooling pumps	AB	SC-3	C	ASME Sec. III ND-2007 with 2008 addenda	Yes	I	
c. Spent fuel pool cleanup pumps	AB	NNS	D	ASME Sec. VIII-2007 with 2008 addenda	A	II	(3)(d)
d. Spent fuel pool cleanup filters	AB	NNS	D	ASME Sec. VIII-2007 with 2008 addenda	A	II	(3)(d)

(3)(e)

Table 3.2-1 (31 of 86)

SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
c. Normal fire protection subsystem in safety-related areas							
1) Subsystem Components							
(a) Fire control panel	ALL	NNS	N/A	UL/NFPA 20-2013	A	II	(3)(d)
(b) Fire hydrant	Yard	NNS	E	NFPA 24-2013	A	II	(3)(d)
(c) Extinguisher	ALL	NNS	E	NFPA 10 -2013	A	II	(3)(d)
(d) Others	ALL	NNS	E	Applicable UL/NFPA	A	II	(3)(d)
2) Subsystem fire protection piping	ALL	NNS	D	ASME B31.1-2010	A	II	(3)(d)
3) Subsystem fire protection piping	ALL	NNS	E	NFPA 13-2013	A	II	(3)(d)
d. Normal fire protection subsystem in non-safety-related areas							
1) Subsystem components							
(a) Main fire pumps and jockey pump	FPWTB	NNS	E	NFPA 20-2013	A	III	(3)(e)
(b) Freshwater storage tanks	Yard	NNS	E	AWWA D-100-2005 NFPA 22-2013	A	III	(3)(e)
(c) Fire control panel	FPWTB	NNS	N/A	UL/NFPA 20-2013	A	III	(3)(e)
(d) Fire hydrant	Yard	NNS	E	NFPA 24-2013	A	III	(3)(e)
(e) Extinguisher	ALL	NNS	E	NFPA 10-2013	A	III	(3)(e)
(f) Others	ALL	NNS	E	Applicable UL/NFPA	A	III	(3)(e)
2) Subsystem fire protection piping	ALL	NNS	D	ASME B31.1-2010	A	III	(3)(e)
3) Subsystem fire protection piping	ALL	NNS	E	NFPA 13-2013	A	III	(3)(e)
4) Clean Agent Suppression Subsystem in Control Room	AB	NNS	E	Applicable UL/NFPA	A	II	(3)(e)
5) Fire Suppression Subsystem in Switchgear Room	AB	NNS	E	Applicable UL/NFPA	A	II	(3)(e)

N/A

Delete

Table 3.2-1 (32 of 86)

SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
39. FW – Feedwater							
a. From the SG up to and including the MSVH penetration anchor	RCB, MSVH	SC-2	B	ASME Sec. III NC-2007 with 2008 addenda	Yes	I	
b. Other piping	TGB	NNS	D	ASME B31.1-2010	N/A	III	
c. Feedwater pumps	TGB	NNS	D	HI Standards - 2010	N/A	III	
d. Feedwater booster pumps	TGB	NNS	D	HI Standards - 2010	N/A	III	
e. Startup feedwater pump	TGB	NNS	D	HI Standards - 2010	A	III	(3)(e)
f. ~~Startup feedwater pump discharge check valve~~	TGB	NNS	D	ASME B31.1-2010	A	III	(3)(e)
g. Startup feedwater pump discharge isolation valve	TGB	NNS	D	ASME B31.1-2010	A	III	(3)(e)
h. Feedwater heaters	TGB	NNS	D	ASME Sec. VIII – 2007 with 2008 addenda	N/A	III	
i. Other components	TGB	NNS	D	ASME Sec. VIII - 2007 with 2008 addenda	N/A	III	
40. GD – Grounding							
a. Grounding conductor	ALL	NNS	N/A	IEEE 80-2000 IEEE 665-1995	N/A	III	
b. Lightning protection equipment	ALL	NNS	N/A	IEEE 80-2000 IEEE 665-1995	N/A	III	

Startup feedwater pump discharge check valve, discharge stop check valve, and suction valve

Equipment in Safety-Related Areas

Table 3.2-1 (37 of 86)

AB, CCWHXB, ESWB, EDGB

Others

SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
50. IS – Security							
a. ~~Security CCTV subconsole and color graphic console~~	~~AB~~	NNS	N/A	10 CFR 73.55-2010 IEEE 692-2010	A	II	(3)(d), (6)
b. ~~Other security equipment~~	ALL	NNS	N/A	N/A	N/A	III	(6)
51. IW – In-Containment Refueling Water Storage							
a. In-containment refueling water storage tanks	RCB	SC-3	G	ACI 349-1997, ASME Sec. III CC-2001 with 2003 Addenda	Yes	I	
b. Holdup volume tank	RCB	SC-3	G	ACI 349-1997, ASME Sec. III CC-2001 with 2003 Addenda	Yes	I	
c. Trisodium phosphate baskets	RCB	SC-3	N/A	AISC N690-1994&2004 (Supplement No.2)	Yes	I	
d. IRWST sump strainers	RCB	SC-3	G	AISC N690-1994&2004 (Supplement No.2)	Yes	I	
e. Swing panels	RCB	SC-3	G	ASME AG-1-2009	Yes	I	
f. In-containment refueling water storage tank spillway	RCB	SC-2	B	ASME Sec. III NC-2007 with 2008 addenda	Yes	I	
g. Holdup volume tank flooding lines including the power operated valves V001 and 002 (MOV)	RCB	SC-2	B	ASME Sec. III NC-2007 with 2008 addenda	Yes	I	
h. Reactor cavity flooding lines including the power operated valves V003 and 004 (MOV)	RCB	SC-2	B	ASME Sec. III NC-2007 with 2008 addenda	Yes	I	

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SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B [3]	Seismic Category	Remarks
53. LL – Lighting							
a. Equipment in safety-related area							
1) Lighting fixture	RCB, AB, CCWHXB, ESWB, EDGB	NNS	N/A	NFPA 101-2012	A	II	(3)(d)
2) Lighting transformer	RCB, AB, CCWHXB, ESWB, EDGB	NNS	N/A	NFPA 101-2012	A	II	(3)(d)
3) Lighting distribution panel	RCB, AB, CCWHXB, ESWB, EDGB	NNS	N/A	NFPA 101-2012	A	II	(3)(d)
b. Equipment in other areas	ALL	NNS	N/A	N/A	N/A	III	
54. LP – Large Display Panel	AB	NNS	N/A	N/A	A	II	(3)(d)
55. MP – Main Power							
a. Protective relays for generator and transformer	AB	NNS	N/A	N/A	A	II	(3)(d)
b. Generator excitation system, ~~main transformer~~, generator circuit breaker, ~~isolated phase bus~~ and related protection facility	TGB Yard	NNS	N/A	N/A	N/A	III	
c. Others	TGB	NNS	N/A	N/A	N/A	III	
b. Main transformer and isolated phase bus	TGB Yard	NNS	N/A	N/A	A	III	(3)(e)

c

d

Delete

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SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
56. MS – Main Steam							
a. Piping and components from SG up to and including the MSVH penetration anchor wall	RCB, MSVH	SC-2	B	ASME Sec. III NC-2007 with 2008 addenda	Yes	I	
b. Piping and components from outlet of MSADVs and MSSVs	AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
c. Piping inside main steam pipe enclosure	MS Pipe Enclosure	NNS	D	ASME B31.1-2010	A	II	(3)(d)
d. Components inside turbine generator building from outside main steam pipe enclosure	TGB	NNS	D	ASME B31.1-2010	N/A	III	
e. Other piping	TGB	NNS	D	ASME B31.1-2010	N/A	III	
57. NB – 4.16 kV Non-Class 1E Power							
a. 4.16 kV switchgear (SW01M) in aux. building	AB	NNS	N/A	N/A	A	II	(3)(d), (3)(e)
b. 4.16 kV switchgear (SW02N) in TG building	TGB	NNS	N/A	N/A	~~A~~ N/A	III	~~(3)(e)~~ Delete
c. 4.16 kV switchgear (SW03N) in AAC GTG building	AAC GTGB	NNS	N/A	N/A	A	III	(3)(b), (3)(e)
d. 4.16 kV switchgear (SW02M) in TG building	TGB	NNS	N/A	N/A	N/A	III	
58. NC – NSSS process control							
a. Feedwater control signal processing and processor	AB	NNS	N/A	N/A	A	II	(3)(d)
b. Steam bypass control signal processing and processor	AB	NNS	N/A	N/A	A	II	(3)(d)
e. 4.16 kV switchgear (SW01N) in aux. building	AB	NNS	N/A	N/A	A	II	(3)(d)

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SSC Identification	Location(2)	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B(3)	Seismic Category	Remarks
67. PG – 480V Class 1E Load Center							
a. 480V LCs and LC XFMRs	AB	SC-3	N/A	IEEE 308-2001, IEEE 323-2003, IEEE 344-2004, IEEE 420-2001	Yes	I	
68. PH – 480V Class 1E MCC and Low Voltage							
a. 480V MCCs 120/208V distribution panels and XFMRs	AB ESWB EDGB	SC-3	N/A	IEEE 308-2001, IEEE 323-2003, IEEE 344-2004, IEEE 420-2001	Yes	I	
69. PM – MCR							
a. Operator console (RO, TO, EO, SS, STA)							
1) Frame	AB	SC-3	N/A	IEEE-323-2003 IEEE-344-2004 IEEE-420-2013 IEEE-603-1991	Yes	I	
2) IFPD	AB	NNS	N/A	N/A	A	II	(3)(d)
3) ESCM	AB	SC-3	N/A	IEEE-603-1991 IEEE-323-2003 IEEE-344-2004 IEEE-420-2013	Yes	I	

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SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
2) ~~Process~~ loop controller cabinet and related components 3) Other process	AB, CPB, TB, FPWTB, CWPH, AAC GTGB, SWYD	NNS	N/A	IEEE-383-2003 [17] IEEE-420-2001[17] IEEE-7-4.3.2-2003[17]	A	II	(3)(d)
b. Non-safety-instrument sensing lines							
1) Non-safety instrument sensing line in safety-related area	AB, RCB, TGB, CPB, ACC GTGB, ESWB, CWPH, CCWHXB, Yard	NNS	D	N/A	A	II	(3)(d)
2) Reliability related non-safety instrument sensing line in non-safety-related area	AB, TGB, CPB FPWTB, RCB CWPH, Yard	NNS	D	N/A	A	III	(3)(e)
3) Other non-safety instrument sensing line in non-safety-related area	AB, TGB, CCWHXB, RCB, CPB, CWPH, FPWTB, ESWB, AAC GTGB, Yard	NNS	D	N/A	N/A	III	

2) Reliability related process loop controller cabinet and related components	TB	NNS	N/A	IEEE-383-2003[17] IEEE-420-2001[17] IEEE-7-4.3.2-2003[17]	A	II	(3)(d), (3)(e)

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SSC Identification	Location[2]	Safety Class	Quality Group	Codes and Standards	10 CFR 50, App. B[3]	Seismic Category	Remarks
j. Demineralized water makeup manual valve	AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
k. Nitrogen makeup control valves	AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
l. Chemical additive tank supply and return line piping and associated valves	AB	NNS	D	ASME B31.1-2010	A	II	(3)(d)
108. WT – Turbine Generator Building Closed Cooling Water							
a. Pumps	TGB	NNS	D	HI Standards-2010	~~N/A~~	III	
~~b. Heat exchangers~~	TGB	NNS	D	ASME Sec. VIII-2007 with 2008 Addenda	N/A	III	
~~c.~~ Valves and associated piping	TGB	NNS	D	ASME B31.1-2010	N/A	III	
109. WV – Liquid Radwaste							
a. Piping and components in safety-related areas	AB	NNS	D	ASME B31.1 - 2010	A	II	(3)(d)
b. Piping and valve containing radioactive materials	CPB	NNS	D	ASME B31.3 - 2010	Note (4)	Note (4)	(4)
c. Floor drain tank	CPB	NNS	D	API650 - 2007	Note (4)	Note (4)	
d. Equipment waste tank	CPB	NNS	D	API650 – 2007	Note (4)	Note (4)	
e. Chemical waste tank	CPB	NNS	D	API650 – 2007	Note (4)	Note (4)	
f. Monitor tank	CPB	NNS	D	API650 – 2007	Note (4)	Note (4)	
b. Surge tank	TGB	NNS	D	ASME Sec. VIII-2007 with 2008 Addenda	A	III	(3)(e)

Heat exchangers, and chemical addition tank

A

(3)(e)

c.

d.