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17.0 QUALITY ASSURANCE AND RELIABILITY ASSURANCE

This chapter of the U.S. EPR Final Safety Analysis Report (FSAR) is incorporated by reference with supplements as identified in the following sections.

17.1 QUALITY ASSURANCE DURING DESIGN

This section of the U.S. EPR FSAR is incorporated by reference.

17.2 QUALITY ASSURANCE DURING THE OPERATIONS PHASE

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

The U.S. EPR FSAR includes the following COL Item in Section 17.2:

A COL applicant that references the U.S. EPR design certification will provide the Quality Assurance Programs associated with the construction and operations phase.

This COL Item is addressed as follows:

This information is provided in Section 17.5.

17.3 QUALITY ASSURANCE PROGRAM DESCRIPTION

This section of the U.S. EPR FSAR is incorporated by reference.

17.4 RELIABILITY ASSURANCE PROGRAM

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

17.4.1 RELIABILITY ASSURANCE PROGRAM SCOPE, STAGES, AND GOALS

No departures or supplements.

17.4.2 RELIABILITY ASSURANCE PROGRAM IMPLEMENTATION

The U.S. EPR FSAR includes the following COL Item in Section 17.4.2:

A COL applicant that references the U.S. EPR design certification will identify the site-specific SSCs within the scope of the RAP.

This COL Item is addressed as follows:

Based on a review of site-specific information, the design certification probabilistic risk assessment (PRA) is bounding and representative of the U.S EPR plant proposed at the {Callaway Plant} site. It is concluded that the U.S. EPR design-specific PRA model can be used, without modification, as the plant-specific PRA. This is based on the plant-specific features being conservatively modeled in the design-specific U.S. EPR PRA. Site and plant parameters that could influence the PRA results are addressed in the evaluation and it is determined that the design-PRA: (1) bounds or sufficiently captures site and plant parameters; and (2) the site and plant parameters do not have a significant impact on the PRA results and insights.

Therefore, no changes to the design-specific internal events PRA are necessary when considering specific site and plant parameters.

Based on the above evaluation, no additional components related to the site are identified for the site-specific RAP scope. Accordingly, the Structures, Systems, Components (SSCs) identified for consideration within the RAP during the design certification process are the same SSCs within the plant-specific RAP scope. No new components are identified as a result of site-specific or plant-specific characterization.

Table 17.4-1 through Table 17.4-7 specify the SSCs for consideration within the scope of RAP.

17.4.3 ORGANIZATION, DESIGN CONTROL, PROCEDURES AND INSTRUCTIONS, CORRECTIVE ACTIONS, AND AUDIT PLANS

No departures or supplements.

17.4.4 RELIABILITY ASSURANCE PROGRAM INFORMATION NEEDED IN A COL APPLICATION

The U.S. EPR FSAR includes the following COL Item in Section 17.4.4:

> A COL applicant that references the U.S. EPR design certification will provide the information requested in Regulatory Guide 1.206, Section C.I.17.4.4.

This COL Item is addressed as follows:

An introduction to the objectives of the Reliability Assurance Program including Design Reliability Assurance (D-RAP) is provided in the U.S. EPR FSAR Section 17.4. This section discusses post-certification D-RAP and the transition to reliability assurance activities during operations.

Reliability assurance activities are implemented in two stages. Stage 1 encompasses D-RAP conducted during certification of the U.S. EPR (described in the U.S. EPR FSAR Section 17.4) and the D-RAP for the site-specific design including procurement, construction, and fabrication and testing leading up to initial fuel load. D-RAP is largely accomplished for {AmerenUE} by the NSSS vendor and the Architect Engineer.

Stage 2 reliability assurance activities are conducted principally by {AmerenUE} and commence during the transition to fuel load and plant operation and are implemented concurrently with and as part of the Maintenance Rule (MR) program described in Section 17.6 and the other programs described below. The MR program is implemented prior to authorization to load fuel per 10 CFR 52.103(g).

Stage 2 reliability assurance activities continue for the life of the plant and with the MR program are implemented using traditional programs for surveillance testing, inservice inspection, inservice testing, the general preventive maintenance program and the {AmerenUE} Quality Assurance Program Description.

Sections 17.4.4.1 through 17.4.4.9 are added as a supplement to the U.S. EPR FSAR.

17.4.4.1 Identification of Site-Specific SSCs for D-RAP

Section 17.4.2 describes a methodology for ensuring site-specific SSCs are identified and included in the RAP.

The initial list of site-specific SSCs and their risk rankings is included in Section 17.4.2. The PRA model will continue to be refined over the life of the plant and this will require periodic adjustment to the risk rankings of SSCs in Section 17.4.2.

As D-RAP enters the detailed design, procurement, fabrication and construction phase, an expert panel with {AmerenUE} representation will be established and utilized to:

- augment PRA techniques in the risk ranking of SSCs using deterministic techniques, operating experience and expert judgment.
- identify risk significant SSCs not modeled in the PRA (if any).
- act as the final approver of risk significant SSCs.
- recommend design changes where appropriate to reduce risk.
- revise/adjust recommend operations phase maintenance/testing activities for risk significant SSCs described in Section 17.4.2.
- designate and chair NSSS and Architect Engineer working groups as necessary to assist in accomplishing the objectives of the expert panel.
- review and approve the recommendations of the working groups.
- assess the overall station risk impact due to SSC performance and all implemented risk-informed programs (including D-RAP) after each plant-specific data update of the PRA.

The expert panel is made up of members with diverse backgrounds in engineering, operations, maintenance, risk and reliability analysis, operating experience and work control. During the detailed design phase of D-RAP, each major engineering organization performing detailed design will be represented on the panel (or working groups) as deemed necessary. The composition of the panel will change during the period leading up to fuel load and operations. The panel will continue to function during operations for the life of the plant.

17.4.4.1.1 Organization

17.4.4.1.1.1 Program Formulation and Organizational Responsibilities

The {AmerenUE} overall site organization is described in Section 13.1. The Vice President, Engineering is responsible for formulating the reliability assurance activities as described in this section.

D-RAP is fundamentally an engineering program. The Vice President, Engineering retains responsibility for reliability assurance activities during design and construction even though implementation will reside principally with AREVA and other contractors (such as {Bechtel}) responsible for completion of detailed design and the development of engineering and procurement specifications. {AmerenUE} has delineated D-RAP requirements expected of the Plant Designer (NSSS and Architect Engineer vendors) including participation on the expert panel. The organizational relationships of {AmerenUE} and its contractors are further described in Section A of the {AmerenUE} QAPD.

For Stage 2, the organizational emphasis will shift from engineering and construction to systems engineering and maintenance. Design engineering will continue to play a role in maintaining the Master Equipment Database (as discussed in Section 17.4.4.1.2.1), configuration control and application of the design change process, if necessary, to improve SSC reliability.

The Expert Panel is composed of a Chairman and additional senior level managers as designated by the {Vice President, Engineering}. The Expert Panel membership may be augmented as determined by the {Vice President, Engineering}. Any change to the Expert Panel membership requires approval of the {Vice President, Engineering}.

The Probabilistic Risk Assessment organization maintains representation on the expert panel and has major input to determinations that SSCs are maintaining performance levels consistent with PRA model assumptions over the life of the plant. The PRA organization will report to the Senior Vice President, Engineering.

17.4.4.1.1.2 Reliability Assurance Interface Coordination

Reliability assurance activity interface issues are coordinated through the Expert Panel since the organizations involved have representation on the panel. Specific interface responsibilities of the panel members are detailed in a controlling procedure. These interface responsibilities include the following:

- The Plant Designer panel member maintains the design interface to ensure that any proposed design changes that involve risk significant SSCs modeled in the PRA are identified and periodically reviewed with the expert panel at a frequency determined by the panel.

- The Plant Designer panel member maintains the design interface to ensure that any proposed changes to the plant PRA model, as identified by the {AmerenUE} PRA representative on the Expert Panel, are appropriately reviewed for design impact and the results of the review appropriately distributed throughout the Plant Designer's and subcontractor's organizations.

- The Plant Designer panel member coordinates with the design organizations and expert panel members to ensure that significant design assumptions related to equipment reliability are realistic and achievable.

- The {AmerenUE} PRA panel member is responsible to inform the panel of changes to the PRA model and to advise other panel members on the potential impact of the change on SSC risk rankings, assumed reliability of SSCs for design activities and the need for adjustments to the MR program.

17.4.4.1.1.3 PRA Organization Input to the Design Process

The {AmerenUE} PRA panel member is responsible to review and concur in design changes involving risk significant SSCs identified by the Plant Designer's expert panel member. During implementation of the MR program prior to fuel load, responsibility for design and configuration control will transition from the Plant Designer to {AmerenUE}. The procedure for Design Change Packages will ensure screening of proposed design changes and PRA review and approval when necessary.

17.4.4.1.1.4 PRA Organization Design Reviews

The PRA organization's participation in periodic design reviews is principally via the PRA configuration control program that incorporates a feedback process to update the PRA model. These updates fall into two categories:

- The plant operating update incorporates plant design changes and procedure changes that affect PRA modeled components, initiating event frequencies, and changes in SSC unavailability that affect the PRA model. These changes will be incorporated into the model on a period not to exceed 36 months.

- The comprehensive data update incorporates changes to plant-specific failure rate distributions and human reliability, and any other database distribution updates (examples would include equipment failure rates, recovery actions, and operator actions). This second category will be updated on a period not to exceed 48 months.

The PRA model may be updated on a more frequent basis.

17.4.4.1.2 Design Control

17.4.4.1.2.1 Configuration Control of SSCs

The initial focal point for configuration control as it relates to D-RAP is the list of SSCs and their risk rankings in Section 17.4.2. During detailed design, a process will be implemented for a Master Equipment Database (MED). During the detailed design phase, this data base, for the risk significant SSCs identified in Section 17.4.2, will be populated from a review performed by the Expert Panel or associated working groups.

The MED will be developed and maintained as a source of approved risk information.

17.4.4.1.2.2 Design Change Feedback

The design control and change processes provide feedback to the PRA organization via identification of components on the MED that are affected by a proposed change. Those affected SSCs with medium or high risk are given additional review in accordance with approved criteria to ensure there is no potential impact to the risk ranking of the affected components. If potential impact is identified then the Risk and Analysis Organization must concur in the change.

17.4.4.1.2.3 Design Interface with PRA Organization

Assurance that SSC performance relates to reliability assumptions made in the PRA and deterministic methods for identifying risk significant SSCs is provided by monitoring the performance of SSCs during plant operation and the review and feedback of Operating Experience. This interface occurs through implementation of the MR and the functioning of the expert panel.

A wide range of traditional sources for relevant operating information is available. The industry and vendor equipment information that is applicable is available to the nuclear industry with the intent of minimizing adverse plant conditions or situations through shared experience. Sources include the NRC (Information Notices and Generic Letters), INPO (EPIX, NPRDS, Operating Events, and Significant Event Reports etc.) and vendor documentation and NSSS supplier information.

17.4.4.1.2.4 Engineering Design Controls for SSC Identification

Engineering design controls applied for determining the SSCs within the scope of the RAP are generally those specified in 10 CFR 50, Criterion III, "Design Control." These include, for example, the use of procedures for establishing risk via deterministic methods, proceduralized criteria for PRA risk ranking and independent verification and peer checking of the inputs necessary for utilization (or when necessary modification) of the site-specific PRA model.

17.4.4.1.2.5 Alternative Design

The process for proposing changes to the design for risk significant SSCs is proceduralized via the Design Change Package process. This process includes the use of a detailed checklist to establish the impact of the change on the PRA or deterministic evaluations performed to establish risk for affected SSCs. Changes identified as having an impact on SSCs and their risk rankings require appropriate special or interdisciplinary reviews.

17.4.4.1.3 Expert Panel

The Expert Panel and designated working groups consist of designated individuals having expertise in the areas of risk assessment, operations, maintenance, engineering, quality assurance, and licensing.

As a minimum, the combined expert panel and working groups include at least three individuals with a minimum of five years experience at similar nuclear plants, and at least one individual who has worked on the modeling and updating of the PRA for similar plants for a minimum of three years.

When utilized, expert panel representatives from contractor design organizations are required to have a minimum of three years experience establishing risk rankings for nuclear plant SSCs using PRA or deterministic techniques (which may include Failure Modes and Effects Analysis).

17.4.4.1.4 Methods of Analysis for Risk Significant SSC Identification

The process for maintaining, revising, and, when necessary, establishing new risk rankings for modified design are based on PRA and deterministic techniques. The process utilized in categorizing components consists of the following major tasks:

- Identification of functions performed by the subject plant system.
- Determination of the risk significance of each system function.
- Identification of the system functions supported by that component.
- Identification of a risk categorization of the component based on PRA insights (where the component is modeled).
- Development of a risk categorization of the component based on deterministic insights.
- Designation of the overall categorization of the component, based upon the higher of the PRA categorization and the deterministic categorization.
- Identification of critical attributes for components determined to be safety/risk significant.

The PRA and deterministic methods are described more fully below.

17.4.4.1.4.1 PRA Risk Ranking

A component's risk determination is based upon its impact on the results of the PRA. Both core damage frequency (CDF) and containment response to a core damaging event, including large early release frequency (LERF) are calculated. The PRA models internal initiating events at full power, and also accounts for the risk associated with external events. The PRA risk categorization of a component is based upon its Fussell-Vessely (FV) importance, which is the fraction of the CDF and LERF to which failure of the component contributes, and its risk achievement worth (RAW), which is the factor by which the CDF and LERF would increase if it were assumed that the component is guaranteed to fail. Specifically, PRA risk categorization to identify SSCs is based upon the following:

PRA Ranking	Criteria
Greater than Low	FV > 0.005 or RAW > 2.0
Low	FV < 0.005 and RAW < 2.0

17.4.4.1.4.2 Deterministic Risk Ranking

Components are subject to a deterministic categorization process, regardless of whether they are also subject to the PRA risk categorization process. This deterministic categorization process can result in an increase, but not a decrease (from the PRA risk) in a component's categorization.

A component's deterministic categorization is directly attributable to the importance of the system function supported by the component. In cases, where a component supports more than one system function, the component is initially classified based on the highest deterministic categorization of the function supported. In categorizing the functions of a system, five critical questions regarding the function are considered, each of which is given a different weight.

These questions and their weight are as follows:

Question	Weight
Is the function used to mitigate accidents or transients?	5
Is the function specifically called out in the Emergency Operating Procedures (EOPs)?	5
Does the loss of the function directly fail another risk-significant system?	4
Is the loss of the function safety significant for shutdown or mode changes?	3
Does the loss of the function, in and of itself, directly cause an initiating event?	3

Based on the impact on safety, if the function is unavailable and the frequency of loss of the function, each of the five questions is given a numerical answer ranging from 0 to 5. This grading scale is as follows:

"0" — Negative response

"1" — Positive response having an insignificant impact and/or occurring very rarely

"2" — Positive response having a minor impact and/or occurring infrequently

"3" — Positive response having a low impact and/or occurring occasionally

"4" — Positive response having a medium impact and/or occurring regularly

"5" — Positive response having a high impact and/or occurring frequently

The definitions for the terms used in this grading scale are as follows:

Frequency Definitions

- Occurring Frequently - continuously or always demanded
- Occurring Regularly - demanded > 5 times per year
- Occurring Occasionally - demanded 1-2 times per cycle
- Occurring Infrequently - demanded < once per cycle
- Occurring Very Rarely - demanded once per lifetime

Impact Definitions

- High Impact - a system function is lost which likely could result in core damage and/or may have a negative impact on the health and safety of the public
- Medium Impact - a system function is lost which may, but is not likely to, result in core damage and/or is unlikely to have a negative impact on the health and safety of the public
- Low Impact - a system function is significantly degraded, but no core damage and/or negative impact on the health and safety of the public is expected
- Minor Impact - a system function has been moderately degraded, but does not result in core damage or negative impact on the health and safety of the public
- Insignificant Impact - a system function has been challenged, but does not result in core damage or negative impact on the health and safety of the public

Although some of these definitions are quantitative, both of these sets of definitions are applied based on collective judgment and experience.

The numerical values, after weighting, are summed; the maximum possible value is 100. Based on the sum, functions are categorized as follows:

SCORE RANGE	CATEGORY
100–71	High Safety Significance (HSS)
70–41	Medium Safety Significance (MSS)
40–21	Low Safety Significance (LSS)
20–0	No Risk Significance (NRS)

A function with a low categorization due to a low sum can receive a higher deterministic categorization if any one of its five questions received a high numerical answer. Specifically, a weighted score of 25 on any one question results in an HSS categorization; a weighted score of 15-20 on any one question results in a minimum categorization of MSS; and a weighted score of 9-12 on any one question results in a minimum categorization of LSS. This is done to ensure that a function with a significant risk in one area does not have that risk contribution masked because of its low risk in other areas.

In general, a component is given the same categorization as the highest categorized system function that the component supports. However, a component may be ranked lower than the associated system function based upon diverse and/or multiple independent means available to satisfy the system function.

17.4.4.2 Procurement, Fabrication, Construction, and Test Specifications

Procurement, fabrication, construction, and test specifications for safety-related and non-safety-related SSCs within the scope of RAP are prepared and implemented under the quality assurance program referenced in Section 17.5. The quality assurance program describes the planned and systematic actions necessary to provide adequate confidence that SSCs will perform satisfactorily in service. These actions are applied to procurement, fabrication construction and test specifications.

Assumptions related to equipment reliability and availability are translated into verifiable attributes, defined characteristics and processes and are included in procurement, fabrication, and construction specifications such that deviations from these attributes, characteristics and processes may be identified and corrected.

Procedures describing equipment selection require consideration of the manufacturer's recommended maintenance activities and the manufacturer's time estimates for accomplishing these activities such that the equipment selected is able to meet availability assumptions while in service, including conservative allowances for unplanned maintenance.

Test specifications will describe to the extent practical the actual conditions that will exist when SSCs are called upon to perform their risk significant functions and testing will document proper performance under the specified conditions when these conditions can be practically established in the field. When these conditions cannot be duplicated, acceptance will be established based on qualification testing performed by the equipment vendor under controlled conditions.

The approved QAPD applies 10 CFR 50 Appendix B (CFR, 2008a) requirements to safety-related SSCs. For non-safety-related SSCs within the scope of RAP, Section V of the QAPD describes the process for selectively applying program controls to those characteristics or critical attributes that render the SSC a significant contributor to plant safety.

Section V of the QAPD specifies the quality requirements required for non-safety-related SSCs credited in mitigating defined events such as Anticipated Transients Without Scram (ATWS) and Station Blackout (SBO). When SSCs are risk significant due to their role in mitigating these defined events then the specified quality requirements for these SSCs will be satisfied.

17.4.4.3 Quality Assurance Implementation

Implementation of the QAPD during procurement, fabrication, construction and preoperational testing of SSCs is accomplished in accordance with written instructions,

procedures or drawings of a type appropriate to the circumstances, and where applicable, include quantitative or qualitative acceptance criteria. These procedures are {AmerenUE} implementing procedures, or supplier implementing procedures governed by a supplier quality program approved by {AmerenUE}.

17.4.4.4 Maintenance Rule/Operational Programs

The {AmerenUE} MR program is described in Section 17.6. Risk significant SSCs identified by reliability assurance activities are included in the MR program as high safety significance (HSS) components (Section 17.6). The opportunity to judge SSC performance under the MR program is provided by the operational programs discussed in Section 17.6.

Many SSCs would meet the criteria to be in the MR program without considerations related to the RAP. In cases where the RAP identifies a high or medium risk SSC that would not otherwise have been in the MR program, the SSC is added. For those SSCs already in the Technical Specifications (TS), Inservice Inspection (ISI), or Inservice Testing (IST) programs, their performance under these programs is factored into the performance monitoring accomplished under the MR program.

In cases where a SSC requires periodic testing or inspection not already accommodated by an existing program, then special provisions will be made to accommodate the necessary testing or inspection, for example, in the Preventive Maintenance (PM) program.

17.4.4.4.1 Performance Goal

Reliability performance assumptions for SSCs are established under the MR at two levels of performance monitoring. The first level of performance monitoring (10 CFR 50.65(a)(2)) (CFR, 2008b) establishes conservative criteria used to judge that SSCs are meeting expected performance objectives. For SSCs, the performance monitoring criteria are established consistent with the reliability and availability assumptions used in the PRA. Failure to meet these objectives would trigger performance monitoring at the second level (10 CFR 50.65(a)(1)) accompanied by the establishment of specific defined goals to return the component to expected performance levels (Section 17.6). These specific defined goals also consider the reliability and availability assumptions used in the PRA.

17.4.4.4.2 Feedback of Actual Equipment Performance and Operating Experience

The feedback mechanism for periodically evaluating reliability assumptions based on actual equipment, train or system performance is realized in the implementation of the MR program. Since the performance monitoring criteria established under the MR program are set consistent with the assumed reliability assumptions used in the PRA, the failure to meet these performance objectives (i.e., equipment, train or system placed in 10 CFR 50.65 (a)(1) category) requires an assessment of the assumed reliability as described in Section17.4.4.4.1 above. This assessment requires that the assumed reliability be reviewed to ensure it is reflective of actual {AmerenUE} and industry performance. The process requires review by the PRA organization to concur that goals have been met before moving a component from a 10 CFR 50.65 (a)(1) status back to a 10 CFR 50.65(a)(2) status.

17.4.4.5 Non-Safety SSC Design/Operational Errors

The process for providing corrective actions for design and operational errors that degrade non-safety-related SSCs within the scope of RAP is procedurally defined. All SSCs (safety-related or non-safety-related) with risk significance greater than “low” are entered into the MR program as HSS. The {AmerenUE} MR program does not distinguish between a Maintenance Rule

Functional Failure (MRFF) and a Maintenance Preventable Functional Failure (MPFF). Therefore, non-safety-related SSCs that have experienced a MRFF attributable to a design or operating error (i.e. could not have been prevented by maintenance) are corrected using the corrective action process described in the QAPD. Under the MR program, MRFFs require cause determination (may be an apparent cause determination) and corrective action is implemented to prevent recurrence.

17.4.4.6 Procedural Control

Implementation of the reliability assurance activities is considered an activity affecting quality and the controls for procedures and instructions used to implement reliability assurance activities are specified in Section A through U and W (safety-related) and Section V (non-safety-related risk significant) of the QAPD. In most cases where a single procedure describes the process for an activity that applies to both safety-related and non-safety-related components (for example establishing the performance monitoring criteria for the MR or establishing risk significance for SSCs in RAP), a single procedure or procedures that meet the full quality program requirements of QAPD will be utilized. For activities such as procurement, non-safety-related SSCs in the RAP will be governed by Procedure Controls meeting the requirements of Section V of the QAPD.

Section V of the QAPD specifies the quality requirements required for non-safety-related SSCs credited in mitigating defined events such as ATWS and SBO. When SSCs are risk significant due to their role in mitigating these defined events then the specified quality requirements for these SSCs will be satisfied.

17.4.4.7 Records

Implementation of the reliability assurance activities is considered an activity affecting quality and the generation of records associated with this activity will meet the requirements of the QAPD.

Records of Expert Panel decisions and supporting documents are retained as QA records in the Records Management System (RMS) and consist of:

- Expert Panel decisions and meeting minutes including dissenting opinions and resolutions.
- Recommendations of the working groups.

The PRA includes models for power operation and for low-power and shutdown operation. For each model, documentation is maintained that includes sources of input data, modeling techniques, and assumptions used in the analysis. These documents are maintained in RMS for the life of the plant.

Section V of the QAPD specifies the quality requirements required for non-safety-related SSCs credited in mitigating defined events such as ATWS and SBO. When SSCs are risk significant due to their role in mitigating these defined events, the specified quality requirements for these SSCs will be satisfied.

17.4.4.8 Corrective Action Process

Under the {AmerenUE} process for MR implementation, any SSC experiencing a MRFF requires use of the Corrective Action process to document the failure, its cause determination and

actions to preclude recurrence. As previously discussed in Section 17.4.4.5, this also includes non-safety-related SSCs.

Other failures of SSCs that are not MRFFs will be documented and corrected as described by the QAPD, Section P and Section V.

Section V of the QAPD specifies the quality requirements required for non-safety-related SSCs credited in mitigating defined events such as ATWS and SBO. When SSCs are risk significant due to their role in mitigating these defined events, the specified quality requirements for these SSCs will be satisfied.

17.4.4.9 Audit Plans

The reliability assurance activities are collectively accomplished by programs related to design, procurement, fabrication, construction, preoperational testing, PRA modeling and PRA risk assessment, deterministic evaluations from the expert panel, maintenance rule, Technical Specifications and other operational programs and the corrective action program. These programs are subject to audit as described in the QAPD.

Section V of the QAPD specifies the quality requirements required for non-safety- related SSCs credited in mitigating defined events such as ATWS and SBO. When SSCs are risk significant due to their role in mitigating these defined events, the specified quality requirements for these SSCs will be satisfied.

17.4.5 REFERENCES

{**CFR, 2008a**. Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, Title 10, Code of Federal Regulations, Part 50, Appendix B, U.S. Nuclear Regulatory Commission, 2008.

CFR, 2008b. Requirements for monitoring the effectiveness of maintenance at nuclear power plants, Title 10, Code of Federal Regulations, Part 50.65, U.S. Nuclear Regulatory Commission, 2008.}

Table 17.4-1—Definitions of Component Failure Modes

Failure Mode	Definition	Sample Basic Event Description
BP	Back Plane Failure	I&C, Analog output module fails (affects backplane bus)
CF	Fails to Control Flow	LHSI, LHSI Pump 10 Throttle Control MOV JNG10AA104, Fails to Control Flow
CL	Fails to Remain Open, Spurious Operation	ELEC, 13.8kV SWGR 31BBA Circuit Breaker 2 to 13.8kV SWGR 31BBC, Fails to Remain Open (SO)
EL	External Leakage	CCWS, Train 1 HTX 10 KAA10AC001, Shell - External Leakage
FC	Fails to Close on Demand	ELEC, 6.9kV SWGR 31BBH to 6.9kV SWGR 31BDC Circuit Breaker, Fails to Close on Demand
FD	RTB UV interposing relay fails to (de-energize to) trip	RTB UV interposing relay fails to (de-energize to) trip
FE	RTB shunt interposing relay fails to (energize to) trip	RTB shunt interposing relay fails to (energize to) trip
FL	Fails During Operation	ELEC, 24V DC I&C Power Rack 31BRW12/31BUW13, Fails During Operation
FO	Fails to Open on Demand	ELEC, 13.8kV SWGR 31BBA Circuit Breaker 2 to 13.8kV SWGR 31BBC, Fails to Open on Demand
FR	Fails to Run	ELEC, Inverter 31BRU01, Fails to Run
FS	Fails to Start on Demand	LHSI, LHSI Train 3 Motor Driven Pump JNG30AP001, Fails to Start on Demand
IR	Internal Rupture	LHSI, LHSI Pump 40 Suction from IRWST MOV JNG40AA001, Internal Rupture
LK	Tube Leakage	LHSI, LHSI Train 1 HTX JNG10AC001, Tube Leakage
MEC1	Left in Wrong Position, Monitored	DWS, DWS Pump 12 Suction Manual Valve GHC12AA001, Left in Wrong Position
MEC3	Left in Wrong Position, Non-Monitored	DWS, DWS Pump 12 Discharge Manual Valve GHC12AA003, Left in Wrong Position
NS	Non-Self-monitored Equipment Failure	I&C, Analog signal modifier fails (non-self-monitored)
OP	Fails to Remain Closed, Spurious Operation	ELEC, 13.8kV SWGR 31BBA Circuit Breaker 1 to 13.8kV SWGR 31BBC, Fails to Remain Closed (SO)
PANS	Priority Module A Fails (Non-Self-Monitored)	ELEC, SWGR 1BBA/1BBC Breaker, PAC A Priority Module (Type AV42) Fails (Non-Self-Monitored)
PASM	Priority Module A Fails (Self-Monitored)	ELEC, SWGR 1BBA/1BBC Breaker, PAC A Priority Module (Type AV42) Fails (Self-Monitored)
PBNS	Priority Module B Fails (Non-Self-Monitored)	ELEC, SWGR 2BBA/2BBC Breaker, PAC B Priority Module (Type AV42) Fails (Non-Self-Monitored)
PBSM	Priority Module B Fails (Self-Monitored)	ELEC, SWGR 2BBA/2BBC Breaker, PAC B Priority Module (Type AV42) Fails (Self-Monitored)
PG	Plugs	IRWST, SIS Sump Strainer to MHSI/LHSI Train 1 Pumps JNK10AT001, Plugs
PO	Premature Opening	LHSI, LHSI/RHR Train 10 Overpressure Protection Safety Valve JNG10AA192, Premature Opening
SF	Seal Failure	Mechanical Failure of the Stand Still Seal for RCP1
SM	Self-Monitored Equipment Failure	I&C, Analog signal modifier fails (self-monitored)
SO	Fails to Remain Closed, Spurious Operation	GWPS, Inflow Line Inboard MOV KPL84AA003, Fails to Remain Closed (SO)
ST	Fails on Demand	ELEC, 250V Non 1E 2-hr Battery 31BTA01, Fails on Demand

Table 17.4-2—Risk Significant SSCs Ranked by FV for "At Power" Events, All Components with FV Greater Than or Equal to 0.005

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No	System US	Component ID	Component Type	Component Description	Failure Modes	FV	RAW
1	ELEC	30XKA20	Diesel Generator	ELEC, Emergency Diesel Generator XKA20	FR, FS	**0.114**	2.1
2	ELEC	30XKA30	Diesel Generator	ELEC, Emergency Diesel Generator XKA30	FR, FS	**0.109**	1.9
3	SCWS	30QKA10GH001	Chiller	SCWS, Train 1 Chiller Unit QKA10GH001	FR, FS, PANS, PASM	**0.102**	18.4
4	ELEC	30XKA10	Diesel Generator	ELEC, Emergency Diesel Generator XKA10	FR, FS	**0.100**	1.6
5	SCWS	30QKA40GH001	Chiller	SCWS, Train 4 Chiller Unit QKA40GH001	FR, FS, PANS, PASM	**0.099**	15.9
6	ELEC	30XKA40	Diesel Generator	ELEC, Emergency Diesel Generator XKA40	FR, FS	**0.097**	1.5
7	SIS/RHRS	30JND10AP001	Pump	MHSI, MHSI Train 1 Motor Driven Pump JND10AP001	FR, FS, PANS, PASM	**0.038**	1.7
8	ELEC	30XKA50	Diesel Generator	ELEC, SBO Diesel Generator XKA50	FR, FS	**0.034**	1.5
9	SIS/RHRS	30JND30AP001	Pump	MHSI, MHSI Train 3 Motor Driven Pump JND30AP001	FR, FS, PANS, PASM	**0.033**	1.5
10	SIS/RHRS	30JND20AP001	Pump	MHSI, MHSI Train 2 Motor Driven Pump JND20AP001	FR, FS, PBNS, PBSM	**0.033**	1.4
11	ELEC	30XKA80	Diesel Generator	ELEC, SBO Diesel Generator XKA80	FR, FS	**0.032**	1.5
12	EFWS	30LAS11AP001	Pump	EFWS, Train 1 Motor Driven Pump LAS11AP001	EL, FR, FS, PANS, PASM	**0.030**	2.5
13	SIS/RHRS	30JND40AP001	Pump	MHSI, MHSI Train 4 Motor Driven Pump JND40AP001	FR, FS, PBNS, PBSM	**0.028**	1.2
14	EFWS	30LAS41AP001	Pump	EFWS, Train 4 Motor Driven Pump LAS41AP001	EL, FR, FS, PBNS, PBSM	**0.028**	2.3
15	ELEC	31BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 31BTD01	ST	**0.028**	13.3
16	ELEC	34BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 34BTD01	ST	**0.027**	13.2
17	MSS	30LBA13AA001	Pneumatic Valve	MSS, Train 1 MSRIV LBA13AA001	CL, FC, FO	**0.020**	1.0
18	MSS	30LBA33AA001	Pneumatic Valve	MSS, Train 3 MSRIV LBA33AA001	CL, FC, FO	**0.020**	1.0
19	MSS	30LBA23AA001	Pneumatic Valve	MSS, Train 2 MSRIV LBA23AA001	CL, FC, FO	**0.020**	1.0
20	MSS	30LBA40AA002	Pneumatic Valve	MSS, Train 4 Main Steam Isolation Valve LBA40AA002	CL, FC, OP	**0.020**	8.7
21	SIS/RHRS	30JNG13AA005	Check Valve	LHSI, CL1 First SIS Isolation Check Valve JNG13AA005	CL, FO	**0.020**	2.0
22	ESWS	30PED10AN002	Fan	UHS, Cooling Tower Train 1 Cooling Fan PED10AN002	FR, FS	**0.020**	2.4
23	SIS/RHRS	30JNG23AA005	Check Valve	LHSI, CL2 First SIS Isolation Check Valve JNG23AA005	CL, FO	**0.019**	1.8
24	MSS	30LBA43AA001	Pneumatic Valve	MSS, Train 4 MSRIV LBA43AA001	CL, FC, FO, OP	**0.019**	1.0
25	SIS/RHRS	30JNG33AA005	Check Valve	LHSI, CL3 First SIS Isolation Check Valve JNG33AA005	CL, FO	**0.019**	1.8

Table 17.4-2—Risk Significant SSCs Ranked by FV for "At Power" Events, All Components with FV Greater Than or Equal to 0.005

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No	System US	Component ID	Component Type	Component Description	Failure Modes	FV	RAW
26	ELEC	32BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 32BTD01	ST	**0.017**	1.6
27	ELEC	33BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 33BTD01	ST	**0.017**	1.4
28	ESWS	30PED20AN002	Fan	UHS, Cooling Tower Train 2 Cooling Fan PED20AN002	FR, FS	**0.017**	1.9
29	SIS/RHRS	30JNG43AA005	Check Valve	LHSI, CL4 First SIS Isolation Check Valve JNG43AA005	CL, FO	**0.017**	1.1
30	EFWS	30LAS31AP001	Pump	EFWS, Train 3 Motor Driven Pump LAS31AP001	EL, FR, FS, PANS, PASM	**0.016**	1.4
31	EFWS	30LAS21AP001	Pump	EFWS, Train 2 Motor Driven Pump LAS21AP001	EL, FR, FS, PBNS, PBSM	**0.016**	1.4
32	ESWS	30PED30AN002	Fan	UHS, Cooling Tower Train 3 Cooling Fan PED30AN002	FR, FS	**0.016**	1.7
33	CCWS	30KAA12AA005	MOV	CCWS, Train 1 to LHSI HTX 10 Cooling MOV KAA12AA005	CL, FO, PANS, PASM	**0.016**	2.3
34	HVAC	30SAC01AN001	Fan	SAC, Normal Air Supply Fan SAC01AN001	FR, FS	**0.015**	17.0
35	HVAC	30SAC31AN001	Fan	SAC, Normal Air Exhaust Fan SAC31AN001	FR, FS	**0.015**	17.0
36	HVAC	30SAC04AN001	Fan	SAC, Normal Air Supply Fan SAC04AN001	FR, FS	**0.015**	15.5
37	HVAC	30SAC34AN001	Fan	SAC, Normal Air Exhaust Fan SAC34AN001	FR, FS	**0.015**	15.5
38	SCWS	30QKA10AP107	Pump	SCWS, Train 1 Motor Driven Safety Chiller Pump QKA10AP107	EL, FR, FS	**0.014**	17.7
39	ELEC	32BRA	MCC	ELEC, 480V MCC 32BRA	FL, FR	**0.014**	80.1
40	ELEC	31BRA	MCC	ELEC, 480V MCC 31BRA	FL, FR	**0.014**	79.9
41	ESWS	30PEB20AP001	Pump	ESWS, Train 2 Motor Driven Pump PEB20AP001	FR, FS, PBNS, PBSM	**0.014**	3.2
42	CCWS	30KAA22AA005	MOV	CCWS, Train 2 to LHSI HTX 20 Cooling MOV KAA22AA005	CL, FO, PBNS, PBSM	**0.014**	1.9
43	SCWS	30QKA40AP107	Pump	SCWS, Train 4 Motor Driven Safety Chiller Pump QKA40AP107	EL, FR, FS	**0.014**	15.3
44	CCWS	30KAA32AA005	MOV	CCWS, Train 3 to LHSI HTX 30 Cooling MOV KAA32AA005	CL, FO, PANS, PASM	**0.013**	1.7
45	RCS	30JEB30AA010	MOV	RCP, RCP3 Leakoff Isolation MOV JEB30AA010	FC, IR, OP	**0.013**	4.7
46	RCS	30JEB30AA020	MOV	RCP Seal, RCP3 Seal Nitrogen Venting Isolation MOV JEB30AA020	FC, IR, OP	**0.013**	4.7
47	RCS	30JEB40AA010	MOV	RCP, RCP4 Leakoff Isolation MOV JEB40AA010	FC, IR, OP	**0.013**	4.7
48	RCS	30JEB40AA020	MOV	RCP Seal, RCP4 Seal Nitrogen Venting Isolation MOV JEB40AA020	FC, IR, OP	**0.013**	4.7

Table 17.4-2—Risk Significant SSCs Ranked by FV for "At Power" Events, All Components with FV Greater Than or Equal to 0.005

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No	System US	Component ID	Component Type	Component Description	Failure Modes	FV	RAW
49	ESWS	30PEB30AP001	Pump	ESWS, Train 3 Motor Driven Pump PEB30AP001	FR, FS, PANS, PASM	**0.012**	2.8
50	MSS	30LBA10AA002	Pneumatic Valve	MSS, Train 1 Main Steam Isolation Valve LBA10AA002	CL, FC, OP	**0.012**	2.8
51	MSS	30LBA20AA002	Pneumatic Valve	MSS, Train 2 Main Steam Isolation Valve LBA20AA002	CL, FC, OP	**0.012**	2.8
52	MSS	30LBA30AA002	Pneumatic Valve	MSS, Train 3 Main Steam Isolation Valve LBA30AA002	CL, FC, OP	**0.010**	1.6
53	ESWS	30PED40AN002	Fan	UHS, Cooling Tower Train 4 Cooling Fan PED40AN002	FR, FS	**0.009**	1.1
54	CCWS	30KAA42AA005	MOV	CCWS, Train 4 to LHSI HTX 40 Cooling MOV KAA42AA005	CL, FO, PBNS, PBSM	**0.009**	1.1
55	HVAC	30SAC02AN001	Fan	SAC, Normal Air Supply Fan SAC02AN001	FR, FS	**0.008**	4.2
56	HVAC	30SAC32AN001	Fan	SAC, Normal Air Exhaust Fan SAC32AN001	FR, FS	**0.008**	4.2
57	ESWS	30PEB20AA005	MOV	ESWS, Train 2 Pump Discharge Isolation MOV PEB20AA005	CL, FO, PBNS, PBSM	**0.008**	3.1
58	HVAC	30SAC03AN001	Fan	SAC, Normal Air Supply Fan SAC03AN001	FR, FS	**0.008**	3.8
59	HVAC	30SAC33AN001	Fan	SAC, Normal Air Exhaust Fan SAC33AN001	FR, FS	**0.008**	3.8
60	SIS/RHRS	30JNG10AA006	Check Valve	LHSI, LHSI CL1 Discharge Manual Chec k Valve JNG10AA006	CL, FO, IR, MEC3	**0.007**	1.8
61	MSS	30LBA43AA101	MOV	MSS, Train 4 MSRCV LBA43AA101	CF, FC, IR, OP, PBNS, PBSM	**0.006**	2.9
62	MSS	30LBA13AA712	Pneumatic Valve	MSS, Train 1a MSRIV Pneumatic Pilot Valve LBA13AA712	CL, FO	**0.006**	1.0
63	MSS	30LBA13AA713	Pneumatic Valve	MSS, Train 1a MSRIV Pneumatic Pilot Valve LBA13AA713	CL, FO	**0.006**	1.0
64	MSS	30LBA23AA712	Pneumatic Valve	MSS, Train 2a MSRIV Pneumatic Pilot Valve LBA23AA712	CL, FO	**0.006**	1.0
65	MSS	30LBA23AA713	Pneumatic Valve	MSS, Train 2a MSRIV Pneumatic Pilot Valve LBA23AA713	CL, FO	**0.006**	1.0
66	MSS	30LBA33AA712	Pneumatic Valve	MSS, Train 3a MSRIV Pneumatic Pilot Valve LBA33AA712	CL, FO	**0.006**	1.0
67	MSS	30LBA33AA713	Pneumatic Valve	MSS, Train 3a MSRIV Pneumatic Pilot Valve LBA33AA713	CL, FO	**0.006**	1.0
68	MSS	30LBA33AA716	Pneumatic Valve	MSS, Train 3b MSRIV Pneumatic Pilot Valve LBA33AA716	CL, FO	**0.006**	1.0

Table 17.4-2—Risk Significant SSCs Ranked by FV for "At Power" Events, All Components with FV Greater Than or Equal to 0.005

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No	System US	Component ID	Component Type	Component Description	Failure Modes	FV	RAW
69	MSS	30LBA33AA717	Pneumatic Valve	MSS, Train 3b MSRIV Pneumatic Pilot Valve LBA33AA717	CL, FO	**0.006**	1.0
70	MSS	30LBA43AA716	Pneumatic Valve	MSS, Train 4b MSRIV Pneumatic Pilot Valve LBA43AA716	CL, FC, FO, OP	**0.006**	1.0
71	ESWS	30PEB30AA005	MOV	ESWS, Train 3 Pump Discharge Isolation MOV PEB30AA005	CL, FO, PANS, PASM	**0.006**	2.7
72	RCS	30JEB10AA010	MOV	RCP, RCP1 Leakoff Isolation MOV JEB10AA010	FC, IR, OP	**0.006**	2.8
73	RCS	30JEB10AA020	MOV	RCP Seal, RCP1 Seal Nitrogen Venting Isolation MOV JEB10AA020	FC, IR, OP	**0.006**	2.8
74	RCS	30JEB20AA010	MOV	RCP, RCP2 Leakoff Isolation MOV JEB20AA010	FC, IR, OP	**0.006**	2.8
75	RCS	30JEB20AA020	MOV	RCP Seal, RCP2 Seal Nitrogen Venting Isolation MOV JEB20AA020	FC, IR, OP	**0.006**	2.8
76	SIS/RHRS	30JNG30AA006	Check Valve	LHSI, LHSI CL3 Discharge Manual Check Valve JNG30AA006	CL, FO, IR, MEC3	**0.006**	1.7
77	SIS/RHRS	30JND10AA003	Check Valve	MHSI, MHSI Pump 10 Discharge Manual Check Valve JND10AA003	CL, FO, IR, MEC3	**0.006**	1.7
78	SCWS	30QKA20AP107	Pump	SCWS, Train 2 Motor Driven Safety Chiller Pump QKA20AP107	EL, FR, FS	**0.006**	4.2
79	SCWS	30QKA30AP107	Pump	SCWS, Train 3 Motor Driven Safety Chiller Pump QKA30AP107	EL, FR, FS	**0.005**	3.8
80	SIS/RHRS	30JNG20AA006	Check Valve	LHSI, LHSI CL2 Discharge Manual Check Valve JNG20AA006	CL, FO, IR, MEC3	**0.005**	1.6

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
1	ELEC	31BDA	SWGR	ELEC, 6.9kV SWGR 31BDA	FL	**88.2**	0.002
2	ELEC	31BDB	SWGR	ELEC, 6.9kV SWGR 31BDB	FL	**82.6**	0.002
3	ELEC	31BMB	Load Center	ELEC, 480V Load Center 31BMB	FL	**82.6**	0.002
4	ELEC	31BMT02	Transformer	ELEC, 6.9kV-480V Transformer 31BMT02	FL	**82.6**	0.002
5	ELEC	31BDC	SWGR	ELEC, 6.9kV SWGR 31BDC	FL	**82.4**	0.002
6	ELEC	32BDB	SWGR	ELEC, 6.9kV SWGR 32BDB	FL	**82.4**	0.002
7	ELEC	32BMB	Load Center	ELEC, 480V Load Center 32BMB	FL	**82.4**	0.002
8	ELEC	32BMT02	Transformer	ELEC, 6.9kV-480V Transformer 32BMT02	FL	**82.4**	0.002
9	ELEC	30BRW10BUW11	Power Rack	ELEC, 24V DC I&C Power Rack 31BRW10/31BUW11	FL	**82.3**	0.002
10	ELEC	30BRW32BUW33	Power Rack	ELEC, 24V DC I&C Power Rack 32BRW32/32BUW33	FL	**82.2**	0.002
11	ELEC	31BDB1BMT02	Circuit Breaker	ELEC, 6.9kV SWGR 31BDB to Transformer 31BMT02 Circuit Breaker	OP	**80.5**	0.001
12	ELEC	31BDC_1BDB1	Circuit Breaker	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	OP	**80.5**	0.001
13	ELEC	31BDC_1BDB2	Circuit Breaker	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	OP	**80.5**	0.001
14	ELEC	31BMT021BMB	Circuit Breaker	ELEC, Transformer 31BMT02 to 480V Load Center 31BMB Circuit Breaker	OP	**80.5**	0.001
15	ELEC	32BDB2BMT02	Circuit Breaker	ELEC, 6.9kV SWGR 32BDB to Transformer 32BMT02 Circuit Breaker	OP	**80.5**	0.001
16	ELEC	32BMT022BMB	Circuit Breaker	ELEC, Transformer 32BMT02 to 480V Load Center 32BMB Circuit Breaker	OP	**80.5**	0.001
17	ELEC	32BRA	MCC	ELEC, 480V MCC 32BRA	FL, FR	**80.1**	0.014
18	ELEC	31BRA	MCC	ELEC, 480V MCC 31BRA	FL, FR	**79.9**	0.014
19	ELEC	31BRU011BRA	Circuit Breaker	ELEC, Inverter 31BRU01 to 480V MCC 31BRA Circuit Breaker	OP	**77.6**	0.001
20	ELEC	32BRU012BRA	Circuit Breaker	ELEC, Inverter 32BRU01 to 480V MCC 32BRA Circuit Breaker	OP	**77.6**	0.001
21	ELEC	32BDA	SWGR	ELEC, 6.9kV SWGR 32BDA	FL	**41.4**	0.001
22	ELEC	32BDA_2BDB1	Circuit Breaker	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	OP	**40.5**	0.000
23	ELEC	32BDA_2BDB2	Circuit Breaker	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB Circuit Breaker	OP	**40.5**	0.000
24	EFWS	30LAR10BB001	Tank	EFWS, Train 1 EFW Storage Tank LAR10BB001	EL	**21.6**	0.000
25	EFWS	30LAR20BB001	Tank	EFWS, Train 2 EFW Storage Tank LAR20BB001	EL	**21.6**	0.000

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
26	EFWS	30LAR30BB001	Tank	EFWS, Train 3 EFW Storage Tank LAR30BB001	EL	**21.6**	0.000
27	EFWS	30LAR40BB001	Tank	EFWS, Train 4 EFW Storage Tank LAR40BB001	EL	**21.6**	0.000
28	ELEC	34BUC	Bus	ELEC, 250V DC Bus 34BUC	FL	**18.8**	0.000
29	SCWS	30QKA10GH001	Chiller	SCWS, Train 1 Chiller Unit QKA10GH001	FR, FS, PANS, PASM	**18.4**	0.102
30	SCWS	30QKA10AP107	Pump	SCWS, Train 1 Motor Driven Safety Chiller Pump QKA10AP107	EL, FR, FS	**17.7**	0.014
31	HVAC	30SAC01AN001	Fan	SAC, Normal Air Supply Fan SAC01AN001	FR, FS	**17.0**	0.015
32	HVAC	30SAC31AN001	Fan	SAC, Normal Air Exhaust Fan SAC31AN001	FR, FS	**17.0**	0.015
33	SCWS	30QKA40GH001	Chiller	SCWS, Train 4 Chiller Unit QKA40GH001	FR, FS, PANS, PASM	**15.9**	0.099
34	ELEC	34BDA	SWGR	ELEC, 6.9kV SWGR 34BDA	FL	**15.8**	0.000
35	HVAC	30SAC04AN001	Fan	SAC, Normal Air Supply Fan SAC04AN001	FR, FS	**15.5**	0.015
36	HVAC	30SAC34AN001	Fan	SAC, Normal Air Exhaust Fan SAC34AN001	FR, FS	**15.5**	0.015
37	SCWS	30QKA40AP107	Pump	SCWS, Train 4 Motor Driven Safety Chiller Pump QKA40AP107	EL, FR, FS	**15.3**	0.014
38	SCWS	30QKA10AA101	MOV	SCWS, Train 1 Chiller By-pass MOV QKA10AA101	CF	**13.8**	0.000
39	SCWS	30QKC10AA101	MOV	SCWS, Return from SAC Div 1 MOV QKC10AA101	CL	**13.8**	0.000
40	HVAC	30SAC01AA003	MOV	SAC, Normal Air Inlet Motor Operated Damper SAC01AA003	CL	**13.8**	0.000
41	HVAC	30SAC31AA002	MOV	SAC, Normal Air Exhaust Motor Operated Damper SAC31AA002	CL	**13.8**	0.000
42	SCWS	30QKA10AA003	Check Valve	SCWS, Train 1 Safety Chiller Pump Discharge Check Valve QKA10AA003	CL, FO	**13.4**	0.001
43	HVAC	30SAC01AA005	Check Valve	SAC, Normal Air Inlet Supply Fan Discharge Check Damper SAC01AA005	CL, FC, FO, IR	**13.4**	0.001
44	HVAC	30SAC31AA003	Check Valve	SAC, Normal Air Exhaust Supply Fan Discharge Check Damper SAC31AA003	CL, FO	**13.4**	0.000
45	ELEC	31BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 31BTD01	ST	**13.3**	0.028
46	ELEC	34BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 34BTD01	ST	**13.2**	0.027
47	ELEC	30BRW70BUW71	Power Rack	ELEC, 24V DC I&C Power Rack 34BRW70/34BUW71	FL	**12.7**	0.000
48	CCWS	30KAB20AA192	Safety Valve	CCWS, CCWS CH2 Return Safety Valve KAB20AA192	PO	**12.7**	0.001

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
49	CCWS	30KAB20AA193	Safety Valve	CCWS, FPCS Train 2 Cooling Header Safety Valve KAB20AA193	PO	**12.7**	0.001
50	CCWS	30KAB30AA192	Safety Valve	CCWS, CCWS CH2 RCP3/4 TB Return Safety Valve KAB30AA192	PO	**12.7**	0.001
51	CCWS	30KAB70AA191	Safety Valve	CCWS, CVCS HP Cooler 2 Return Safety Valve KAB60AA191	PO	**12.7**	0.001
52	SCWS	30QKA40AA101	MOV	SCWS, Train 4 Chiller By-pass MOV QKA40AA101	CF	**12.2**	0.000
53	SCWS	30QKC40AA101	MOV	SCWS, Return from SAC Div 4 MOV QKC40AA101	CL	**12.2**	0.000
54	HVAC	30SAC04AA003	MOV	SAC, Normal Air Inlet Motor Operated Damper SAC04AA003	CL	**12.2**	0.000
55	HVAC	30SAC34AA002	MOV	SAC, Normal Air Exhaust Motor Operated Damper SAC34AA002	CL	**12.2**	0.000
56	SCWS	30QKA40AA003	Check Valve	SCWS, Train 4 Safety Chiller Pump Discharge Check Valve QKA40AA003	CL, FO	**11.9**	0.001
57	HVAC	30SAC04AA005	Check Valve	SAC, Normal Air Inlet Supply Fan Discharge Check Damper SAC04AA005	CL, FC, FO, IR	**11.9**	0.001
58	HVAC	30SAC34AA003	Check Valve	SAC, Normal Air Exhaust Supply Fan Discharge Check Damper SAC34AA003	CL, FO	**11.9**	0.000
59	ELEC	31BDA_1BDC1	Circuit Breaker	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	OP	**11.1**	0.000
60	ELEC	31BDA_1BDC2	Circuit Breaker	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	CL, FO, OP	**11.1**	0.000
61	ELEC	31BNB01	MCC	ELEC, 480V MCC 31BNB01	FL, FR	**9.9**	0.001
62	ELEC	31BUC	Bus	ELEC, 250V DC Bus 31BUC	FL	**9.7**	0.000
63	ELEC	34BNB01	MCC	ELEC, 480V MCC 34BNB01	FL, FR	**9.7**	0.001
64	MSS	30LBA40AA002	Pneumatic Valve	MSS, Train 4 Main Steam Isolation Valve LBA40AA002	CL, FC, OP	**8.7**	0.020
65	MSS	30LBA41AA191	Safety Valve	MSS, Train 4 Main Steam Safety Relief Valve LBA41AA191	FO, PO	**8.4**	0.004
66	MSS	30LBA42AA191	Safety Valve	MSS, Train 4 Main Steam Safety Relief Valve LBA42AA191	FO, PO	**8.4**	0.004
67	ELEC	31BTD01	Circuit Breaker	ELEC, 250V Battery 31BTD01 Circuit Breaker	OP	**7.7**	0.000
68	ELEC	34BTD01	Circuit Breaker	ELEC, 250V Battery 34BTD01 Circuit Breaker	OP	**7.3**	0.000
69	CCWS	30KAB10AA192	Safety Valve	CCWS, CCWS CH1 Return Safety Valve KAB10AA192	PO	**6.3**	0.000
70	CCWS	30KAB10AA193	Safety Valve	CCWS, FPCS Train 1 Cooling Header Safety Valve KAB10AA193	PO	**6.3**	0.000

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
71	CCWS	30KAB30AA191	Safety Valve	CCWS, CCWS CH1 RCP1/2 TB Return Safety Valve KAB30AA191	PO	**6.3**	0.000
72	CCWS	30KAB60AA191	Safety Valve	CCWS, CVCS HP Cooler 1 Return Safety Valve KAB60AA191	PO	**6.3**	0.000
73	ELEC	34BDD	SWGR	ELEC, 6.9kV SWGR 34BDD	FL	**5.9**	0.000
74	ELEC	34BMD	Load Center	ELEC, 480V Load Center 34BMD	FL	**5.9**	0.000
75	ELEC	34BMT04	Transformer	ELEC, 6.9kV-480V Transformer 34BMT04	FL	**5.9**	0.000
76	ELEC	34BRB	MCC	ELEC, 480V MCC 34BRB	FL, FR	**4.9**	0.001
77	ELEC	34BDB	SWGR	ELEC, 6.9kV SWGR 34BDB	FL	**4.8**	0.000
78	ELEC	34BMB	Load Center	ELEC, 480V Load Center 34BMB	FL	**4.8**	0.000
79	ELEC	34BMT02	Transformer	ELEC, 6.9kV-480V Transformer 34BMT02	FL	**4.8**	0.000
80	ELEC	34BDC	SWGR	ELEC, 6.9kV SWGR 34BDC	FL	**4.8**	0.000
81	RCS	30JEB30AA010	MOV	RCP, RCP3 Leakoff Isolation MOV JEB30AA010	FC, IR, OP	**4.7**	0.013
82	RCS	30JEB30AA020	MOV	RCP Seal, RCP3 Seal Nitrogen Venting Isolation MOV JEB30AA020	FC, IR, OP	**4.7**	0.013
83	RCS	30JEB40AA010	MOV	RCP, RCP4 Leakoff Isolation MOV JEB40AA010	FC, IR, OP	**4.7**	0.013
84	RCS	30JEB40AA020	MOV	RCP Seal, RCP4 Seal Nitrogen Venting Isolation MOV JEB40AA020	FC, IR, OP	**4.7**	0.013
85	ELEC	31BTB01_BAT	Battery	ELEC, 250V Non 1E 12-hr Battery 31BTB01	ST	**4.6**	0.002
86	ELEC	33BDB	SWGR	ELEC, 6.9kV SWGR 33BDB	FL	**4.6**	0.000
87	ELEC	33BMB	Load Center	ELEC, 480V Load Center 33BMB	FL	**4.6**	0.000
88	ELEC	33BMT02	Transformer	ELEC, 6.9kV-480V Transformer 33BMT02	FL	**4.6**	0.000
89	ELEC	30BRW52BUW53	Power Rack	ELEC, 24V DC I&C Power Rack BRW52/BUW53	FL	**4.5**	0.000
90	ELEC	32BTB01_BAT	Battery	ELEC, 250V Non 1E 12-hr Battery 32BTB01	ST	**4.5**	0.002
91	ELEC	34BRA	MCC	ELEC, 480V MCC 34BRA	FL, FR	**4.4**	0.001
92	ESWS	30PEB10AP001	Pump	ESWS, Train 1 Motor Driven Pump PEB10AP001	FR, FS, PANS, PASM	**4.4**	0.003
93	SCWS	30QKA20GH001	Chiller	SCWS, Train 2 Chiller Unit QKA20GH001	FR, FS, PBNS, PBSM	**4.3**	0.004
94	HVAC	30SAC02AN001	Fan	SAC, Normal Air Supply Fan SAC02AN001	FR, FS	**4.2**	0.008
95	HVAC	30SAC32AN001	Fan	SAC, Normal Air Exhaust Fan SAC32AN001	FR, FS	**4.2**	0.008
96	SCWS	30QKA20AP107	Pump	SCWS, Train 2 Motor Driven Safety Chiller Pump QKA20AP107	EL, FR, FS	**4.2**	0.006
97	RCS	30JEB30 SSSF	Stand Still Seal	Stand Still Seal for RCP3	SF	**4.2**	0.003
98	RCS	30JEB40 SSSF	Stand Still Seal	Stand Still Seal for RCP4	SF	**4.2**	0.003

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
99	ELEC	32BUD	Bus	ELEC, Non 1E 250V DC Distribution Panel 32BUD	FL	**4.1**	0.000
100	CCWS	30KAA10AP001	Pump	CCWS, Train 1 Motor Driven Pump KAA10AP001	EL, FR, FS, PANS, PASM	**3.9**	0.000
101	SCWS	30QKA30GH001	Chiller	SCWS, Train 3 Chiller Unit QKA30GH001	FR, FS, PBNS, PBSM	**3.9**	0.004
102	ELEC	34BDA_4BDD1	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDD Circuit Breaker	OP	**3.9**	0.000
103	ELEC	34BDA_4BDD2	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDD Circuit Breaker	OP	**3.9**	0.000
104	ELEC	34BDD4BMT04	Circuit Breaker	ELEC, 6.9kV SWGR 34BDD to Transformer 34BMT04 Circuit Breaker	OP	**3.9**	0.000
105	ELEC	34BMT044BMD	Circuit Breaker	ELEC, Transformer 34BMT04 to 480V Load Center 34BMD Circuit Breaker	OP	**3.9**	0.000
106	HVAC	30SAC03AN001	Fan	SAC, Normal Air Supply Fan SAC03AN001	FR, FS	**3.8**	0.008
107	HVAC	30SAC33AN001	Fan	SAC, Normal Air Exhaust Fan SAC33AN001	FR, FS	**3.8**	0.008
108	RCS	30JEB30AA018	SOV	RCP Seal, RCP3 Nitrogen Supply Solenoid Valve JEB30AA018	CL, FO	**3.8**	0.001
109	RCS	30JEB40AA018	SOV	RCP Seal, RCP4 Nitrogen Supply Solenoid Valve JEB40AA018	CL, FO	**3.8**	0.001
110	SCWS	30QKA30AP107	Pump	SCWS, Train 3 Motor Driven Safety Chiller Pump QKA30AP107	EL, FR, FS	**3.8**	0.005
111	ELEC	31BUD	Bus	ELEC, Non 1E 250V DC Distribution Panel 31BUD	FL	**3.8**	0.000
112	CCWS	30KAA22AA101	MOV	CCWS, Common Header 1 QKA20 Chiller Return 3-Way MOV KAA22AA101	CL	**3.6**	0.000
113	SCWS	30QKA20AA003	Check Valve	SCWS, Train 2 Safety Chiller Pump Discharge Check Valve QKA20AA003	CL, FO	**3.6**	0.000
114	SCWS	30QKA20AA101	MOV	SCWS, Train 2 Chiller By-pass MOV QKA20AA101	CF	**3.6**	0.000
115	SCWS	30QKC20AA101	MOV	SCWS, Return from SAC Div 2 MOV QKC20AA101	CL	**3.6**	0.000
116	HVAC	30SAC02AA003	MOV	SAC, Normal Air Inlet Motor Operated Damper SAC02AA003	CL	**3.6**	0.000
117	HVAC	30SAC02AA005	Check Valve	SAC, Normal Air Inlet Supply Fan Discharge Check Damper SAC02AA005	CL, FC, FO, IR	**3.6**	0.000
118	HVAC	30SAC32AA002	MOV	SAC, Normal Air Exhaust Motor Operated Damper SAC32AA002	CL	**3.6**	0.000

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
119	HVAC	30SAC32AA003	Check Valve	SAC, Normal Air Exhaust Supply Fan Discharge Check Damper SAC32AA003	CL, FO	**3.6**	0.000
120	ELEC	31BRB	MCC	ELEC, 480V MCC 31BRB	FL, FR	**3.6**	0.000
121	ELEC	33BDB3BMT02	Circuit Breaker	ELEC, 6.9kV SWGR 33BDB to Transformer 33BMT02 Circuit Breaker	OP	**3.5**	0.000
122	ELEC	33BMT023BMB	Circuit Breaker	ELEC, Transformer 33BMT02 to 480V Load Center 33BMB Circuit Breaker	OP	**3.5**	0.000
123	ELEC	34BDB4BMT02	Circuit Breaker	ELEC, 6.9kV SWGR 34BDB to Transformer 34BMT02 Circuit Breaker	OP	**3.5**	0.000
124	ELEC	34BDC_4BDB1	Circuit Breaker	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	OP	**3.5**	0.000
125	ELEC	34BDC_4BDB2	Circuit Breaker	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	OP	**3.5**	0.000
126	ELEC	34BMT024BMB	Circuit Breaker	ELEC, Transformer 34BMT02 to 480V Load Center 34BMB Circuit Breaker	OP	**3.5**	0.000
127	ELEC	34BDA_4BDC1	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	OP	**3.5**	0.000
128	ELEC	34BDA_4BDC2	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	CL, FO, OP	**3.5**	0.000
129	CCWS	30KAA32AA101	MOV	CCWS, Common Header 2 QKA30 Chiller Return 3-Way MOV KAA32AA101	CL	**3.3**	0.000
130	SCWS	30QKA30AA003	Check Valve	SCWS, Train 3 Safety Chiller Pump Discharge Check Valve QKA30AA003	CL, FO	**3.3**	0.000
131	SCWS	30QKA30AA101	MOV	SCWS, Train 3 Chiller By-pass MOV QKA30AA101	CF	**3.3**	0.000
132	SCWS	30QKC30AA101	MOV	SCWS, Return from SAC Div 3 MOV QKC30AA101	CL	**3.3**	0.000
133	HVAC	30SAC03AA003	MOV	SAC, Normal Air Inlet Motor Operated Damper SAC03AA003	CL	**3.3**	0.000
134	HVAC	30SAC03AA005	Check Valve	SAC, Normal Air Inlet Supply Fan Discharge Check Damper SAC03AA005	CL, FC, FO, IR	**3.3**	0.000
135	HVAC	30SAC33AA002	MOV	SAC, Normal Air Exhaust Motor Operated Damper SAC33AA002	CL	**3.3**	0.000
136	HVAC	30SAC33AA003	Check Valve	SAC, Normal Air Exhaust Supply Fan Discharge Check Damper SAC33AA003	CL, FO	**3.3**	0.000
137	ESWS	30PEB20AP001	Pump	ESWS, Train 2 Motor Driven Pump PEB20AP001	FR, FS, PBNS, PBSM	**3.2**	0.014

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
138	ELEC	32BRU03	Inverter	ELEC, Inverter 32BRU03	FR	**3.1**	0.000
139	ELEC	31BNB02	MCC	ELEC, 480V MCC 31BNB02	FL, FR	**3.1**	0.000
140	ESWS	30PEB20AA005	MOV	ESWS, Train 2 Pump Discharge Isolation MOV PEB20AA005	CL, FO, PBNS, PBSM	**3.1**	0.008
141	ELEC	32BRC	MCC	ELEC, 480V MCC 32BRC	FL	**2.9**	0.000
142	ELEC	32BRU0301	Switch	ELEC, Inverter 32BRU03 Bypass Switch 32BRU0301	OP	**2.9**	0.000
143	MSS	30LBA43AA101	MOV	MSS, Train 4 MSRCV LBA43AA101	CF, FC, IR, OP, PBNS, PBSM	**2.9**	0.006
144	ESWS	30PEB30AP001	Pump	ESWS, Train 3 Motor Driven Pump PEB30AP001	FR, FS, PANS, PASM	**2.8**	0.012
145	RCS	30JEB10AA010	MOV	RCP, RCP1 Leakoff Isolation MOV JEB10AA010	FC, IR, OP	**2.8**	0.006
146	RCS	30JEB10AA020	MOV	RCP Seal, RCP1 Seal Nitrogen Venting Isolation MOV JEB10AA020	FC, IR, OP	**2.8**	0.006
147	RCS	30JEB20AA010	MOV	RCP, RCP2 Leakoff Isolation MOV JEB20AA010	FC, IR, OP	**2.8**	0.006
148	RCS	30JEB20AA020	MOV	RCP Seal, RCP2 Seal Nitrogen Venting Isolation MOV JEB20AA020	FC, IR, OP	**2.8**	0.006
149	MSS	30LBA10AA002	Pneumatic Valve	MSS, Train 1 Main Steam Isolation Valve LBA10AA002	CL, FC, OP	**2.8**	0.012
150	MSS	30LBA20AA002	Pneumatic Valve	MSS, Train 2 Main Steam Isolation Valve LBA20AA002	CL, FC, OP	**2.8**	0.012
151	ESWS	30PEB30AA005	MOV	ESWS, Train 3 Pump Discharge Isolation MOV PEB30AA005	CL, FO, PANS, PASM	**2.7**	0.006
152	SIS/RHRS	30JNG10AC001	HTX	LHSI, LHSI Train 1 HTX JNG10AC001	LK	**2.6**	0.000
153	ELEC	31BDD	SWGR	ELEC, 6.9kV SWGR 31BDD	FL	**2.6**	0.000
154	ELEC	31BMD	Load Center	ELEC, 480V Load Center 31BMD	FL	**2.6**	0.000
155	ELEC	31BMT04	Transformer	ELEC, 6.9kV-480V Transformer 31BMT04	FL	**2.6**	0.000
156	ELEC	33BDA	SWGR	ELEC, 6.9kV SWGR 33BDA	FL	**2.5**	0.000
157	EFWS	30LAS11AP001	Pump	EFWS, Train 1 Motor Driven Pump LAS11AP001	EL, FR, FS, PANS, PASM	**2.5**	0.030
158	OCWS	30QNA22AN001	Chiller	OCWS, Train 2A Chiller Unit QNA22AN001	FR	**2.4**	0.001
159	OCWS	30QNA23AN001	Chiller	OCWS, Train 1B Chiller Unit QNA23AN001	FR	**2.4**	0.001
160	ELEC	33BRA	MCC	ELEC, 480V MCC 33BRA	FL, FR	**2.4**	0.000
161	RCS	30JEB10 SSSF	Stand Still Seal	Stand Still Seal for RCP1	SF	**2.4**	0.001
162	RCS	30JEB20 SSSF	Stand Still Seal	Stand Still Seal for RCP2	SF	**2.4**	0.001
163	RCS	30JEB30AA019	Check Valve	RCP Seal, RCP3 Nitrogen Supply Check Valve JEB30AA019	CL, FO	**2.4**	0.000
164	RCS	30JEB40AA019	Check Valve	RCP Seal, RCP4 Nitrogen Supply Check Valve JEB40AA019	CL, FO	**2.4**	0.000

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
165	ESWS	30PED10AN002	Fan	UHS, Cooling Tower Train 1 Cooling Fan PED10AN002	FR, FS	**2.4**	0.020
166	EFWS	30LAS41AP001	Pump	EFWS, Train 4 Motor Driven Pump LAS41AP001	EL, FR, FS, PBNS, PBSM	**2.3**	0.028
167	ELEC	31BRU03	Inverter	ELEC, Inverter 31BRU03	FR	**2.3**	0.000
168	CCWS	30KAA12AA005	MOV	CCWS, Train 1 to LHSI HTX 10 Cooling MOV KAA12AA005	CL, FO, PANS, PASM	**2.3**	0.016
169	RCS	30JEB30AP001	Circuit Breaker	ELEC, 13.8kV SWGR 33BBC Circuit Breaker for RCP JEB30AP001	CL, FO, PANS, PASM	**2.3**	0.001
170	RCS	30JEB40AP001	Circuit Breaker	ELEC, 13.8kV Bus BBH Circuit Breaker for RCP JEB40AP001	CL, FO, PANS, PASM	**2.3**	0.001
171	ELEC	35BBA	SWGR	ELEC, 13.8kV SWGR 35BBA	FL	**2.3**	0.000
172	ELEC	35BFE	Load Center	ELEC, 480V Load Center 35BFE	FL	**2.3**	0.000
173	ELEC	35BFT05	Transformer	ELEC, 13.8kV-480V Transformer 35BFT05	FL	**2.3**	0.000
174	CCWS	30KAA10BB001	Tank	CCWS, Train 1 Surge Tank KAA10BB001	EL	**2.3**	0.000
175	OCWS	30QNA22AP033	Pump	OCWS, Train 2A Motor Driven Chiller Unit Pump QNA22AP033	EL, FR	**2.3**	0.000
176	OCWS	30QNA23AP043	Pump	OCWS, Train 1B Motor Driven Chiller Unit Pump QNA23AP043	EL, FR	**2.3**	0.000
177	ELEC	31BRC	MCC	ELEC, 480V MCC 31BRC	FL	**2.3**	0.000
178	ELEC	31BRU0301	Switch	ELEC, Inverter 31BRU03 Bypass Switch 31BRU0301	OP	**2.3**	0.000
179	ELEC	34BNB02	MCC	ELEC, 480V MCC 34BNB02	FL, FR	**2.3**	0.000
180	ELEC	33BDA_3BDB1	Circuit Breaker	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDB Circuit Breaker	OP	**2.2**	0.000
181	ELEC	33BDA_3BDB2	Circuit Breaker	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDB Circuit Breaker	OP	**2.2**	0.000
182	SIS/RHRS	30JNG10AA104	MOV	LHSI, LHSI Pump 10 Throttle Control MOV JNG10AA104	CF, CL	**2.2**	0.002
183	CCWS	30KAA20AP001	Pump	CCWS, Train 2 Motor Driven Pump KAA20AP001	EL, FR, FS, PBNS, PBSM	**2.2**	0.004
184	RCS	30JEB10AA018	SOV	RCP Seal, RCP1 Nitrogen Supply Solenoid Valve JEB10AA018	CL, FO	**2.2**	0.001
185	RCS	30JEB20AA018	SOV	RCP Seal, RCP2 Nitrogen Supply Solenoid Valve JEB20AA018	CL, FO	**2.2**	0.001
186	EFWS	30LAR11AA103	MOV	EFWS, Train 1 SG Pressure Control MOV LAR11AA103	CF, PANS, PASM	**2.2**	0.002
187	EFWS	30LAR11AA105	MOV	EFWS, Train 1 SG Level Control MOV LAR11AA005	CF, PANS, PASM	**2.2**	0.002
188	ESWS	30PEB20AA007	Manual Valve	ESWS, Train 2 Manual Valve PEB20AA007	MEC1	**2.1**	0.000

Table 17.4-3—Risk Significant SSCs Ranked by RAW for "At Power" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
189	ESWS	30PEB20AA009	Manual Valve	ESWS, Train 2 Manual Valve PEB20AA009	MEC1	**2.1**	0.000
190	ESWS	30PEB20AA010	Manual Valve	ESWS, Train 2 Manual Valve PEB20AA010	CL, MEC1	**2.1**	0.000
191	EFWS	30LAR41AA103	MOV	EFWS, Train 4 SG Pressure Control MOV LAR41AA103	CF, PBNS, PBSM	**2.1**	0.002
192	EFWS	30LAR41AA105	MOV	EFWS, Train 4 SG Level Control MOV LAR41AA005	CF, PBNS, PBSM	**2.1**	0.002
193	ELEC	32BNB02	MCC	ELEC, 480V MCC 32BNB02	FL, FR	**2.1**	0.000
194	CCWS	30KAA10AA112	MOV	CCWS, Train 1 Heat Exchanger Bypass MOV KAA10AA112	IR, OP	**2.1**	0.000
195	ESWS	30PEB10AA005	MOV	ESWS, Train 1 Pump Discharge Isolation MOV, PEB10AA005	CL	**2.1**	0.000
196	ESWS	30PEB10AA010	MOV	UHS, Cooling Tower Train 1 Spray MOV PEB10AA010, Fails to Remain Open (SO)	CL	**2.1**	0.000
197	ESWS	30PEB10AA011	MOV	UHS, Cooling Tower Train 1 Bypass Line MOV PEB10AA011, Internal Rupture	IR, OP	**2.1**	0.000
198	ELEC	30XKA20	Diesel Generator	ELEC, Emergency Diesel Generator XKA20	FR, FS	**2.1**	0.114
199	SIS/RHRS	30JNG13AA005	Check Valve	LHSI, CL1 First SIS Isolation Check Valve JNG13AA005	CL, FO	**2.0**	0.020
200	ESWS	30PED10AN001	Fan	UHS, Cooling Tower Train 1 Cooling Fan PED10AN001	FR, FS	**2.0**	0.003
201	MFWS	30LAB31AA001	Pneumatic Valve	FWS, HP Heater Train 1 Bypass Pneumatic Valve LAB31AA001	CL	**2.0**	0.000
202	MFWS	30LAB31AA002	Pneumatic Valve	FWS, HP Heater Train 1 Bypass Pneumatic Valve LAB31AA002	CL	**2.0**	0.000
203	MFWS	30LAB32AA001	Pneumatic Valve	FWS, HP Heater Train 2 Bypass Pneumatic Valve LAB32AA001	CL	**2.0**	0.000
204	MFWS	30LAB32AA002	Pneumatic Valve	FWS, HP Heater Train 2 Bypass Pneumatic Valve LAB32AA002	CL	**2.0**	0.000
205	CLCWS	30PGB19AA191	Safety Valve	CLCWS, Safety Valve PGB19AA191	PO	**2.0**	0.000

Table 17.4-4—Risk Significant SSCs Common Cause Failure (CCF) Ranked by RAW for "At Power" Events, All CCFs with RAW Greater Than or Equal to 20

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No	System US	CCF ID	Component Type	CCF Component Description	CCF RAW
1	ELEC	BTD01_BAT__ST_D-ALL	Battery	CCF of Safety Related Batteries on Demand	**39, 960**
2	I&C	CL-TXS-OSCCF	Software	Software CCF of TXS operating system or multiple diversity groups	**23, 510**
3	HVAC	SAC01AN001EFR_D-ALL	Fan	CCF to Run Normal Air Supply Fans	**3, 768**
4	HVAC	SAC31AN001EFR_D-ALL	Fan	CCF to Run Normal Air Exhaust Fans	**3, 768**
5	SCWS	QKA10AP107EFR_D-ALL	Pump	CCF of SCWS Pumps to Run	**3, 736**
6	IRWST	JNK10AT001SPG_P-ALL	Strainer	CCF of IRWST Sump Strainers - Plugged	**3, 117**
7	SIS/RHRS	JNG13AA005CFO_D-ALL	Check Valve	CCF to Open LHSI/MHSI Common Injection Check Valves	**3, 040**
8	I&C	CL-PS-B-SWCCF	Software	Software CCF of Protection System diversity group B	**3, 009**
9	I&C	ALU-B CCF NS-ALL	ALU	CCF of ALU-B Protection System Computer Processors (Non-Self-Monitored)	**2, 921**
10	I&C	ALU-B CCF SM-ALL	ALU	CCF of ALU-B Protection System Computer Processors (Self-Monitored)	**2, 889**
11	I&C	APU4 CCF NS-ALL	APU	CCF of APU-4 Protection System Computer Processors (Non-Self-Monitored)	**2, 064**
12	I&C	APU4 CCF SM-ALL	APU	CCF of APU-4 Protection System Computer Processors (Self-Monitored)	**2, 045**
13	I&C	SG4 PRES CCF-ALL	Sensor	CCF of SG4 pressure sensors	**2, 037**
14	I&C	SAS CCF-ALL	SAS	CCF of Safety Automation System (SAS) Divisions	**805**
15	ELEC	XKA10_____DFR_D-ALL	Diesel Generator	CCF of EDGs to Run	**518**
16	MSS	LBA13AA001PFO_D-ALL	Pneumatic Valve	CCF to Open Main Steam Relief Isolation Valves	**498**
17	MSS	MSRIVSCPFO_P-ALL	Pneumatic Valve	CCF to Open Main Steam Relief Isolation Pneumatic Pilot Valves	**496**
18	MSS	MSRIVSOOFO_P-ALL	SOV	CCF to Open Main Steam Relief Isolation Solenoid Pilot Valves	**494**
19	ELEC	XKA10_____DFS_D-ALL	Diesel Generator	CCF of EDGs to Start	**473**
20	SIS/RHRS	JND10AP001EFR_D-ALL	Pump	CCF of MHSI Pumps to Run	**447**
21	SIS/RHRS	JND10AP001EFS_D-ALL	Pump	CCF of MHSI Pumps to Start	**438**
22	I&C	PZR PRES CCF-ALL	Sensor	CCF of pressurizer (RCS) pressure sensors	**426**
23	SIS/RHRS	JND10AA003CFO_D-ALL	Check Valve	CCF to Open MHSI Pump Discharge Motor Operated CHECK Valves	**421**
24	SIS/RHRS	JND10AA007CFO_D-ALL	Check Valve	CCF to Open MHSI Discharge CVs (CIVs)	**421**
25	I&C	APU3 CCF NS-ALL	APU	CCF of APU-3 Protection System Computer Processors (Non-Self-Monitored)	**403**
26	I&C	APU3 CCF SM-ALL	APU	CCF of APU-3 Protection System Computer Processors (Self-Monitored)	**394**
27	ELEC	BDT01_BDA_BFO_D-ALL	Circuit Breaker	CCF to Open Normal Supply 6.9kV Circuit Breakers from Aux. Xfrm to Safety Related SWGRs	**379**
28	ELEC	BDT02_BDA-BFO_D-ALL	Circuit Breaker	CCF to Open Backup Supply 6.9kV Circuit Breakers from Aux. Xfrm to Safety Related SWGRs	**379**
29	ELEC	XKA10_1BDABFO_D-ALL	Circuit Breaker	CCF to Close EDG Supply Breakers	**379**

Table 17.4-4—Risk Significant SSCs Common Cause Failure (CCF) Ranked by RAW for "At Power" Events, All CCFs with RAW Greater Than or Equal to 20

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No	System US	CCF ID	Component Type	CCF Component Description	CCF RAW
30	ESWS	PED10AN001EFR_D-ALL	Fan	CCF to Run Normally Running Cooling Tower Fans	**370**
31	CCWS	KAA12AA005EFO_D-ALL	MOV	CCF to Open CCWS to LHSI HTX Cooling MOV	**368**
32	ESWS	PED10AN002EFS_D-ALL	Fan	CCF to Start Standby Cooling Tower Fans	**367**
33	ESWS	PED10AN002EFR_D-ALL	Fan	CCF to Run Standby Cooling Tower Fans	**357**
34	SIS/RHRS	JNG10AP001EFS_D-ALL	Pump	CCF of LHSI Pumps to Start	**339**
35	MSS	LBA11AA191SFO_H-ALL	Safety Valve	CCF to Open Main Steam Safety Relief Valves	**328**
36	SIS/RHRS	JNG10AP001EFR_D-ALL	Pump	CCF of LHSI Pumps to Run	**322**
37	ESWS	PEB10AA004CFO_D-ALL	Check Valve	CCF to Open ESWS Pump Discharge Check Valves	**321**
38	CCWS	KAA12AA012CFO_D-ALL	Check Valve	CCF to Open CCWS from LHSI HTX Discharge Check Valve	**316**
39	SIS/RHRS	JNG10AA006CFO_D-ALL	Check Valve	CCF to Open LHSI Check Valves (SIS Second Isolation Valves)	**311**
40	SIS/RHRS	JNG10AA009CFO_D-ALL	Check Valve	CCF to Open LHSI Discharge Check Valves	**311**
41	SIS/RHRS	JNG10AA011CFO_D-ALL	Check Valve	CCF to Open LHSI Discharge Check Valves	**311**
42	SCWS	QKA10GH001_FR_B-ALL	Chiller	CCF of the Air Cooled SCWS Chiller Units to Run	**300**
43	EFWS	LAS11AP001EFS_D-ALL	Pump	CCF of EFWS Pumps to Start	**283**
44	EFWS	LAS11AP001EFR_D-ALL	Pump	CCF of EFWS Pumps to Run	**283**
45	I&C	CL-PS-A-SWCCF	Software	Software CCF of Protection System diversity group A	**274**
46	MSS	LBA10AA002PFC_D-ALL	Pneumatic Valve	CCF to Close Main Steam Isolation Valves	**221**
47	I&C	ALU-A CCF NS-ALL	ALU	CCF of ALU-A Protection System Computer Processors (Non-Self-Monitored)	**202**
48	I&C	APU2 CCF NS-ALL	APU	CCF of APU-2 Protection System Computer Processors (Non-Self-Monitored)	**202**
49	SCWS	QKA10GH001_FS_B-ALL	Chiller	CCF of the Air Cooled SCWS Chiller Units to Start	**202**
50	SCWS	QKA10AP107EFS_D-ALL	Pump	CCF of SCWS Pumps to Start	**198**
51	HVAC	SAC01AN001EFS_D-ALL	Fan	CCF to Start Normal Air Supply Fans	**196**
52	HVAC	SAC31AN001EFS_D-ALL	Fan	CCF to Start Normal Air Exhaust Fans	**196**
53	SCWS	QKA10AA003CFO_D-ALL	Check Valve	CCF to Open SCWS Pump Discharge Check Valves	**194**
54	HVAC	SAC01AA005CFO_D-ALL	Check Valve	CCF to Open Normal SAC Supply Fan Discharge Check Dampers	**194**
55	HVAC	SAC31AA003CFO_D-ALL	Check Valve	CCF to Open Normal Air Exhaust Fan Discharge Check Damper	**184**
56	I&C	ALU-A CCF SM-ALL	ALU	CCF of ALU-A Protection System Computer Processors (Self-Monitored)	**101**
57	I&C	APU2 CCF SM-ALL	APU	CCF of APU-2 Protection System Computer Processors (Self-Monitored)	**101**
58	SIS/RHRS	JNA10AA001EFO_D-ALL	MOV	CCF to Open LHSI Pump Suction from RCS MOVs	**64**
59	SIS/RHRS	JNA10AA002EFO_D-ALL	MOV	CCF to Open LHSI Pump Suction from RCS Angled MOVs	**64**
60	SIS/RHRS	JNA10AA003EFO_D-ALL	MOV	CCF to Open LHSI Pump Suction from RCS MOVs	**64**

Table 17.4-4—Risk Significant SSCs Common Cause Failure (CCF) Ranked by RAW for "At Power" Events, All CCFs with RAW Greater Than or Equal to 20

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No	System US	CCF ID	Component Type	CCF Component Description	CCF RAW
61	SIS/RHRS	JNG10AA004EFC_D-ALL	MOV	CCF to Close LHSI to Tangential Miniflow MOTOR Operated Check Valves	**64**
62	I&C	PAS	PAS	Process Automation System (PAS) Fails (Estimate)	**30**
63	ESWS	PEB20AP001EFS_B-ALL	Pump	CCF of ESWS Pumps 2 and 3 to Start (Standby)	**29**
64	CCWS	KAA20AP001EFS_B-ALL	Pump	CCF of CCWS Pumps 2 and 3 to Start (Standby)	**25**
65	CCWS	KAA10AA004CFO_D-ALL	Check Valve	CCF to Open CCWS HTX Discharge Check Valves	**21**
66	SCWS	QKA20GH001_FR_B-ALL	Chiller	CCF of the CCWS Cooled SCWS Chiller Units to Run	**20**

Table 17.4-5—Risk Significant SSCs Ranked by FV for "Shutdown" Events, All Components with FV Greater Than or Equal to 0.005

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No	System US	Component ID	Component Type	Component Description	Failure Modes	FV	RAW[1]
1	ELEC	30XKA20	Diesel Generator	ELEC, Emergency Diesel Generator XKA20	FR, FS	**0.291**	1.8
2	ELEC	30XKA30	Diesel Generator	ELEC, Emergency Diesel Generator XKA30	FR, FS	**0.289**	1.8
3	ELEC	30XKA40	Diesel Generator	ELEC, Emergency Diesel Generator XKA40	FR, FS	**0.288**	1.8
4	ELEC	30XKA10	Diesel Generator	ELEC, Emergency Diesel Generator XKA10	FR, FS	**0.264**	1.5
5	SIS/RHRS	30JNG33AA005	Check Valve	LHSI, CL3 First SIS Isolation Check Valve JNG33AA005	CL, FO	**0.244**	3.2
6	SIS/RHRS	30JNG23AA005	Check Valve	LHSI, CL2 First SIS Isolation Check Valve JNG23AA005	CL, FO	**0.243**	2.7
7	SIS/RHRS	30JNG43AA005	Check Valve	LHSI, CL4 First SIS Isolation Check Valve JNG43AA005	CL, FO	**0.243**	1.8
8	CVCS	30KBA14AA004	MOV	CVCS, Low Pressure Reducing Station Isolation MOV KBA14AA004	CL, FC, IR, PANS, PASM	**0.239**	29.9
9	SIS/RHRS	30JNG13AA005	Check Valve	LHSI, CL1 First SIS Isolation Check Valve JNG13AA005	CL, FO	**0.236**	4.6
10	ELEC	30XKA50	Diesel Generator	ELEC, SBO Diesel Generator XKA50	FR, FS	**0.226**	4.6
11	CVCS	30KBA14AA106	MOV	CVCS, CVCS Low Power Reducing Station MOV KBA14AA106	FC, IR, OP, PBNS, PBSM	**0.170**	32.3
12	SIS/RHRS	30JNA20AA191	Safety Valve	RHR, LHSI Train 2 Safety Valve JNA20AA191	PO	**0.042**	
13	SIS/RHRS	30JNA10AA191	Safety Valve	RHR, LHSI Train 1 Safety Valve JNA10AA191	PO	**0.042**	
14	SIS/RHRS	30JNG10AA192	Safety Valve	LHSI, LHSI/RHR Train 10 Overpressure Protection Safety Valve JNG10AA192	PO	**0.042**	
15	SIS/RHRS	30JNG20AA192	Safety Valve	LHSI, LHSI/RHR Train 20 Overpressure Protection Safety Valve JNG20AA192, Premature Opening	PO	**0.042**	
16	SIS/RHRS	30JND10AP001	Pump	MHSI, MHSI Train 1 Motor Driven Pump JND10AP001	FR, FS, PANS, PASM	**0.041**	1.6
17	ELEC	30XKA80	Diesel Generator	ELEC, SBO Diesel Generator XKA80	FR, FS	**0.034**	1.4
18	SIS/RHRS	30JND20AP001	Pump	MHSI, MHSI Train 2 Motor Driven Pump JND20AP001	FR, FS, PBNS, PBSM	**0.034**	1.1
19	SIS/RHRS	30JND30AP001	Pump	MHSI, MHSI Train 3 Motor Driven Pump JND30AP001	FR, FS, PANS, PASM	**0.034**	1.0
20	SIS/RHRS	30JND40AP001	Pump	MHSI, MHSI Train 4 Motor Driven Pump JND40AP001	FR, FS, PBNS, PBSM	**0.033**	1.0
21	IRWST	30JNK11AT001	Strainer	IRWST, SIS Sump Strainer to MHSI/LHSI Train 4 Pumps JNK11AT001	PG	**0.029**	1.2
22	IRWST	30JNK11AT002	Strainer	IRWST, SIS Sump Strainer to MHSI/LHSI Train 3 Pumps JNK11AT002	PG	**0.029**	1.1
23	IRWST	30JNK10AT002	Strainer	IRWST, SIS Sump Strainer to MHSI/LHSI Train 2 Pumps JNK10AT002	PG	**0.029**	1.1

Table 17.4-5—Risk Significant SSCs Ranked by FV for "Shutdown" Events, All Components with FV Greater Than or Equal to 0.005

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No	System US	Component ID	Component Type	Component Description	Failure Modes	FV	RAW[1]
24	IRWST	30JNK10AT001	Strainer	IRWST, SIS Sump Strainer to MHSI/LHSI Train 1 Pumps JNK10AT001	PG	**0.028**	1.3
25	IRWST	30JNK11AT003	Strainer	IRWST, SAHR Sump Strainer JNK11AT003	PG	**0.028**	2.3
26	SIS/RHRS	30JNG30AA192	Safety Valve	LHSI, LHSI/RHR Train 30 Overpressure Protection Safety Valve JNG30AA192, Premature Opening	PO	**0.020**	
27	SCWS	30QKA10GH001	Chiller	SCWS, Train 1 Chiller Unit QKA10GH001	FR, FS, PANS, PASM	**0.019**	4.4
28	ELEC	31BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 31BTD01	ST	**0.018**	10.2
29	SIS/RHRS	30JNA30AA191	Safety Valve	RHR, LHSI Train 3 Safety Valve JNA30AA191	PO	**0.017**	
30	CCWS	30KAA10AP001	Pump	CCWS, Train 1 Motor Driven Pump KAA10AP001	EL, FR, FS, PANS, PASM	**0.012**	3.7
31	ELEC	34BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 34BTD01	ST	**0.012**	2.5
32	ELEC	33BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 33BTD01	ST	**0.012**	1.7
33	ELEC	32BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 32BTD01	ST	**0.011**	1.5
34	SIS/RHRS	30JNG10AA001	MOV	LHSI, LHSI Pump 10 Suction from IRWST MOV JNG10AA001	CL, FC, FL, FO, IR, OP, PANS, PASM	**0.011**	
35	SAHRS	30JMQ40AA001	MOV	SAHR, Suction Line Containment Isolation MOV JMQ40AA001	CL, FO, PANS, PASM	**0.011**	3.8
36	SAHRS	30JMQ42AA001	MOV	SAHR, Train Recirculation Line MOV JMQ42AA001	CL, FC, FO, IR, OP, PANS, PASM	**0.011**	3.8
37	IRWST	30JNK11AA009	MOV	IRWST, SAHR Sump Containment Isolation MOV JNK11AA009	CL, FO, PBNS, PBSM	**0.011**	3.8
38	EFWS	30LAS11AP001	Pump	EFWS, Train 1 Motor Driven Pump LAS11AP001	EL, FR, FS, PANS, PASM	**0.011**	1.7
39	SIS/RHRS	30JNG20AA001	MOV	LHSI, LHSI Pump 20 Suction from IRWST MOV JNG20AA001	CL, FC, FL, FO, IR, OP, PBNS, PBSM	**0.010**	
40	HVAC	30SAC01AN001	Fan	SAC, Normal Air Supply Fan SAC01AN001	FR, FS	**0.010**	1.6
41	HVAC	30SAC31AN001	Fan	SAC, Normal Air Exhaust Fan SAC31AN001	FR, FS	**0.010**	1.6
42	CCWS	30KAA30AP001	Pump	CCWS, Train 3 Motor Driven Pump KAA30AP001	EL, FR, FS, PANS, PASM	**0.010**	2.5
43	HVAC	30SAC03AN001	Fan	SAC, Normal Air Supply Fan SAC03AN001	FR, FS	**0.010**	1.1
44	HVAC	30SAC33AN001	Fan	SAC, Normal Air Exhaust Fan SAC33AN001	FR, FS	**0.010**	1.1
45	HVAC	30SAC02AN001	Fan	SAC, Normal Air Supply Fan SAC02AN001	FR, FS	**0.010**	1.0
46	HVAC	30SAC32AN001	Fan	SAC, Normal Air Exhaust Fan SAC32AN001	FR, FS	**0.010**	1.0

Table 17.4-5—Risk Significant SSCs Ranked by FV for "Shutdown" Events, All Components with FV Greater Than or Equal to 0.005

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No	System US	Component ID	Component Type	Component Description	Failure Modes	FV	RAW[1]
47	CCWS	30KAA20AP001	Pump	CCWS, Train 2 Motor Driven Pump KAA20AP001 External Leakage	EL, FR, FS, PBNS, PBSM	**0.009**	2.2
48	SIS/RHRS	30JND10AA003	Check Valve	MHSI, MHSI Pump 10 Discharge Manual Check Valve JND10AA003	CL, FO, IR, MEC3	**0.009**	
49	CCWS	30KAA40AP001	Pump	CCWS, Train 40 Motor Driven Pump KAA40AP001	EL, FR, FS, PBNS, PBSM	**0.009**	1.9
50	SCWS	30QKA10AP107	Pump	SCWS, Train 1 Motor Driven Safety Chiller Pump QKA10AP107	EL, FR, FS	**0.009**	4.2
51	SIS/RHRS	30JND20AA003	Check Valve	MHSI, MHSI Pump 20 Discharge Manual Check Valve JND20AA003	CL, FO, IR, MEC3	**0.008**	
52	SIS/RHRS	30JNG10AP001	Pump	LHSI, LHSI Train 1 Motor Driven Pump JNG10AP001	FR, FS, PANS, PASM	**0.008**	3.7
53	SCWS	30QKA40GH001	Chiller	SCWS, Train 4 Chiller Unit QKA40GH001	FR, FS, PANS, PASM	**0.007**	2.3
54	HVAC	30SAC04AN001	Fan	SAC, Normal Air Supply Fan SAC04AN001	FR, FS	**0.007**	1.3
55	HVAC	30SAC34AN001	Fan	SAC, Normal Air Exhaust Fan SAC34AN001	FR, FS	**0.007**	1.3
56	SIS/RHRS	30JNG30AP001	Pump	LHSI, LHSI Train 3 Motor Driven Pump JNG30AP001	FR, FS, PANS, PASM	**0.007**	2.3
57	SIS/RHRS	30JNG20AA003	MOV	LHSI, LHSI Train 2 to Radial Miniflow Motor Operated Check Valve JNG20AA003	IR, OP	**0.007**	
58	SIS/RHRS	30JNG10AA004	MOV	LHSI, LHSI Train 1 to Tangential Miniflow Motor Operated CV JNG10AA004	CL, FC, FO, IR, OP, PANS, PASM	**0.007**	
59	SIS/RHRS	30JNG40AP001	Pump	LHSI, LHSI Train 4 Motor Driven Pump JNG40AP001	FR, FS, PBNS, PBSM	**0.007**	2.0
60	SIS/RHRS	30JNG20AP001	Pump	LHSI, LHSI Train 2 Motor Driven Pump JNG20AP001	FR, FS, PBNS, PBSM	**0.007**	1.8
61	SCWS	30QKA30AP107	Pump	SCWS, Train 3 Motor Driven Safety Chiller Pump QKA30AP107	EL, FR, FS	**0.007**	1.1
62	SCWS	30QKA20AP107	Pump	SCWS, Train 2 Motor Driven Safety Chiller Pump QKA20AP107	EL, FR, FS	**0.007**	1.0
63	SIS/RHRS	30JNG20AA004	MOV	LHSI, LHSI Train 2 to Tangential Miniflow Motor Operated CV JNG20AA004	CL, FC, FO, IR, OP, PBNS, PBSM	**0.006**	
64	SIS/RHRS	30JNG10AA003	MOV	LHSI, LHSI Train 1 to Radial Miniflow Motor Operated Check Valve JNG10AA003	IR, OP	**0.006**	
65	SIS/RHRS	30JNG30AA001	MOV	LHSI, LHSI Pump 30 Suction from IRWST MOV JNG30AA001	CL, FC, FL, FO, IR, OP, PANS, PASM	**0.005**	
66	SCWS	30QKA40AP107	Pump	SCWS, Train 4 Motor Driven Safety Chiller Pump QKA40AP107	EL, FR, FS	**0.005**	2.2

Notes

(1) Due to modeling constraints, some components' RAW values are left blank.

Table 17.4-6—Risk Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
1	ELEC	34BDB	SWGR	ELEC, 6.9kV SWGR 34BDB	FL	**50.6**	0.001
2	ELEC	34BDC	SWGR	ELEC, 6.9kV SWGR 34BDC	FL	**50.6**	0.001
3	ELEC	34BMB	Load Center	ELEC, 480V Load Center 34BMB	FL	**50.6**	0.001
4	ELEC	34BMT02	Transformer	ELEC, 6.9kV-480V Transformer 34BMT02	FL	**50.6**	0.001
5	ELEC	34BDB4BMT02	Circuit Breaker	ELEC, 6.9kV SWGR 34BDB to Transformer 34BMT02 Circuit Breaker	OP	**47.4**	0.000
6	ELEC	34BDC_4BDB1	Circuit Breaker	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	OP	**47.4**	0.000
7	ELEC	34BDC_4BDB2	Circuit Breaker	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB Circuit Breaker	OP	**47.4**	0.000
8	ELEC	34BMT024BMB	Circuit Breaker	ELEC, Transformer 34BMT02 to 480V Load Center 34BMB Circuit Breaker	OP	**47.4**	0.000
9	ELEC	34BNB02	MCC	ELEC, 480V MCC 34BNB02	FL, FR	**42.8**	0.001
10	ELEC	34BNT01	Transformer	ELEC, Constant Voltage Transformer 34BNT01	FL	**42.8**	0.001
11	ELEC	34BMB4BNT01	Circuit Breaker	ELEC, 480V Load Center 34BMB to Transformer 34BNT01 Circuit Breaker	OP	**41.6**	0.000
12	ELEC	34BNT014BNB02	Circuit Breaker	ELEC, Transformer 34BNT01 to 480V MCC 34BNB02 Circuit Breaker	OP	**41.6**	0.000
13	CVCS	30KBA14AA106	MOV	CVCS, CVCS Low Power Reducing Station MOV KBA14AA106	FC, IR, OP, PBNS, PBSM	**32.3**	0.170
14	CVCS	30KBA14AA004	MOV	CVCS, Low Pressure Reducing Station Isolation MOV KBA14AA004	CL, FC, IR, PANS, PASM	**29.9**	0.239
15	ELEC	34BDA	SWGR	ELEC, 6.9kV SWGR 34BDA	FL	**14.8**	0.000
16	ELEC	31BDB	SWGR	ELEC, 6.9kV SWGR 31BDB	FL	**13.7**	0.000
17	ELEC	31BDC	SWGR	ELEC, 6.9kV SWGR 31BDC	FL	**13.7**	0.000
18	ELEC	31BMB	Load Center	ELEC, 480V Load Center 31BMB	FL	**13.7**	0.000
19	ELEC	31BMT02	Transformer	ELEC, 6.9kV-480V Transformer 31BMT02	FL	**13.7**	0.000
20	ELEC	34BDD	SWGR	ELEC, 6.9kV SWGR 34BDD	FL	**11.6**	0.000
21	ELEC	34BMD	Load Center	ELEC, 480V Load Center 34BMD	FL	**11.6**	0.000
22	ELEC	34BMT04	Transformer	ELEC, 6.9kV-480V Transformer 34BMT04	FL	**11.6**	0.000
23	ELEC	31BDB1BMT02	Circuit Breaker	ELEC, 6.9kV SWGR 31BDB to Transformer 31BMT02 Circuit Breaker	OP	**11.2**	0.000
24	ELEC	31BDC_1BDB1	Circuit Breaker	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	OP	**11.2**	0.000

Table 17.4-6—Risk Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
25	ELEC	31BDC_1BDB2	Circuit Breaker	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB Circuit Breaker	OP	**11.2**	0.000
26	ELEC	31BMT021BMB	Circuit Breaker	ELEC, Transformer 31BMT02 to 480V Load Center 31BMB Circuit Breaker	OP	**11.2**	0.000
27	ELEC	31BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 31BTD01	ST	**10.2**	0.018
28	ELEC	34BUC	Bus	ELEC, 250V DC Bus 34BUC	FL	**10.0**	0.000
29	ELEC	31BUC	Bus	ELEC, 250V DC Bus 31BUC	FL	**9.0**	0.000
30	ELEC	34BDA_4BDD1	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDD Circuit Breaker	OP	**8.8**	0.000
31	ELEC	34BDA_4BDD2	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDD Circuit Breaker	OP	**8.8**	0.000
32	ELEC	34BDD4BMT04	Circuit Breaker	ELEC, 6.9kV SWGR 34BDD to Transformer 34BMT04 Circuit Breaker	OP	**8.8**	0.000
33	ELEC	34BMT044BMD	Circuit Breaker	ELEC, Transformer 34BMT04 to 480V Load Center 34BMD Circuit Breaker	OP	**8.8**	0.000
34	ELEC	31BNB02	MCC	ELEC, 480V MCC 31BNB02	FL, FR	**7.7**	0.000
35	ELEC	31BNT01	Transformer	ELEC, Constant Voltage Transformer 31BNT01	FL	**7.7**	0.000
36	ELEC	31BTD01	Circuit Breaker	ELEC, 250V Battery 31BTD01 Circuit Breaker	OP	**7.6**	0.000
37	ELEC	31BMB1BNT01	Circuit Breaker	ELEC, 480V Load Center 31BMB to Transformer 31BNT01 Circuit Breaker	OP	**6.6**	0.000
38	ELEC	31BNT011BNB02	Circuit Breaker	ELEC, Transformer 31BNT01 to 480V MCC 31BNB02 Circuit Breaker	OP	**6.6**	0.000
39	ELEC	31BUD	Bus	ELEC, Non 1E 250V DC Distribution Panel 31BUD	FL	**5.7**	0.000
40	ELEC	34BDA_4BDC1	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	OP	**5.0**	0.000
41	ELEC	34BDA_4BDC2	Circuit Breaker	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC Circuit Breaker	CL, FO, OP	**5.0**	0.000
42	SIS/RHRS	30JNG13AA005	Check Valve	LHSI, CL1 First SIS Isolation Check Valve JNG13AA005	CL, FO	**4.6**	0.236
43	ELEC	30XKA50	Diesel Generator	ELEC, SBO Diesel Generator XKA50	FR, FS	**4.6**	0.226
44	ELEC	31BTB01_BAT	Battery	ELEC, 250V Non 1E 12-hr Battery 31BTB01	ST	**4.6**	0.002
45	ELEC	30XKA50_1BBH	Circuit Breaker	ELEC, SBO DG XKA50 to 6.9kV SWGR 31BBH Circuit Breaker	FC, OP	**4.5**	0.002
46	ELEC	31BBH_1BDC1	Circuit Breaker	ELEC, 6.9kV SWGR 31BBH to 6.9kV SWGR 31BDC Circuit Breaker	FC, OP	**4.5**	0.002

Table 17.4-6—Risk Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
47	ELEC	31BBH_1BDC2	Circuit Breaker	ELEC, 6.9kV SWGR 31BBH to 6.9kV SWGR 31BDC Circuit Breaker	FC, OP	**4.5**	0.002
48	ELEC	31BBT081BBH	Circuit Breaker	ELEC, Transformer 31BBT08 to 6.9kV SWGR 31BBH Circuit Breaker	CL, FO, OP	**4.5**	0.002
49	ELEC	31BDA_1BDC2	Circuit Breaker	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC Circuit Breaker	CL, FO, OP	**4.5**	0.002
50	SCWS	30QKA10GH001	Chiller	SCWS, Train 1 Chiller Unit QKA10GH001	FR, FS, PANS, PASM	**4.4**	0.019
51	SCWS	30QKA10AP107	Pump	SCWS, Train 1 Motor Driven Safety Chiller Pump QKA10AP107	EL, FR, FS	**4.2**	0.009
52	ELEC	31BBH	SWGR	ELEC, 6.9kV SWGR 31BBH	FL	**4.2**	0.000
53	ELEC	31BRV31BUV	Power Rack	ELEC, 24V DC I&C Power Rack 31BRV/31BUV	FL	**4.2**	0.000
54	ELEC	31BTB01	Circuit Breaker	ELEC, 250V Battery 31BTB01 Circuit Breaker	OP	**3.9**	0.000
55	SAHRS	30JMQ40AA001	MOV	SAHR, Suction Line Containment Isolation MOV JMQ40AA001	CL, FO, PANS, PASM	**3.8**	0.011
56	SAHRS	30JMQ42AA001	MOV	SAHR, Train Recirculation Line MOV JMQ42AA001	CL, FC, FO, IR, OP, PANS, PASM	**3.8**	0.011
57	IRWST	30JNK11AA009	MOV	IRWST, SAHR Sump Containment Isolation MOV JNK11AA009	CL, FO, PBNS, PBSM	**3.8**	0.011
58	SIS/RHRS	30JNG10AC001	HTX	LHSI, LHSI Train 1 HTX JNG10AC001	LK	**3.7**	0.000
59	ELEC	34BNB03	MCC	ELEC, 480V MCC 34BNB03	FL, FR	**3.7**	0.000
60	CCWS	30KAA10AP001	Pump	CCWS, Train 1 Motor Driven Pump KAA10AP001	EL, FR, FS, PANS, PASM	**3.7**	0.012
61	SIS/RHRS	30JNG10AP001	Pump	LHSI, LHSI Train 1 Motor Driven Pump JNG10AP001	FR, FS, PANS, PASM	**3.7**	0.008
62	ELEC	31BNB01	MCC	ELEC, 480V MCC 31BNB01	FL, FR	**3.6**	0.000
63	CCWS	30KAA80AP001	Pump	CCWS, SA-CCW Motor Driven Pump KAA80AP001	FR, FS	**3.6**	0.002
64	SAHRS	30JMQ40AP001	Pump	SAHR, Motor Driven Pump JMQ40AP001	FR, FS, PBNS, PBSM	**3.6**	0.002
65	ELEC	31BDD	SWGR	ELEC, 6.9kV SWGR 31BDD	FL	**3.4**	0.000
66	ELEC	31BMD	Load Center	ELEC, 480V Load Center 31BMD	FL	**3.4**	0.000
67	ELEC	31BMT04	Transformer	ELEC, 6.9kV-480V Transformer 31BMT04	FL	**3.4**	0.000
68	SAHRS	30JMQ40AA002	Manual Valve	SAHR, Suction Manual Valve JMQ40AA002	MEC1	**3.3**	0.000
69	SAHRS	30JMQ40AA003	Manual Valve	SAHR, Discharge Manual Valve JMQ40AA003	MEC1	**3.3**	0.000
70	SAHRS	30JMQ40AA004	Manual Valve	SAHR, HTX Discharge Manual Valve JMQ40AA004	MEC1	**3.3**	0.000

Table 17.4-6—Risk Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
71	CCWS	30KAA80AA001	Manual Valve	CCWS, SA-CCW Pump Suction Manual Valve KAA80AA001	MEC1	**3.3**	0.000
72	CCWS	30KAA80AA002	Manual Valve	CCWS, SA-CCW Pump Cooling Manual Valve KAA80AA002	MEC1	**3.3**	0.000
73	CCWS	30KAA80AA003	Manual Valve	CCWS, SA-CCW Pump Cooling Manual Valve KAA80AA003	MEC1	**3.3**	0.000
74	CCWS	30KAA80AA004	Manual Valve	CCWS, SA-CCW Pump Discharge Manual Valve KAA80AA004	MEC1	**3.3**	0.000
75	CCWS	30KAA80AA005	Manual Valve	CCWS, SA-CCW Pump Cooling Manual Valve KAA80AA005	MEC1	**3.3**	0.000
76	CCWS	30KAA82AA001	Manual Valve	CCWS, SA-CCW to SAHR Pump Coolers Manual Valve KAA82AA001	MEC1	**3.3**	0.000
77	CCWS	30KAA82AA002	Manual Valve	CCWS, SA-CCW from SAHR Pump Seal Water Cooler Manual Valve KAA82AA002	MEC1	**3.3**	0.000
78	CCWS	30KAA82AA003	Manual Valve	CCWS, SA-CCW from SAHR Pump Motor Air Cooler Manual Valve KAA82AA003	MEC1	**3.3**	0.000
79	CCWS	30KAA82AA004	Manual Valve	CCWS, SA-CCW to SAGR Pump Bearing Cooler Manual Valve KAA82AA004	MEC1	**3.3**	0.000
80	SCWS	30QKA10AA003	Check Valve	SCWS, Train 1 Safety Chiller Pump Discharge Check Valve QKA10AA003	CL, FO	**3.3**	0.000
81	ESWS	30PEB80AP001	Pump	ESWS, SA-ESWS Motor Driven Pump PEB80AP001	FR, FS, PBNS, PBSM	**3.3**	0.002
82	SIS/RHRS	30JNG10AA006	Check Valve	LHSI, LHSI CL1 Discharge Manual Check Valve JNG10AA006	CL, FO, IR, MEC3	**3.3**	0.000
83	SIS/RHRS	30JNG10AA009	Check Valve	LHSI, LHSI Pump 10 Discharge Check Valve JNG10AA009	CL, FO	**3.3**	0.000
84	ELEC	31BNB03	MCC	ELEC, 480V MCC 31BNB03	FL, FR	**3.3**	0.000
85	SIS/RHRS	30JNG33AA005	Check Valve	LHSI, CL3 First SIS Isolation Check Valve JNG33AA005	CL, FO	**3.2**	0.244
86	CCWS	30KAA10AA004	Check Valve	CCWS, Train 1 Discharge from CCW HTX 10 Check Valve KAA10AA004	CL, FO	**3.1**	0.000
87	CCWS	30KAA12AA012	Check Valve	CCWS, Train 1 LHSI HTX Discharge Check Valve KAA12AA012	CL, FO	**3.1**	0.000
88	ELEC	30BRW10BUW11	Power Rack	ELEC, 24V DC I&C Power Rack 31BRW10/31BUW11	FL	**3.1**	0.000
89	ESWS	30PEB80AA002	Check Valve	ESWS, SA-ESWS Pump Discharge Manual Check Valve PEB80AA002	CL, FO, IR, MEC1	**3.1**	0.001
90	ESWS	30PEB80AA003	Manual Valve	ESWS, SA-CCWS HTX Suction Manual Valve PEB80AA003	MEC1	**3.1**	0.000

Table 17.4-6—Risk Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
91	ESWS	30PEB80AA004	Manual Valve	ESWS, SA-CCWS HTX Discharge Manual Valve PEB80AA004	MEC1	**3.1**	0.000
92	ESWS	30PEB80AA008	Manual Valve	ESWS, SA-CCWS HTX Discharge Manual Valve PEB80AA008	MEC1	**3.1**	0.000
93	CCWS	30KAA80AA191	Safety Valve	CCWS, SA-CCW Surge Tank to Pump Suction Line Safety Valve KAA80AA191	PO	**3.1**	0.000
94	SAHRS	30JMQ42AA002	Check Valve	SAHR, Recirculation Line Check Valve JMQ42AA002	CL, FO	**3.0**	0.000
95	CCWS	30KAA10BB001	Tank	CCWS, Train 1 Surge Tank KAA10BB001	EL	**3.0**	0.000
96	ESWS	30PEB80AT001	Filter	ESWS, SA-ESWS Debris Filter PEB80AT001	PG	**3.0**	0.000
97	SCWS	30QKA10AA101	MOV	SCWS, Train 1 Chiller By-pass MOV QKA10AA101	CF	**2.9**	0.000
98	ELEC	32BUD	Bus	ELEC, Non 1E 250V DC Distribution Panel 32BUD	FL	**2.7**	0.000
99	SIS/RHRS	30JNG23AA005	Check Valve	LHSI, CL2 First SIS Isolation Check Valve JNG23AA005	CL, FO	**2.7**	0.243
100	ELEC	30BRX10BUX11	Power Rack	ELEC, 24V DC I&C Power Rack 31BRX10/31BUX11	FL	**2.6**	0.000
101	ELEC	30BRX70BUX71	Power Rack	ELEC, 24V DC I&C Power Rack 34BRX70/34BUX71	FL	**2.6**	0.000
102	SAHRS	30JMQ40AC001	HTX	SAHR, HTX JMQ40AC001	LK	**2.6**	0.000
103	CCWS	30KAA80AC001	HTX	CCWS, SA-CCW Heat Exchanger KAA80AC001	EL, LK	**2.6**	0.000
104	ELEC	34BMC	Load Center	ELEC, 480V Load Center 34BMC	FL	**2.6**	0.000
105	ELEC	34BMT03	Transformer	ELEC, 6.9kV-480V Transformer 34BMT03	FL	**2.6**	0.000
106	CCWS	30KAA10AA112	MOV	CCWS, Train 1 Heat Exchanger Bypass MOV KAA10AA112	IR, OP	**2.6**	0.000
107	SIS/RHRS	30JNA10AA101	MOV	RHR, LHSI Train 1 HTX Bypass MOV JNA10AA101	IR, OP	**2.6**	0.000
108	SIS/RHRS	30JNG10AA060	MOV	LHSI, LHSI Pump 10 Discharge MOV JNG10AA060	CL	**2.6**	0.000
109	SIS/RHRS	30JNG10AA102	MOV	LHSI, LHSI Pump 10 Flow Control MOV JNG10AA102	CL	**2.6**	0.000
110	ELEC	31BMB1BNB01	Circuit Breaker	ELEC, 480V Load Center 31BMB to 480V MCC 31BNB01 Circuit Breaker	OP	**2.6**	0.000
111	CCWS	30KAA30AP001	Pump	CCWS, Train 3 Motor Driven Pump KAA30AP001	EL, FR, FS, PANS, PASM	**2.5**	0.010
112	CCWS	30KAA10AC001	HTX	CCWS, Train 1 HTX 10 KAA10AC001	EL	**2.5**	0.000
113	ELEC	31BDA_1BDD1	Circuit Breaker	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDD Circuit Breaker	OP	**2.5**	0.000

Table 17.4-6—Risk Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
114	ELEC	31BDA_1BDD2	Circuit Breaker	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDD Circuit Breaker	OP	**2.5**	0.000
115	ELEC	31BDD1BMT04	Circuit Breaker	ELEC, 6.9kV SWGR 31BDD to Transformer 31BMT04 Circuit Breaker	OP	**2.5**	0.000
116	ELEC	31BMT041BMD	Circuit Breaker	ELEC, Transformer 31BMT04 to 480V Load Center 31BMD Circuit Breaker	OP	**2.5**	0.000
117	ELEC	34BTD01_BAT	Battery	ELEC, 250V 1E 2-hr Battery 34BTD01	ST	**2.5**	0.012
118	CCWS	30KAA12AA005	MOV	CCWS, Train 1 to LHSI HTX 10 Cooling MOV KAA12AA005	CL, FO, PANS, PASM	**2.5**	0.000
119	CCWS	30KAA80BB001	Tank	CCWS, SA-CCW Surge Tank to Pump Suction KAA80BB001	EL	**2.4**	0.000
120	SIS/RHRS	30JNG30AP001	Pump	LHSI, LHSI Train 3 Motor Driven Pump JNG30AP001	FR, FS, PANS, PASM	**2.3**	0.007
121	SCWS	30QKA40GH001	Chiller	SCWS, Train 4 Chiller Unit QKA40GH001	FR, FS, PANS, PASM	**2.3**	0.007
122	ESWS	30PEB40AA004	Check Valve	ESWS, Train 4 Pump Discharge Check Valve PEB40AA004	CL, FO, IR	**2.3**	0.001
123	IRWST	30JNK11AT003	Strainer	IRWST, SAHR Sump Strainer JNK11AT003	PG	**2.3**	0.028
124	CCWS	30KAA80AA020	MOV	CCWS, SA-CCW Surge Tank to Pump Suction Line MOV KAA80AA020	CL	**2.3**	0.000
125	CCWS	30KAA20AP001	Pump	CCWS, Train 2 Motor Driven Pump KAA20AP001 External Leakage	EL, FR, FS, PBNS, PBSM	**2.2**	0.009
126	SIS/RHRS	30JNG40AC001	HTX	LHSI, LHSI Train 4 HTX JNG40AC001	LK	**2.2**	0.000
127	ELEC	34BNB024BNB031	Circuit Breaker	ELEC, 480V MCC 34BNB02 to 480V MCC 34BNB03 Circuit Break	OP	**2.2**	0.000
128	ELEC	34BNB024BNB032	Circuit Breaker	ELEC, 480V MCC 34BNB02 to 480V MCC 34BNB03 Circuit Break	OP	**2.2**	0.000
129	ELEC	31BNB021BNB031	Circuit Breaker	ELEC, 480V MCC 31BNB02 to 480V MCC 31BNB03 Circuit Break	OP	**2.2**	0.000
130	ELEC	31BNB021BNB032	Circuit Breaker	ELEC, 480V MCC 31BNB02 to 480V MCC 31BNB03 Circuit Break	OP	**2.2**	0.000
131	ELEC	34BDC4BMT03	Circuit Breaker	ELEC, 6.9kV SWGR 34BDB to Transformer 34BMT03 Circuit Breaker	OP	**2.2**	0.000
132	ELEC	34BMT034BMC	Circuit Breaker	ELEC, Transformer 34BMT03 to 480V Load Center 34BMC Circuit Breaker	OP	**2.2**	0.000

Table 17.4-6—Risk Significant SSCs Ranked by RAW for "Shutdown" Events, All Components with RAW Greater Than or Equal to 2

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No	System US	Component ID	Component Type	Component Description	Failure Modes	RAW	FV
133	SCWS	30QKA40AP107	Pump	SCWS, Train 4 Motor Driven Safety Chiller Pump QKA40AP107	EL, FR, FS	**2.2**	0.005
134	SIS/RHRS	30JNG30AC001	HTX	LHSI, LHSI Train 3 HTX JNG30AC001	LK	**2.1**	0.000
135	ELEC	33BDD	SWGR	ELEC, 6.9kV SWGR 33BDD	FL	**2.1**	0.000

Table 17.4-7—Risk Significant SSCs Common Cause Failure (CCF) Ranked by RAW for "Shutdown" Events, All CCFs with RAW Greater Than or Equal to 20

(Page 1 of 2)

No	System US	CCF ID	Component Type	CCF Component Description	CCF RAW
1	SIS/RHRS	JNG13AA005CFO_D-ALL	Check Valve	CCF to Open LHSI/MHSI Common Injection Check Valves (SIS First Isolation Valves)	**50, 890**
2	IRWST	JNK10AT001SPG_P-ALL	Strainer	CCF of IRWST Sump Strainers - Plugged	**50, 250**
3	ELEC	BTD01_BAT__ST_D-ALL	Battery	CCF of Safety Related Batteries on Demand	**30, 590**
4	I&C	CL-TXS-OSCCF	Software	Software CCF of TXS operating system or multiple diversity groups	**8, 059**
5	I&C	SAS CCF-ALL	SAS	CCF of Safety Automation System (SAS) Divisions	**5, 673**
6	HVAC	SAC01AN001EFR_D-ALL	Fan	CCF to Run Normal Air Supply Fans	**5, 100**
7	HVAC	SAC31AN001EFR_D-ALL	Fan	CCF to Run Normal Air Exhaust Fans	**5, 100**
8	SCWS	QKA10AP107EFR_D-ALL	Pump	CCF of SCWS Pumps to Run	**5, 078**
9	CVCS	KBA14AA004EFC_B-ALL	MOV	CCF to Close CVCS Low Pressure Reducing Station MOVs	**2, 099**
10	ESWS	PEB10AP001EFS_D-ALL	Pump	CCF of the ESWS Pumps to Start	**1, 977**
11	ELEC	XKA10_____DFR_D-ALL	Diesel Generator	CCF of EDGs to Run	**1, 933**
12	ELEC	XKA10_____DFS_D-ALL	Diesel Generator	CCF of EDGs to Start	**1, 916**
13	ESWS	PEB10AA004CFO_D-ALL	Check Valve	CCF to Open ESWS Pump Discharge Check Valves	**1, 902**
14	ELEC	BDT01_BDA_BFO_D-ALL	Circuit Breaker	CCF to Open Normal Supply 6.9kV Circuit Breakers from Aux. Xfrm to Safety Related SWGRs	**1, 884**
15	ELEC	BDT02_BDA_BFO_D-ALL	Circuit Breaker	CCF to Open Backup Supply 6.9kV Circuit Breakers from Aux. Xfrm to Safety Related SWGRs	**1, 884**
16	ELEC	XKA10_1BDABFC_D-ALL	Circuit Breaker	CCF to Close EDG Supply Breakers	**1, 884**
17	SIS/RHRS	JND10AP001EFR_D-ALL	Pump	CCF of MHSI Pumps to Run	**752**
18	SIS/RHRS	JND10AP001EFS_D-ALL	Pump	CCF of MHSI Pumps to Start	**695**
19	I&C	CL-PS-B-SWCCF	Software	Software CCF of Protection System diversity group B	**617**
20	SIS/RHRS	JND10AA007CFO_D-ALL	Check Valve	CCF to Open MHSI Discharge CVs (CIVs)	**558**
21	I&C	HL LVL CCF-ALL	Sensor	CCF of hotleg loop level	**553**
22	SCWS	QKA10AP107EFS_D-ALL	Pump	CCF of SCWS Pumps to Start	**401**
23	SCWS	QKA10AA003CFO_D-ALL	Check Valve	CCF to Open SCWS Pump Discharge Check Valves	**399**
24	HVAC	SAC01AN001EFS_D-ALL	Fan	CCF to Start Normal Air Supply Fans	**398**
25	HVAC	SAC31AN001EFS_D-ALL	Fan	CCF to Start Normal Air Exhaust Fans	**398**
26	HVAC	SAC01AA005CFO_D-ALL	Check Valve	CCF to Open Normal SAC Supply Fan Discharge Check Dampers	**398**
27	HVAC	SAC31AA003CFO_D-ALL	Check Valve	CCF to Open Normal Air Exhaust Fan Discharge Check Damper	**398**
28	I&C	ALU-B CCF NS-ALL	ALU	CCF of ALU-B Protection System Computer Processors (Non-Self-Monitored)	**369**
29	I&C	APU3 CCF NS-ALL	APU	CCF of APU-3 Protection System Computer Processors (Non-Self-Monitored)	**369**
30	I&C	ALU-B CCF SM-ALL	ALU	CCF of ALU-B Protection System Computer Processors (Self-Monitored)	**291**

Table 17.4-7—Risk Significant SSCs Common Cause Failure (CCF) Ranked by RAW for "Shutdown" Events, All CCFs with RAW Greater Than or Equal to 20

(Page 2 of 2)

No	System US	CCF ID	Component Type	CCF Component Description	CCF RAW
31	I&C	APU3 CCF SM-ALL	APU	CCF of APU-3 Protection System Computer Processors (Self-Monitored)	**291**
32	SIS/RHRS	JNG10AA006CFO_D-ALL	Check Valve	CCF to Open LHSI Check Valves (SIS Second Isolation Valves)	**287**
33	SIS/RHRS	JNG10AA009CFO_D-ALL	Check Valve	CCF to Open LHSI Discharge CVs (CIVs)	**287**
34	I&C	PAS	PAS	Process Automation System (PAS) Fails (Estimate)	**55**
35	I&C	HL TEMP CCF-ALL	Sensor	CCF of hotleg WR temperature sensors	**54**
36	CCWS	KAA10AP001EFS_D-ALL	Pump	CCF of the CCWS Pumps to Start	**52**
37	I&C	HL PRES CCF-ALL	Sensor	CCF of hotleg WR pressure sensors	**42**
38	I&C	CL WRTEMP CCF-ALL	Sensor	CCF of cold leg WR temp sensors	**30**

17.5 QUALITY ASSURANCE PROGRAM GUIDANCE

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

17.5.1 QA PROGRAM RESPONSIBILITIES

The QA Program is established in {the AmerenUE Quality Assurance Program Description, Revision 1 (AmerenUE, 2008.) The AmerenUE QAPD incorporates Revision 1 of the UniStar Nuclear Energy QAPD (UniStar, 2008) in its entirety, with the exception of changes to reflect the AmerenUE organization in Section A (and title changes throughout when appropriate). The AmerenUE QAPD is submitted as Part 11 of this COL Application. The AmerenUE} QAPD is applicable to the siting, design, fabrication, construction (including pre-operational testing), operation (including testing), maintenance and modification of the facility. The {AmerenUE} QAPD conforms to the criteria established in 10 CFR 50, Appendix B, (CFR, 2008a). {AmerenUE} commits to implement the:

- Basic Requirements and Supplements of ASME/NQA-1-1994, "Quality Assurance Requirements for Nuclear Facility Applications," (ASME, 1994) as described in the QAPD.
- Specific subparts of NQA-1-1994, as described in the QAPD.

{AmerenUE} does not delegate any of the activities associated with planning, establishing, or implementing the overall QA program to others, and retained the responsibility for the program. {AmerenUE contracted with UniStar Nuclear Energy (UniStar), Paul C. Rizzo Associates, Inc (Rizzo) and Black & Veatch Corporation to develop the Callaway Unit 2 COL application, including site characterization activities. The process of developing the reference COL application sections was performed by UniStar under the UniStar QAPD. The process of collection, review and analysis of specific data for site characterization was performed by Rizzo under the Paul C. Rizzo Associates, Inc. Quality Assurance Manual (Rizzo, 2007). Work performed by Black & Veatch in support of the COL application was limited to the Essential Service Water Emergency Makeup System and was performed under the Black & Veatch Nuclear Organization Quality Assurance Manual (Black & Veatch, 2008). AmerenUE maintains oversight under its existing 10 CFR Part 50 Appendix B program as described in the Callaway Plant Unit 1 Operating Quality Assurance Manual (AmerenUE, 2006). Specific project controls are further defined in the Callaway Plant Unit 2 Combined License Application Quality Assurance Program Plan (AmerenUE, 2007).

AmerenUE oversight is provided through its review and approval of the UniStar, Rizzo and Black & Veatch quality assurance plans, by conducting audits and surveillances of UniStar, Rizzo and Black & Veatch activities, and by direct participation in COL development activities, including providing site-specific applicant input and review of COL application content, signing the COL application as applicant at submittal, and working directly with UniStar, Rizzo, Black & Veatch and contractors to respond to NRC requests for additional information.}

Revision 0 of UN-TR-06-001-A (UniStar, 2007) was approved by the NRC (NRC, 2007a) (NRC, 2007b). {Revision 1 of the AmerenUE QAPD is included in Part 11a of this COL application, and is incorporated by reference into the FSAR.}

Changes to the QAPD are accomplished in accordance with 10 CFR 50.54(a)(3) and 10 CFR 50.55(f)(4).

17.5.2 SRP SECTION 17.5 AND THE QA PROGRAM DESCRIPTION

{The AmerenUE QAPD is applicable to the siting, design, fabrication, construction (including pre-operational testing), operation (including testing), maintenance and modification of the facility. The AmerenUE QAPD is provided in Part 11 of this COL Application.}

This {AmerenUE} QAPD is incorporated by reference.

17.5.3 EVALUATION OF THE QAPD AGAINST THE SRP AND QAPD SUBMITTAL GUIDANCE

The UniStar Nuclear QAPD, as established in Revision 0 of UN-TR-06-001-A (UniStar, 2007), was approved by the NRC (NRC, 2007a)(NRC, 2007b) and conforms to the guidance provided in the NUREG-0800 (NRC, 2007c).

{The AmerenUE QAPD incorporates the UniStar Nuclear QAPD with the exception of changes to reflect AmerenUE and the AmerenUE organization. The AmerenUE QAPD incorporates Revision 1 of the UniStar Nuclear Energy QAPD.}

17.5.4 REFERENCES

{**AmerenUE, 2006.** AmerenUE Callaway Plant Unit 1, Operating Quality Assurance Manual, Rev. 25, September 2006.

AmerenUE, 2007. AmerenUE Callaway Unit 2, Combined License Application Quality Assurance Program Plan, Rev. 0, November 2007.

AmerenUE, 2008. AmerenUE Quality Assurance Program Description, Rev. 1.

Black & Veatch, 2008. Black & Veatch Nuclear Organization Quality Assurance Manual, Rev. 3, March, 2008.

ASME, 1994. Quality Assurance Requirements for Nuclear Facility Applications, ASME/NQA-1-1994, American National Standards Institute, 1994.

CFR, 2008a. Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants, Title 10, Code of Federal Regulations, Part 50, Appendix B, U.S. Nuclear Regulatory Commission, 2008.

NRC, 2007a. Letter from L. J. Burkhart (NRC) to R. M. Krich (UniStar Nuclear), "Final Safety Evaluation for Topical Report (TR) UN-TR-06-0001, 'Quality Assurance Program Description' (Project No. 746)," dated March 14, 2007.

NRC 2007b. Letter from L. J. Burkhart (NRC) to R. M. Krich (UniStar Nuclear), "Replacement Pages for the Final Safety Evaluation for Topical Report (TR) UN-TR-06-0001, 'Quality Assurance Program Description' (Project No. 746)," dated March 16, 2007.

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

Rizzo, 2007. Paul C. Rizzo Quality Assurance Manual, Rev. 4, September 2007.

UniStar, 2007. Letter from R. M. Krich (UniStar Nuclear) to the U.S. Nuclear Regulatory Commission, "UniStar Nuclear, NRC Project No. 746, Submittal of the Published UniStar Topical

Report No. UN-TR-06-001-A, 'Quality Assurance Program Description,' Revision 0," dated April 9, 2007.

UniStar, 2008. UniStar Quality Assurance Program Description Rev 1, dated January 21, 2008.}

17.6 DESCRIPTION OF APPLICANT'S PROGRAM FOR IMPLEMENTATION OF 10 CFR 50.65, THE MAINTENANCE RULE

This section of the U.S. EPR FSAR is incorporated by reference with the following supplements.

The U.S. EPR FSAR includes the following COL Item in Section 17:

A COL applicant that references the U.S. EPR design certification will describe the program for Maintenance Rule implementation.

This COL Item is addressed as follows:

The Maintenance Rule Program description included in NEI 07-02, "Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52," Revision 3, dated September 2007, (NEI, 2007) is incorporated by reference.

The text of the template provided in NEI 07-02 is generically numbered as "17.X." When the template is incorporated by reference into this FSAR, section numbering is changed from "17.X" to "17.6."

Descriptions of the programs listed in Subsection 17.6.3 of NEI 07-02 are provided in the following FSAR Chapters/Sections:

- Maintenance rule program (Section 17.6).
- Quality assurance program (Section 17.5).
- Inservice inspection program (Sections 5.2 and 6.6).
- Inservice testing program (Section 3.9).
- Technical specifications surveillance test program (Chapter 16).
- Preventive Maintenance Program (Section 17.6).

17.6.1 SCOPING PER 10 CFR 50.65(b)

The U.S. EPR FSAR includes the following COL Item in Section 17.6.1:

A COL applicant that references the U.S. EPR design certification will describe the process for determining which plant structures, systems, and components (SSC) will be included in the scope of the Maintenance Rule Program in accordance with 10 CFR 50.65(b).

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

17.6.2 MONITORING PER 10 CFR 50.65(a)

The U.S. EPR FSAR includes the following COL Item in Section 17.6.2:

> A COL applicant referencing the U.S. EPR design certification will provide a program description for monitoring SSC in accordance with 10 CFR 50.65(a)(1).

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

The U.S. EPR FSAR includes the following COL Item in Section 17.6.2:

> A COL applicant that references the U.S. EPR design certification will provide the process for determining which SSC within the scope of the Maintenance Rule Program will be tracked to demonstrate effective control of their performance or condition in accordance with paragraph 50.65(a)(2).

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

17.6.3 PERIODIC EVALUATION PER 10 CFR 50.65(a)(3)

The U.S. EPR FSAR includes the following COL Item in Section 17.6.3:

> A COL applicant that references the U.S. EPR design certification will identify and describe the program for periodic evaluation of the Maintenance Rule Program in accordance with 10 CFR 50.65(a)(3).

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

17.6.4 RISK ASSESSMENT AND MANAGEMENT PER 10 CFR 50.65(a)(4)

The U.S. EPR FSAR includes the following COL Item in Section 17.6.4:

> A COL applicant that references the U.S. EPR design certification will describe the program for maintenance risk assessment and management in accordance with 10 CFR 50.65(a)(4).

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

17.6.5 MAINTENANCE RULE TRAINING AND QUALIFICATION

The U.S. EPR FSAR includes the following COL Item in Section 17.6.5:

> A COL applicant that references the U.S. EPR design certification will describe the program for selection, training, and qualification of personnel with Maintenance-Rule-related responsibilities consistent with the provisions of Section 13.2 as applicable.

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

17.6.6 MAINTENANCE RULE PROGRAM ROLE IN IMPLEMENTATION OF RELIABILITY ASSURANCE PROGRAM (RAP) IN THE OPERATIONS PHASE

The U.S. EPR FSAR includes the following COL Item in Section 17.6.6:

> A COL applicant referencing the U.S. EPR design certification will describe the relationship and interface between Maintenance Rule Program and the Reliability Assurance Program (refer to Section 17.4).

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

17.6.7 MAINTENANCE RULE PROGRAM IMPLEMENTATION

The U.S. EPR FSAR includes the following COL Item in Section 17.6.7:

> A COL applicant referencing the U.S. EPR design certification will describe the plan or process for implementing the Maintenance Rule Program as described in the COL application, which includes establishing program elements through sequence and milestones and monitoring or tracking the performance and/or condition of SSC as they become operational.

This COL Item is addressed as follows:

The Maintenance Rule Program is described in Section 17.6.

17.6.8 REFERENCES

{This section is added as a supplement to the U.S. EPR FSAR.

NEI, 2007. Generic FSAR Template Guidance for Maintenance Rule Program Description for Plants Licensed Under 10 CFR Part 52, NEI 07-02, Revision 3, Nuclear Energy Institute, September 2007.}