17.4 Reliability Assurance Program

The reliability assurance program (RAP) applies to the systems, structures, and components (SSC) that are identified as risk-significant (or significant contributors to plant safety) as determined by using probabilistic, deterministic, and other methods of analysis, including information obtained from sources such as the plant-specific and site-specific probabilistic risk analysis (PRA), industry operating experience, relevant component failure databases and expert panels. Implementing the RAP will enhance safety by focusing on design resources for risk-significant SSC and on maintaining the reliability of such SSC during the design and operation stages of the plant.

17.4.1 Reliability Assurance Program Scope, Stages, and Goals

The purpose of the RAP for the U.S. EPR is to provide reasonable assurance of the following considerations:

- The plant is designed, constructed and operated consistent with assumptions and risk insights for risk-significant SSC.
- Risk-significant SSC are selected and maintained so that they do not degrade to an unacceptable level during the life of the plant.
- The frequency of challenges (transients) to risk-significant SSC is minimized.
- These SSC will function reliably when challenged.

The RAP is implemented as an integral part of the design process and is implemented during the detailed design phase so that the important U.S. EPR reliability assumptions of the PRA are considered throughout the course of plant life.

The RAP is implemented in two stages. The first stage applies to reliability assurance activities that occur before the initial fuel load. The objective of the RAP during the first stage is to provide reasonable assurance that the reactor design meets the preceding considerations in the areas of design, procurement, fabrication, construction, and preoperational testing activities and programs. The assumed reliability of SSC in the design stage will be realistic and achievable.

The second stage of the RAP applies to reliability assurance activities for an operating plant. During the second stage of the RAP, the goal is to verify that the reliability of the SSC within the scope of the RAP is maintained during plant operation. The activities for the second stage will be integrated into relevant existing programs, such as maintenance rule, surveillance testing, inservice inspection, inservice testing, and quality assurance (QA). Individual component reliability may change throughout the course of plant life because of a number of factors, including aging and changes in suppliers and technology. Plant programs will provide reasonable assurance that the reliability of SSC will remain acceptable.

17.4.2 Reliability Assurance Program Implementation

The RAP for the design stage is implemented in several phases. The first phase is the design certification phase, which defines the overall structure of the RAP, including guidance for procedures and other activities which will be implemented in future phases. A design-specific PRA model is used to develop a list of SSC and insights. The risk-significant SSC are identified in this phase for inclusion in the program using the probabilistic, deterministic, or other methods previously indicated.

The second phase is the site-specific phase, which introduces the plant site-specific design information to the RAP process. A COL applicant that references the U.S. EPR design certification will identify the site-specific SSC within the scope of the RAP. Also in this phase, the RAP is modified or appended based on consideration specific to the site.

Risk-significant SSC are subject to the appropriate quality requirements through the implementation of the RAP. Safety-related SSC that are also determined to be risk-significant in the RAP have a full 10 CFR 50 Appendix B quality assurance program applied along with the applicable GDC.

For non-safety-related SSC that have been determined to be "risk-significant" under the RAP in Section 17.4, the U.S. EPR design applies additional quality assurance measures and design requirements consistent with the guidance in SRP 17.5, Part V, "Non-Safety Related SSC Quality Controls." These additional quality assurance measures are described in the approved topical report ANP-10266A, Revision 1, "AREVA NP Inc. Quality Assurance Plan (QAP) for Design Certification of the U.S. EPR Topical Report," Addendum A, and are applied to all risk-significant SSC during the design certification phase.

All risk-significant SSC will be included in the scope of the COL applicant's Maintenance Rule program in accordance with 10 CFR 50.65(b) in the high safety significance category. This is done so that the risk-significant SSC are subject to performance monitoring criteria which are established consistent with the reliability and availability assumptions used in the PRA.

Tier 1 Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) provide confirmation that as the SSC design progresses, the procurement and construction information for risk-significant SSC is consistent with the RAP related key assumptions and insights. This confirmation occurs by verifying that appropriate quality requirements are specified in the documents approved for the procurement and construction of risk-significant SSC.

Beyond the writing of design specifications, consistency with RAP related key assumptions and insights during the construction and initial testing phases are verified by confirming that the systems are as built in accordance with the system level ITAAC

identified in Tier 1 Chapter 2. Related to the RAP SSC, at a plant level, safety-significant features based on PRA insights and severe accident analyses are identified in Table 14.3-6, which are verified by corresponding system related ITAAC.

Also in this phase, the RAP is modified or appended based on consideration of conditions specific to the site.

17.4.2.1 Design Consideration

The RAP is established to provide sufficient documentation during the design and operation of the U.S. EPR. As part of the design process, SSC are evaluated to determine their dominant failure modes and the associated effects. Most components have an industry operating history available that defines the significant failure modes and their likely causes.

Strategies for failure prevention or mitigation are developed through the identification and prioritization of the various possible failure modes for each component. This information is provided as input for the operational program phase.

During the design phase, appropriate design reviews and reliability assessments evaluate the reliability of risk-significant SSC that are identified by the PRA and other sources. As part of the design reliability process, design engineers provide quality and reliability to the development of the SSC while verifying that the PRA properly models the basis for the design of SSC. PRA model development during the design phase mostly relies on generic information, bounding assumptions, or design requirements as a basis for model development. An assessment of the model can be performed when changes occur during the plant design phase, as well as during normal plant operations. The assessment considers reliability concepts, such as human reliability, redundancy, diversity, and external events to improve the system design. A further evaluation of design options is pursued if the results of the assessment reveal that the proposed design change could conflict with the results and insights derived from the PRA, or could cause significant unavailability of a safety function.

The design changes that affect the PRA model are reviewed and appropriate revisions are prepared in accordance with the PRA update process.

17.4.2.2 SSC Identification and Prioritization

The first task of the RAP is to identify the risk-significant SSC that are to be included in the scope of the program. A table that includes a list of design-specific SSC is included in the RAP. This preliminary list is prepared and controlled under the RAP program. This list is updated when the plant-specific PRA is developed. The selection of risk-significant SSC uses a combination of probabilistic and deterministic insights such as PRA analytical results, industry experience, regulations, expert panel process, and engineering judgment to identify and prioritize the SSC.

The Level 1 and Level 2 PRA provides an evaluation of the accident sequences from initiating events and failures of safety functions that lead to core damage. The analysis of external events considers events caused externally to systems associated with power or plant shutdown operations. These events include internal fire, high winds, internal flooding, and seismic margins.

Risk-significant SSC can be judged by using the PRA Level 1 and Level 2 model based on the risk achievement worth (RAW), common cause failure (CCF) RAW, or Fussell-Vesely (FV) of the respective SSC. Components with an RAW value of two or greater, a CCF RAW value of 20 or greater, or FV of 0.005 or greater can be considered risk-significant. The RAW of a component is the factor by which the plant core damage frequency increases if the component reliability is assigned the value of 1.0 (assumed guaranteed to fail). The CCF RAW of a common cause group is the factor by which the plant core damage frequency increases if the common cause group probability of failure is set to 1 (common cause failure is assumed to occur). FV is a measure of the component's contribution to the overall core damage frequency.

Section 19.1.7.4 describes the use of the PRA and risk importance measures as input to determining the RAP list. The results tables within U.S. EPR FSAR Chapter 19 provide lists of risk-significant SSC. Table 17.4-1 provides a compiled summary of the PRA input to the RAP program along with an indication of the following applicable PRA based rationale for selection:

- FV Importance to at-power CDF (FV - PWR CDF).
- RAW Importance to at-power CDF (RAW- PWR CDF).
- CCF RAW Importance to at-power CDF (CCF RAW- PWR CDF).
- FV Importance to at-power LRF (FV - PWR LRF).
- RAW Importance to at-power LRF (RAW - PWR LRF).
- CCF RAW Importance to at-power LRF (CCF RAW - PWR LRF).
- FV Importance to low-power and shutdown CDF (FV - SD CDF).
- RAW Importance to low-power and shutdown CDF (RAW - SD CDF).
- CCF RAW importance to low-power and shutdown CDF (CCF RAW - SD CDF).
- FV importance to low-power and shutdown LRF (FV - SD LRF).
- RAW importance to low-power and shutdown LRF (RAW - SD LRF).
- CCF RAW importance to low-power and shutdown (LRF CCF RAW - SD LRF).

17.4.2.3 Expert Panel

An expert panel is established to assess the qualitative and quantitative inputs related to risk-significant SSC. A preliminary list of risk-significant SSC is developed using a combination of probabilistic and deterministic insights. This includes information obtained from sources, such as design-specific PRA, nuclear plant operating experience, relevant component failure databases.

The expert panel will use their expertise and PRA insights to develop the list of the risk-significant SSC. The panel members will use input from the specific risk importance calculational methods (i.e., FV and RAW) to determine risk-significant SSC. Each calculational method will identify a different set of SSC based on differing concepts of importance. Each method is useful for providing insights into the selection of risk-significant SSC. The expert panel may use all of these methods in the decision making process.

The use of an expert panel compensates for the limitations of the PRA model, such as model assumptions, treatment for support systems, level of definition of cut sets, cut sets truncation, shadowing effect of very large (high frequency) cutsets, and inclusion of repair or restoration of failed equipment and limitations in the meanings of the importance measures in the Nuclear Energy Institute Guideline NUMARC 93-01 (Reference 1).

The expert panel consists of individuals who possess extensive knowledge in the areas of PRA, risk and reliability, plant operation, system engineering and maintenance. A process is developed for the selection and the qualification of the members.

Meetings are held on an as-needed basis to discuss the final selection of the risk-significant SSC that are to be included in the RAP. Industry-wide information sources and engineering judgment will be used to consider the addition of SSC to the RAP.

In addition to the quantitative factor from the PRA, the expert panel qualitatively evaluated systems and structures within the design certification scope based on deterministic criteria including but not limited to:

- A contribution to the initiators.
- An implicit contribution to the CDF.
- An implicit contribution to the LRF.
- A contribution to seismic margin analysis, performance history/operating experience of the component.
- Technical Specifications considerations for the component.

- Detection of component failures.
- The effect of component failure on the other systems.

As a result of the expert panel review, a list of non-site-specific systems and structures within the RAP scope, and an indication of whether they are PRA based input versus added by the expert panel, is provided in Table 17.4-2.

17.4.3 Organization, Design Control, Procedures and Instructions, Corrective Actions, and Audit Plans

AREVA NP is an integrated design and engineering organization that is responsible for formulating and implementing Phase 1 of the RAP.

The AREVA NP RAP implementation plan includes RAP scope, objectives, design consideration, the identification and prioritization of SSC, RAP organization, and expert panel. This RAP implementation plan is described in the following paragraphs.

The AREVA NP engineering organization is responsible for the safety analyses, risk and reliability analyses, and the PRA necessary to support the development of the RAP. PRA and design engineering personnel report to the manager of nuclear island engineering. Therefore, risk and reliability personnel are directly involved with the design organization and are responsible for keeping the design staff cognizant of the risk-significant items of the RAP, program needs, and project status. Risk and reliability personnel participate in the design change control process to incorporate RAP-related inputs into the design process. Additionally, a cognizant representative of risk and reliability is present at design reviews to identify interfaces between the performance of risk-significant SSC and the reliability assumptions in the PRA. Meetings between risk and reliability personnel and the designer are held to manage interface issues.

AREVA NP engineering design procedural controls are applied to the RAP. Specific procedures provide guidance for the design control process, control of design changes, and storage and retrieval controls.

The design control procedure defines the process for performing, documenting, and verifying design activities. This includes the development or modification of system designs, evaluations, analyses, calculations and design document preparation (e.g., specifications, drawings, reports).

The procedure for design change control defines the process for evaluating design changes in engineering controlled documents so that the total effect is considered before a change is approved, and the affected documents are identified and changed accordingly. The procedure identifies the information and organizations responsible

for these interfaces, including PRA review. If a proposed change could affect the safety, availability, or capacity factor of the U.S. EPR, system reliability is analyzed.

There are several AREVA NP corporate quality assurance and design control procedures which provide guidance for the development of a high-quality process for the reliability assurance program and for maintaining the appropriate documentation of it. The documentation development and maintenance procedure establishes the requirements and responsibilities for the preparation, approval, and issue of documents controlled by the engineering design organizations. The QA records procedure provides requirements for QA record retention. The self-assessment, corrective action, and audit procedures specify the responsibilities associated with respective audits of the engineering organization. This self-assessment is also used to promptly identify, document, and determine corrective actions for conditions that are adverse to quality.

The above AREVA NP corporate processes provide configuration control of the list of SSC within the scope of RAP thereby demonstrating that the U.S. EPR reliability assurance implementation program will maintain the scope of RAP SSC throughout the design process.

17.4.4 Reliability Assurance Program Information Needed in a COL Application

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.

17.4.5 References

1. NUMARC 93-01, Nuclear Utilities Management and Resources Council, “Industry Guideline for Monitoring Effectiveness of Maintenance at Nuclear Power Plants,” April 1996.

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 1 of 34

Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
CCWS	30KAAX0AA004	CCWS, Discharge from CCW HTX Check Valves KAA10/20/30/40AA004	4	Check Valve	Fails to Remain Open, Spurious Operation (CL)			X					X			X	
CCWS	30KAAX2AA005	CCWS, LHSI HTX Cooling MOVs KAA12/22/32/42AA005	4	MOV	Fails to Open on Demand (FO)	X	X	X	X		X		X			X	
CCWS	30KAAX2AA012	CCWS, LHSI HTX Discharge Check Valves KAA12/22/32/42AA012	4	Check Valve	Fails to Open on Demand (FO)			X			X		X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 2 of 34

Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
CCWS	30KAAX2AA101	CCWS, Common Header QKA20/30 Chiller Return 3-Way MOVs KAA22/32AA101	2	MOV	Fails to Remain Open, Spurious Operation (CL)		X										
CCWS	30KAAX0AC001	CCWS, Train HTX KAA10/20/30/ 40AC001	4	HTX	External Leakage (EL)		X						X			X	
CCWS	30KAAX0AP001	CCWS, Motor Driven Pumps KAA10/20/30/ 40AP001	4	Pump	External Leakage (EL)		X					X	X		X	X	
CCWS	30KAAX0BB001	CCWS, Train Surge Tank KAA10/20/30/ 40BB001	4	Tank	External Leakage (EL)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 3 of 34

Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
CCWS	30KAB30AA191 /192	CCWS, CCWS CH RCP TB Return Safety Valves KAB30AA191/192	2	Safety Valve	Premature Opening (PO)		X										
CCWS	30KABX0AA191	CCWS, CVCS HP Cooler Return Safety Valves KAB60/70AA191	2	Safety Valve	Premature Opening (PO)		X										
CCWS	30KABX0AA192	CCWS, CCWS CH Return Safety Valves KAB10/20AA192	2	Safety Valve	Premature Opening (PO)		X										
CCWS	30KABX0AA193	CCWS, FPCS Train Cooling Header Safety Valves KAB10/20AA193	2	Safety Valve	Premature Opening (PO)		X										
CLCWS	30PGB19AA191	CLCWS, Safety Valve PGB19AA191	1	Safety Valve	Premature Opening (PO)		X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
CVCS	30KBA14AA004 /106	CVCS, Low Pressure Reducing Station Isolation MOVs KBA14AA004/106	2	MOV	Fails to Close on Demand (FC)							X	SD IE	SD IE	X	SD IE	SD IE
EFWS	30LARX1AA103	EFWS, SG Pressure Control MOVs LAR11/41AA103	2	MOV	Fails to Control Flow (CF)		X										
EFWS	30LARX1AA105	EFWS, SG Level Control MOVs LAR11/41AA005	2	MOV	Fails to Control Flow (CF)		X										
EFWS	30LARX0BB001	EFWS, EFW Storage Tanks LAR10/20/30/ 40BB001	4	Tank	External Leakage (EL)		X										
EFWS	30LASX1AP001	EFWS, Motor Driven Pumps LAS11/21/31/ 41AP001	4	Pump	Fails to Run (FR)	X	X	X	X		X	X			X		

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 5 of 34

Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	3XBTB01_BAT	ELEC, 250V Non 1E 12-hr Batteries 31/32BTB01	2	Battery	Fails on Demand (ST)		X			X			X				
ELEC	3XBTD01_BAT	ELEC, 250V 1E 2-hr Batteries 31/32/33/34BTD01	4	Battery	Fails on Demand (ST)	X	X	X	X	X	X	X	X	X	X	X	X
ELEC	3XBUC	ELEC, 250V DC Bus 31/34BUC	2	Bus	Fails During Operation (FL)		X			X			X			X	
ELEC	3XBUD	ELEC, Non 1E 250V DC Distribution Panels 31/32BUD	2	Bus	Fails During Operation (FL)		X						X				
ELEC	3XBTD01	ELEC, 250V Battery 31/34BTD01 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 6 of 34

Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	3XBMBXBNT01	ELEC, 480V Load Center 31/34BMB to Transformer 31/ 34BNT01 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)								X			X	
ELEC	31BDA_1BDC1/ 2	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDC1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X			X						X	
ELEC	31BDA_1BDD1/ 2	ELEC, 6.9kV SWGR 31BDA to 6.9kV SWGR 31BDD1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 7 of 34

Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	31BDB1BMT02	ELEC, 6.9kV SWGR 31BDB to Transformer 31BMT02 Circuit Breaker	1	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X			X			X			X	
ELEC	31BDC_1BDB1/2	ELEC, 6.9kV SWGR 31BDC to 6.9kV SWGR 31BDB1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X			X			X			X	
ELEC	31BDD1BMT04	ELEC, 6.9kV SWGR 31BDD to Transformer 31BMT04 Circuit Breaker	1	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 8 of 34

Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	32BDA_2BDB1/2	ELEC, 6.9kV SWGR 32BDA to 6.9kV SWGR 32BDB1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X			X						X	
ELEC	32BDB2BMT02	ELEC, 6.9kV SWGR 32BDB to Transformer 32BMT02 Circuit Breaker	1	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X			X						X	
ELEC	33BDA_3BDB1/2	ELEC, 6.9kV SWGR 33BDA to 6.9kV SWGR 33BDB1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	33BDB3BMT02	ELEC, 6.9kV SWGR 33BDB to Transformer 33BMT02 Circuit Breaker	1	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X										
ELEC	34BDA_4BDC1/2	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDC1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	
ELEC	34BDA_4BDD1/2	ELEC, 6.9kV SWGR 34BDA to 6.9kV SWGR 34BDD1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	34BDB4BMT02	ELEC, 6.9kV SWGR 34BDB to Transformer 34BMT02 Circuit Breaker	1	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	
ELEC	34BDC_4BDB1/2	ELEC, 6.9kV SWGR 34BDC to 6.9kV SWGR 34BDB1/2 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	
ELEC	34BDD4BMT04	ELEC, 6.9kV SWGR 34BDD to Transformer 34BMT04 Circuit Breaker	1	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 11 of 34

Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	3XBDT01_XBDA	ELEC, Aux Transformer 30BDT01 to 6.9kV SWGR 31/32/33/ 34BDA Circuit Breaker	4	Circuit Breaker	Fails to Open on Demand (FO)			X			X			X			X
ELEC	3XBDT02_XBDA	ELEC, Aux Transformer 30BDT02 to 6.9kV SWGR 31/32/33/ 34BDA Circuit Breaker	4	Circuit Breaker	Fails to Open on Demand (FO)			X			X			X			X
ELEC	3XKAX0_XBDA	ELEC, EDG XKA10/ 20/30/40 to 6.9kV SWGR 31/32/33/ 34BDA Circuit Breaker	4	Circuit Breaker	Fails to Close on Demand (FC)			X			X			X			X

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 12 of 34

Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	3XBRU01XBRA	ELEC, Inverter 31/32BRU01 to 480V MCC 31/32BRA Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X			X						X	
ELEC	3XBMT02XBMB	ELEC, Transformer 31/32/33/34BMT02 to 480V Load Center 31/32/33/34BMB Circuit Breaker	4	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X			X			X			X	
ELEC	3XBMT04XBMD	ELEC, Transformer 31/34BMT04 to 480V Load Center 31/34BMD Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	3XBNT01XBNB02	ELEC, Transformer 31/34BNT01 to 480V MCC 31/34BNB02 Circuit Breaker	2	Circuit Breaker	Fails to Remain Closed, Spurious Operation (OP)								X			X	
ELEC	30XKAX0	ELEC, Emergency Diesel Generators XKA10/20/30/40	4	Diesel Generator	Fails to Run (FR)	X		X	X		X	X		X	X		X
ELEC	30XKA50/60	ELEC, SBO Diesel Generators XKA50/80	2	Diesel Generator	Fails to Run (FR)	X			X			X	X		X	X	
ELEC	3XBRU03	ELEC, Inverters 31/32BRU03	2	Inverter	Fails to Run (FR)		X										
ELEC	3XBMB	ELEC, 480V Load Centers 31/32/33/34BMB	4	Load Center	Fails During Operation (FL)		X			X			X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	3XBMD	ELEC, 480V Load Center 31/34BMD	2	Load Center	Fails During Operation (FL)		X						X			X	
ELEC	35BFE	ELEC, 480V Load Center 35BFE	1	Load Center	Fails During Operation (FL)		X										
ELEC	3XBNB01	ELEC, 480V MCC 31/34BNB01	2	MCC	Fails to Run (FR)		X			X			X			X	
ELEC	3XBNB02	ELEC, 480V MCC 31/32/34BNB02	3	MCC	Fails to Run (FR)		X						X			X	
ELEC	3XBRA	ELEC, 480V MCC 31/32/33/34BRA	4	MCC	Fails to Run (FR)	X	X		X	X						X	
ELEC	3XBRB	ELEC, 480V MCC 31/34BRB	2	MCC	Fails to Run (FR)		X										
ELEC	3XBRC	ELEC, 480V MCC 31/32BRC	2	MCC	Fails During Operation (FL)		X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	3XBRWXXBUWXX	ELEC, 24V DC I&C Power Rack 31BRW10/31BUW11 32BRW32/32BUW33 BRW52/BUW53 34BRW70/34BUW71	4	Power Rack	Fails During Operation (FL)		X			X			X				
ELEC	3XBDA	ELEC, 6.9kV SWGR 31/32/33/34BDA	4	SWGR	Fails During Operation (FL)		X			X							
ELEC	3XBDB	ELEC, 6.9kV SWGR 31/32/33/34BDB	4	SWGR	Fails During Operation (FL)		X			X			X			X	
ELEC	3XBDC	ELEC, 6.9kV SWGR 31/34BDC	2	SWGR	Fails During Operation (FL)		X			X			X			X	
ELEC	3XBDD	ELEC, 6.9kV SWGR 31/34BDD	2	SWGR	Fails During Operation (FL)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	35BBA	ELEC, 13.8kV SWGR 35BBA	1	SWGR	Fails During Operation (FL)		X										
ELEC	3XBRU0301	ELEC, Inverter BRU03 Bypass Switch 31/32BRU0301	2	Switch	Fails to Remain Closed, Spurious Operation (OP)		X										
ELEC	3XBMT02	ELEC, 6.9kV-480V Transformer 31/32/ 33/34BMT02	4	Transforme r	Fails During Operation (FL)		X			X			X			X	
ELEC	3XBMT04	ELEC, 6.9kV-480V Transformer 31/34BMT04	2	Transforme r	Fails During Operation (FL)		X						X			X	
ELEC	3XBNT01	ELEC, Constant Voltage Transformer 31/34BNT01	2	Transforme r	Fails During Operation (FL)								X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ELEC	35BFT05	ELEC, 13.8kV-480V Transformer 35BFT05	1	Transformer	Fails During Operation (FL)		X										
ESWS	30PEBX0AA004	ESWS Pump Discharge Check Valves PEB10/20/30/40AA004	4	Check Valve	Fails to Remain Open, Spurious Operation (CL)			X						X			X
ESWS	30PEBX0AA005	ESWS, Pump Discharge Isolation MOVs PEB10/20/30/40AA005	4	MOV	Fails to Remain Open, Spurious Operation (CL)		X										
ESWS	30PEBX0AP001	ESWS, Motor Driven Pumps PEB10/20/30/40AP001	4	Pump	Fails to Start on Demand (FS)		X					X			X		

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
ESWS	30PEDX0AN001	UHS, Cooling Tower Cooling Fans PED10/20/30/ 40AN001	4	Fan	Fails to Run (FR)		X	X			X						
ESWS	30PEDX0AN002	UHS, Cooling Tower Cooling Fans PED10/20/30/ 40AN002	4	Fan	Fails to Start on Demand (FS)	X	X	X	X		X						
HVAC	30SAC3XAA002	SAC, Normal Air Exhaust Motor Operated Dampers SAC31/32/33/ 34AA002	4	MOV Damper	Fails to Remain Open, Spurious Operation (CL)		X										
HVAC	30SAC3XAA003	SAC, Normal Air Exhaust Supply Fan Discharge Check Dampers SAC31/32/33/ 34AA003	4	Check Damper	Fails to Remain Open, Spurious Operation (CL)		X	X						X			X

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
HVAC	30SAC0XAA003	SAC, Normal Air Inlet Motor Operated Dampers SAC01/02/03/ 04AA003	4	MOV Damper	Fails to Remain Open, Spurious Operation (CL)		X										
HVAC	30SAC0XAA005	SAC, Normal Air Inlet Supply Fan Discharge Check Dampers SAC01/02/03/ 04AA005	4	Check Damper	Fails to Open on Demand (FO)		X	X		X	X			X			X
HVAC	30SAC3XAN001	SAC, Normal Air Exhaust Fans SAC31/32/33/ 34AN001	4	Fan	Fails to Run (FR)	X	X	X	X	X	X	X		X	X		X
HVAC	30SAC0XAN001	SAC, Normal Air Supply Fans SAC01/02/03/ 04AN001	4	Fan	Fails to Run (FR)	X	X	X	X	X	X	X		X	X		X

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
IRWST	30JNK1XAT001	IRWST, SIS Sump Strainers to MHSI/ LHSI Pumps 1/4 JNK10/11AT001	2	Strainer	Plugs (PG)			X			X	X		X	X		X
IRWST	30JNK1XAT002	IRWST, SIS Sump Strainers to MHSI/ LHSI Pumps 2/3 JNK10/11AT002	2	Strainer	Plugs (PG)			X			X	X		X	X		X
IRWST	30JNK10AT003	IRWST, CVCS Sump Strainer JNK10AT003	1	Strainer	Plugs (PG)			X			X	X		X	X		X
IRWST	30JNK11AT003	IRWST, SAHR Sump Strainer JNK11AT003	1	Strainer	Plugs (PG)			X			X	X	X	X	X		X
MFWS	30LAB3XAA001	FWS, HP Heater Bypass Pneumatic Valves LAB31/32AA001	2	Pneumatic Valve	Fails to Remain Open, Spurious Operation (CL)		X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
MFWS	30LAB3XAA002	FWS, HP Heater Bypass Pneumatic Valves LAB31/32AA002	2	Pneumatic Valve	Fails to Remain Open, Spurious Operation (CL)		X										
MSS	30LBAX3AA001	MSS, MSRIVs LBA13/23/33/ 43AA001	4	Pneumatic Valve	Fails to Close on Demand (FC) & Fails to Open on Demand (FO)	X		X	X		X						
MSS	30LBAX0AA002	MSS, Main Steam Isolation Valves LBA10/20/30/ 40AA002	4	Pneumatic Valve	Fails to Remain Open (CL) & Fails to Close on Demand (FC)	X	X	X	X		X						
MSS	30LBAX3AA101	MSS, MSRCVs LBA13/23/33/ 43AA101	4	MOV	Fails to Close on Demand (FC)	X	X		X	X							

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
MSS	30LBAXXAA191	MSS, Main Steam Safety Relief Valves LBA11/12/21/22/31/32/41/42AA191	8	Safety Valve	Fails to Open on Demand (FO)			X			X						
MSS	30LBAX3AA712	MSS, Train 1/2/3/4a MSRIV Pneumatic Pilot Valves LBA13/23/33/43AA712	4	Pneumatic Valve	Fails to Open on Demand (FO)	X		X			X						
MSS	30LBAX3AA713	MSS, Train 1/2/3/4a MSRIV Pneumatic Pilot Valves LBA13/23/33/43AA713	4	Pneumatic Valve	Fails to Open on Demand (FO)	X		X			X						
MSS	30LBAX3AA716	MSS, Train 1/2/3/4b MSRIV Pneumatic Pilot Valves LBA13/23/33/43AA716	4	Pneumatic Valve	Fails to Open on Demand (FO)	X		X			X						

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
MSS	30LBAX3AA717	MSS, Train 1/2/3/4b MSRIV Pneumatic Pilot Valves LBA13/23/33/ 43AA717	4	Pneumatic Valve	Fails to Open on Demand (FO)	X		X			X						
MSS	30LBAX3AA722	MSS, Train 1/2/3/4a MSRIV Solenoid Pilot Valves LBA13/23/33/ 43AA722	4	SOV	Fails to Open on Demand (FO)			X			X						
MSS	30LBAX3AA723	MSS, Train 1/2/3/4a MSRIV Solenoid Pilot Valves LBA13/23/33/ 43AA723	4	SOV	Fails to Open on Demand (FO)			X			X						
MSS	30LBAX3AA726	MSS, Train 1/2/3/4b MSRIV Solenoid Pilot Valves LBA13/23/33/ 43AA726	4	SOV	Fails to Open on Demand (FO)			X			X						

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
MSS	30LBAX3AA727	MSS, Train 1/2/3/4b MSRIV Solenoid Pilot Valves LBA13/23/33/ 43AA727	4	SOV	Fails to Open on Demand (FO)			X			X						
OCWS	30QNA2XAN00 1	OCWS, Train 1A/2A/ 1B/2B Chiller Units QNA21/22/23/ 24AN001	4	Chiller	Fails to Run (FR)					X							
PS	CLX22EQ011LV 60SM/NS	ALU-A1 Train 1/2/3/4 Protection System Computer Processors (Self-Monitored & Non-Self-Monitored)	8	Processor	Fails to Perform Its Function			X									
PS	CLX22EQ021LV 60SM/NS	ALU-A2 Train 1/2/3/4 Protection System Computer Processors (Self-Monitored & Non-Self-Monitored)	8	Processor	Fails to Perform Its Function			X									

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
PS	CLX22EQ001LV 60SM/NS	ALU-B1 Train 1/2/3/4 Protection System Computer Processors (Self-Monitored & Non-Self-Monitored)	8	Processor	Fails to Perform Its Function			X									
PS	CLX22EQ002LV 60SM/NS	ALU-B2 Train 1/2/3/4 Protection System Computer Processors (Self-Monitored & Non-Self-Monitored)	8	Processor	Fails to Perform Its Function			X									
PS	CLX21EQ002LV 60SM/NS	APU-2 Train 1/2/3/4 Protection System Computer Processors (Self-Monitored & Non-Self-Monitored)	8	Processor	Fails to Perform Its Function			X									
PS	CLX23EQ001LV 60SM/NS	APU-3 Train 1/2/3/4 Protection System Computer Processors (Self-Monitored & Non-Self-Monitored)	8	Processor	Fails to Perform Its Function			X									

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
PS	CLX23EQ002LV 60SM/NS	APU-4 Train 1/2/3/4 Protection System Computer Processors (Self-Monitored & Non-Self-Monitored)	8	Processor	Fails to Perform Its Function			X									
PS	CL-PS-A/B-SWCCF	Protection System diversity group A&B Software	2	Software	Fails to Perform Its Function			X									
PS	JEF10CP801/ 803/805/807-SNPFL	Train 1/2/3/4 Pressurizer (RCS) pressure sensor	4	Sensor	Fails to Perform Its Function			X									
PS	LBA40CP811/ 821/831/841-SNPFL	Train 1/2/3/4 SG4 pressure sensors	4	Sensor	Fails to Perform Its Function			X									
PS	CL-TXS-OSCCF	TXS operating system software or multiple diversity groups	1	Software	Fails to Perform Its Function			X									
RCS	30JEBX0 SSSF	Stand Still Seal for RCP1/2/3/4	4	Stand Still Seal	Seal Failure (SF)		X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
RCS	30JEBX0AA010	RCP, RCP Leakoff Isolation MOVs JEB10/20/30/ 40AA010	4	MOV	Fails to Close on Demand (FC)	X	X										
RCS	30JEBX0AA018	RCP Seal, RCP Nitrogen Supply Solenoid Valves JEB10/20/30/ 40AA018	4	SOV	Fails to Open on Demand (FO)		X										
RCS	30JEBX0AA019	RCP Seal, RCP Nitrogen Supply Check Valves JEB10/20/30/ 40AA019	4	Check Valve	Fails to Open on Demand (FO)		X										
RCS	30JEB10AA020	RCP Seal, RCP Seal Nitrogen Venting Isolation MOVs JEB10/20/30/ 40AA020	4	MOV	Fails to Close on Demand (FC)	X	X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
RCS	30JEBX0AP001	RCP, RCP Pumps JEB10/20/30/40AP001 13.8kV SWGR 31/32/ 33/34BBC Circuit Breakers	4	Pump	Fails to Open on Demand (FO)		X										
SAHRS	30JMQ40AP001	SAHR, Motor Driven Pump JMQ40AP001	1	Pump	Fails to Start on Demand (FS)	X							X		X	X	
SCWS	30QKAX0AA00 3	SCWS, Safety Chiller Pump Discharge Check Valves QKA10/20/30/ 40AA003	4	Check Valve	Fails to Open on Demand (FO)		X	X		X	X		X	X		X	X
SCWS	30QKAX0AA10 1	SCWS, Chiller By-pass MOVs QKA10/20/30/ 40AA101	4	MOV	Fails to Control Flow (CF)		X						X			X	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
SCWS	30QKA40AA108	SCWS, Train 4 Safety Chiller Pump Discharge Check Valve QKA40AA108	1	Check Valve	Fails to Open on Demand (FO)					X	X						
SCWS	30QKAX0AP107	SCWS, Motor Driven Safety Chiller Pumps QKA10/20/30/40AP107	4	Pump	Fails to Run (FR)	X	X	X	X	X	X	X	X	X	X	X	X
SCWS	30QKAX0GH001	SCWS, Chiller Units QKA10/20/30/40GH001	4	Chiller	Fails to Start on Demand (FS)	X	X	X	X	X	X	X	X		X	X	
SCWS	30QKCX0AA101	SCWS, Return from SAC MOVs QKC10/20/30/40AA101	4	MOV	Fails to Remain Open, Spurious Operation (CL)		X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
SIS/ RHRS	30JNAX0AA001	RHR, LHSI Pump Hot Leg Isolation MOVs JNA10/20/30/ 40AA001	4	MOV	Fails to Open on Demand (FO)			X			X				X		
SIS/ RHRS	30JNAX0AA002	RHR, LHSI Pump Hot Leg Isolation MOVs JNA10/20/30/ 40AA002	4	MOV	Fails to Open on Demand (FO)			X			X				X		
SIS/ RHRS	30JNAX0AA003	RHR, LHSI Pump Hot Leg Isolation MOVs JNA10/20/30/ 40AA003	4	MOV	Fails to Open on Demand (FO)			X			X						
SIS/ RHRS	30JNAX0AA191	RHR, LHSI Train Safety Valves JNA10/20/30/ 40AA191	4	Safety Valve	Premature Opening (PO)							X	SD IE		X	SD IE	

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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
SIS/ RHRS	30JNDX0AA003	MHSI, MHSI Pump Discharge Manual CHECK Valves JND10/20/30/ 40AA003	4	Check Valve	Left in Wrong Position, Non-Monitored (MEC3)	X		X				X	SD IE	SD IE	X	SD IE	SD IE
SIS/ RHRS	30JNDX0AA007	MHSI, MHSI Pump Discharge Check Valves JND10/20/30/ 40AA007 (CIV)	4	Check Valve	Fails to Open on Demand (FO)			X						X			X
SIS/ RHRS	30JNDX0AP001	MHSI, MHSI Motor Driven Pumps JND10/20/30/ 40AP001	4	Pump	Fails to Run (FR)	X		X			X	X		X	X		X
SIS/ RHRS	30JNGX0AA001	LHSI, LHSI Pump Suction from IRWST MOVs JNG10/20/30/ 40AA001	4	MOV	Fails to Close on Demand (FC)							X	SD IE		X	SD IE	

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
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Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
SIS/ RHRS	30JNGX0AA003	LHSI, LHSI Radial Miniflow Motor Operated Check Valves JNG10/20/30/ 40AA003	4	MOV	Fails to Remain Closed, Spurious Operation (OP)							X	SD IE		X	SD IE	
SIS/ RHRS	30JNGX0AA004	LHSI, LHSI Tangential Miniflow Motor Operated CVs JNG10/20/30/ 40AA004	4	MOV	Fails to Close on Demand (FC)			X			X	X	SD IE		X	SD IE	
SIS/ RHRS	30JNGX3AA005	LHSI, CL1/2/3/4 First SIS Isolation Check Valves JNG13/23/33/ 43AA005	4	Check Valve	Fails to Open on Demand (FO)	X	X	X	X		X	X	X	X	X	X	X

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 33 of 34

Equipment Definition						Rationale FOR Selection										
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
SIS/ RHRS	30JNGX0AA006	LHSI, LHSI CL1/2/3/4 Discharge Manual CHECK Valves JNG10/20/30/ 40AA006	4	Check Valve	Left in Wrong Position, Non-Monitored (MEC3)	X		X			X		X	X		X	X
SIS/ RHRS	30JNGX0AA009	LHSI, LHSI Pump Discharge Check Valves JNG10/20/30/ 40AA009	4	Check Valve	Fails to Open on Demand (FO)			X			X		X	X		X	X
SIS/ RHRS	30JNGX0AA011	LHSI, LHSI Pump Discharge Check Valves JNG10/20/30/ 40AA011	4	Check Valve	Fails to Open on Demand (FO)			X			X						
SIS/ RHRS	30JNGX0AA104	LHSI, LHSI Pump Throttle Control MOVs JNG10/20/30/ 40AA104	4	MOV	Fails to Control Flow (CF)		X										

Table 17.4-1—Input to RAP List from Importance Measures and Initiating Event Contribution
Sheet 34 of 34

Equipment Definition						Rationale FOR Selection											
System	Component General ID	Component Description	Number of Components	Component Type	Dominant Failure Mode	FV - PWR CDF	RAW- PWR CDF	CCF RAW- PWR CDF	FV - PWR LRF	RAW - PWR LRF	CCF RAW - PWR LRF	FV - SD CDF	RAW - SD CDF	CCF RAW - SD CDF	FV - SD LRF	RAW - SD LRF	CCF RAW - SD LRF
SIS/ RHRS	30JNGX0AA192	LHSI, LHSI/RHR Train Overpressure Protection Safety Valves JNG10/20/30/ 40AA192	4	Safety Valve	Fails to Open on Demand (FO)							X	SD IE		X	SD IE	
SIS/ RHRS	30JNGX0AC001	LHSI, LHSI Train HTX JNG10/20/30/ 40AC001	4	HTX	Tube Leakage (LK)		X						X			X	
SIS/ RHRS	30JNGX0AP001	LHSI, LHSI Motor Driven Pumps JNG10/20/30/ 40AP001	4	Pump	Fails to Start on Demand (FS)	X		X			X	X	X		X	X	

Table 17.4-2—Design Certification Scope Systems and Structures Included Within RAP
Sheet 1 of 3

System Names	Rationale for Selection
NSSS Support Systems	
Fuel Handling System	Added by expert panel
Chemical & Volume Control System; including RCP Seal Injection	PRA input to the RAP
Reactor Coolant Systems	
Reactor Coolant System	PRA input to the RAP
Frontline Safety Systems	
Combustible Gas Control System	Added by expert panel
Safety Injection System / Residual Heat Removal System	PRA input to the RAP
In Containment Refueling Water Storage Tank System	PRA input to the RAP
Severe Accident Heat Removal System	PRA input to the RAP
Extra Borating System	Added by expert panel
Emergency Feedwater System	PRA input to the RAP
Core Melt Stabilization System	Added by expert panel
Structures	
Emergency Power Generating Buildings	Added by expert panel
Nuclear Island Structural System (Fuel Building, Reactor Building, Shield Building, Safeguard Buildings, Vent Stack)	Added by expert panel
Essential Service Water Cooling Tower Structures & Pump Structure	Added by expert panel
Distributed Utilities	
Demineralized Water Distribution System	Added by expert panel
Seal Water Supply System	Added by expert panel
Component Cooling Water System	PRA input to the RAP
Essential Service Water System	PRA input to the RAP
Safety Chilled Water System	PRA input to the RAP
Closed Cooling Water System	PRA input to the RAP
Operational Chilled Water System - Nuclear Island	PRA input to the RAP
Fire Water Distribution System	Added by expert panel
Spray Deluge Systems	Added by expert panel
Sprinkler Systems	Added by expert panel
Gaseous Fire Extinguishing Systems	Added by expert panel

Table 17.4-2—Design Certification Scope Systems and Structures Included Within RAP
Sheet 2 of 3

System Names	Rationale for Selection
Power Conversion Systems	
Feedwater System	PRA input to the RAP
Main Steam System	PRA input to the RAP
Feedwater Heating System	Added by expert panel
Steam Generator Blowdown System	Added by expert panel
HVAC Systems	
Containment Building Ventilation System	Added by expert panel
Annulus Ventilation System	Added by expert panel
Electrical Division of Safeguard Building Ventilation System	PRA input to the RAP
Safeguard Building Controlled Area Ventilation System	Added by expert panel
Fuel Building Ventilation System	Added by expert panel
Main Control Room Air Conditioning System	Added by expert panel
Emergency Power Generating Building Ventilation System	Added by expert panel
Station Blackout Room Ventilation System	Added by expert panel
Essential Service Water Pump Building Ventilation System	Added by expert panel
Auxiliary Systems	
Liquid Waste Storage & Processing System	Added by expert panel
Gaseous Waste Processing System	Added by expert panel
Station Blackout Diesel Generator Set	PRA input to the RAP
Emergency Diesel Generator Set	PRA input to the RAP
Electrical Systems	
Offsite Power System	Added by expert panel
Switchyard	Added by expert panel
Class 1E Uninterruptible Power Supply System	PRA input to the RAP
Emergency Power Supply System	PRA input to the RAP
Non-Class 1E Uninterruptible Power Supply System	Added by expert panel
Normal Power Supply System	PRA input to the RAP
12-Hour Uninterruptible Power Supply System	PRA input to the RAP
I&C Systems	
Boron Concentration Measurement System	Added by expert panel
Process Automation System	Added by expert panel
Process Information & Control System	Added by expert panel

Table 17.4-2—Design Certification Scope Systems and Structures Included Within RAP
Sheet 3 of 3

System Names	Rationale for Selection
Communication System	Added by expert panel
Safety Automation System	Added by expert panel
Safety Information & Control System	Added by expert panel
Main Control Room	Added by expert panel
Remote Shutdown Station	Added by expert panel
Incore Instrumentation System	Added by expert panel
Excore Instrumentation System	Added by expert panel
Radiation Monitoring System	Added by expert panel
Protection System	PRA input to the RAP
Priority & Actuator Control System	Added by expert panel
Reactor Control, Surveillance & Limitation System	Added by expert panel
Control Rod Drive Control System	Added by expert panel
Reactor Pressure Vessel Level Measurement System	Added by expert panel
Hydrogen Monitoring System	Added by expert panel
Turbine-Generator Instrumentation and Control System	Added by expert panel
Leak Detection Systems	Added by expert panel
Plant Fire Alarm System	Added by expert panel