ENCLOSURE 1

License Amendment Request

Callaway Unit No. 1
Renewed Facility Operating License NPF-30
NRC Docket No. 50-483

Revise Technical Specifications to Adopt Risk-Informed Completion Times TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4b"

List of Revised Required Actions to Corresponding PRA Functions

1.0 INTRODUCTION

The purpose of this enclosure is to provide a mapping of identified in-scope Technical Specifications (TSs) statements to modeled (and surrogate) Probabilistic Risk Assessment (PRA) functions. This mapping provides the basis by which to quantify the increase in risk associated with extending the Completion Time for a given TS Action and to calculate a Risk-Informed Completion Time (RICT) for the RICT Program application.

Section 4.0, Item 2 of the U.S. Nuclear Regulatory Commission (NRC) Final Safety Evaluation (Reference 1) for NEI 06-09-A (Reference 2) identifies the following necessary content:

- The license amendment request (LAR) will provide identification of the TS Limiting Conditions for Operation (LCOs) and Required Actions to which the RMTS (or RICT for TSTF-505) will apply.

- The LAR will provide a comparison of the TS functions to the PRA modeled functions of the structures, systems and components (SSCs) subject to those LCO actions.

- The comparison should justify that the scope of the PRA model, including applicable success criteria such as number of SSCs required, flow rate, etc., are consistent with licensing basis assumptions (i.e., 10 CFR 50.46 emergency core cooling system (ECCS) flowrates) for each of the TS requirements, or an appropriate disposition or programmatic restriction will be provided.

This enclosure provides confirmation that Callaway Plant, Unit No. 1 PRA models include the necessary scope of SSCs and their functions to address each proposed application of the RICT Program to the proposed scope of TS LCOs. The enclosure also provides the information requested by Section 4.0, Item 2 of Reference 1. The comparison includes each of the TS LCOs and associated Required Actions within the scope of the RICT Program. The Callaway PRA model has the capability to model directly, or using a bounding surrogate, the risk impact of entering each of the Actions associated with the TS LCOs that are in the scope of the RICT Program.

Table E1-1 below lists each TS LCO Condition to which the RICT Program is proposed to be applied and documents the following information regarding the TSs with the associated safety analyses, the analogous PRA functions and the results of the comparison:

- **Column “Tech Spec Description”:** Lists all of the LCOs and condition statements within the scope of the RICT Program.

- **Column “SSCs Covered by TS LCO Condition”:** The SSCs addressed by each action requirement.

- **Column “Modeled in PRA?”:** Indicates whether the SSCs addressed by the TS LCO Condition are included in the PRA.

- **Column “Function Covered by TS LCO Condition”:** A summary of the required functions from the design basis analyses.

- **Column "Design Success Criteria":** A summary of the success criteria from the design basis analyses.

- **Column "PRA Success Criteria":** The function success criteria modeled in the PRA.

- **Column "Comments":** Provides the justification or resolution to address any inconsistencies between the TS and PRA functions regarding the scope of SSCs and the success criteria. Where the PRA scope of SSCs is not consistent with the TS, additional information is provided to describe how the LCO condition can be evaluated using appropriate surrogate events. Differences in the success criteria for TS functions are addressed to demonstrate the PRA criteria provide a realistic estimate of the risk of the TS condition as required by NEI 06-09-A, Revision 0-A.

The corresponding SSCs for each TS LCO and the associated TS functions are identified and compared to the PRA models. This description also includes the design success criteria and the applicable PRA success criteria. Any differences between the scope or success criteria are described in the table. Scope differences are justified by identifying appropriate surrogate events which permit a risk evaluation to be completed using the Configuration Risk Management Program (CRMP) tool for the RICT Program. Differences in success criteria typically arise due to the requirement in the American Society of Mechanical Engineers (ASME)/American Nuclear Society (ANS) PRA Standard to make PRAs realistic rather than bounding, whereas design basis criteria are necessarily conservative and bounding. The use of realistic success criteria is necessary to conform to Capability Category II of the ASME/ANS PRA Standard as required by NEI 06-09-A (Reference 2).

Examples of calculated RICTs are provided in Table E1-2 for each individual Action to which the RICT Program is proposed to apply. These calculations assume the SSC in question is the only SSC out-of-service, and thus the values in Table E1-2 are representative examples only.

Following RICT Program implementation, RICT calculations will be based upon the actual real-time maintenance configuration of the plant and the current revision of the PRA model representing the as-built, as-operated condition of the plant, as required by NEI 06-09-A (Reference 2) and the NRC Safety Evaluation. Thus, in practice, RICT values may differ from the RICTs presented in Table E1-2.

For the purposes of the following information, the terms subsystem, train, and division are all considered interchangeable.

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.3.1.B	One Manual Reactor Trip channel inoperable.	Two manual Reactor Trip Channels	Yes	Reactor Trip Initiation	One of two reactor trip channels	Same	1 of 2 reactor trip switches used as surrogate for the channel (Note 4)
3.3.1.D	One Power Range Neutron Flux-High channel inoperable.	Four Power Range Neutron Flux-High sensors	Not explicitly	Reactor Trip Initiation	Two of four channels	Same	The function One Power Range Neutron Flux-High is not explicitly modeled in the PRA, one of the 2 reactor trip breakers will be used as a conservative surrogate in the RICT calculation. (Notes 1 and 2)
3.3.1.E	One channel inoperable.	Power Range Neutron Flux Rate – High Positive Rate, Overtemperature ΔT, Overpower ΔT. Pressurizer Pressure – High, SG Water Level Low-Low (Adverse and Normal Containment Environment)	Partially	Reactor Trip Initiation	<u>Power Range Neutron Flux Rate – High Positive Rate</u>, 2 of 4 channels [2 seconds] <u>Overtemperature ΔT</u>, 2 of 4 channels <u>Overpower ΔT</u>, 2 of 4 channels <u>Pressurizer Pressure – High</u>, 2 of 4 channels <u>SG Water Level Low-Low (Adverse and Normal Containment Environment)</u> , 2 of 4 channels on 1 of 4 generators	Same	The functions <u>Power Range Neutron-Flux-High Positive Rate</u>, <u>Overtemperature ΔT</u>, <u>Overpower ΔT</u> are not explicitly modeled in PRA, one of the 2 reactor trip breakers will be used as a conservative surrogate in the RICT calculation. Pressurizer Pressure and SG level are explicitly modeled. (Notes 1 and 2)

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.3.1.K	One channel inoperable.	RCPs (Undervoltage, Underfrequency) (per bus), Pressurizer (Pressure Low, Water Level-High), Reactor Coolant Flow-Low (per loop)	Partially	Reactor Trip Initiation	RCP'UV/UFs,1 of 2 channels on 2 of 2 busses. Pressurizer Pressure Low, 2 of 4; Pressurizer Water Level – High 2 of 3, RCS Flow-Low 2 of 3 per loop	Same	The functions RCP'UV/UFs, Pressurizer Water Level – High, RCS Flow- Low are not explicitly modeled in the PRA,~~.,~~ one of the 2 reactor trip breakers will be used as a conservative surrogate in the RICT calculation. Pressurizer pressure channels are explicitly modelled. (Notes 1 and 2)
3.3.1.M	One Low Fluid Oil Pressure Turbine Trip channel inoperable	Turbine Emergency Trip System (ETS) (three sensors)	Not explicitly	Reactor Trip Initiation	Two of Three Electro-Hydraulic (EH) Fluid Pressure switches	1 of 2 for reactor trip breakers	The function Trip Turbine Emergency Trip System is not explicitly modeled in the PRA, one of the 2 reactor trip breakers will be used as a conservative surrogate in the RICT calculation. (Notes 1 and 2)
3.3.1.P	One train inoperable.	SI Input from ESFAS, Automatic Trip logic	Not explicitly	Reactor Trip Initiation	One of two trains	1 of 2 for automatic trip signals (manual trip also credited)	The function SI Input from ESFAS, Automatic Trip logic is not explicitly modeled in the PRA, 1 of 2 modeled auto trip signals will be used as a conservative surrogate in the RICT calculation. (Note 3)
3.3.1.Q	One RTB train inoperable.	Reactor Trip Breakers and Bypass Breakers	Yes	Reactor Trip Initiation	One of two RTBs open	Same	(Note 5)
3.3.1.U	One trip mechanism inoperable for one RTB.	RTB Undervoltage and Shunt Trip Mechanisms	Yes	Reactor Trip Initiation	One trip mechanism	Same	(Notes 3 and 4)

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.3.2.B	One channel or train inoperable.	Manual Initiation (Safety Injection, Containment Spray, Containment Isolation (Phase A and B Isolation))	Partially	ESF Actuation	<u>SI Function:</u> One of two SI Manual Initiation channels <u>CS/CIS-B Function:</u> Two of two CS Manual Initiation channels <u>CIS-A Function:</u> One of two CIS-A Manual Initiation channels	Same	Manual trip hand switches for SI and CIS-A are explicitly modeled. CS/CIS-B Function is not explicitly modeled in the PRA. Hydraulic analysis has been performed to show that success or failure of CS does not impact which sequences contribute to LERF. CIS-B isolates the component cooling water system (CCW) to the components located within the containment. CCW is a seismically designed closed loop system both inside and outside of the containment. Penetrations associated with CCW (and therefore associated with CIS-B) have been screened from the PRA. (Notes 1 and 2)

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions							
TS LCO Action	**Tech Spec Description**	**SSCs Addressed by TS LCO Condition**	**Modeled in PRA**	**Function Addressed by TS LCO Condition**	**Design Success Criteria**	**PRA Success Criteria**	**Comments**
3.3.2.C	One train inoperable.	Automatic Actuation Logic and Actuation Relays (Safety Injection, Containment Spray, Containment Isolation (Phase A and B), Automatic Switchover to Containment Sump)	Partially	ESF Actuation	One of two trains	Same	Auto-signals for SI, switchover, and CIS-A are explicitly modeled. The functions Containment Spray and Containment Isolation – Phase B Isolation are not explicitly modeled in PRA. Hydraulic analysis has been performed to show that success or failure of CS does not impact which sequences contribute to LERF. CIS-B isolates the component cooling water system (CCW) to the components located within the containment. CCW is a seismically designed closed loop system both inside and outside of the containment. Penetrations associated with CCW (and therefore associated with CIS-B) have been screened from the PRA. (Notes 1 and 2)

3.3.2.D	One channel inoperable.	SI (Containment Pressure – High 1, Pressurizer Pressure - Low, Steam Line Pressure - Low), Steam Line Isolation (Containment Pressure – High 2, Steam Line Pressure {Low, Negative Rate - High}) Turbine Trip and Feedwater Isolation (SG Water Level-Low Low {Adverse and Normal Containment}) Auxiliary Feedwater (SG Water Level-Low Low {Adverse and Normal Containment}) Automatic Pressurizer PORV Actuation – Pressurizer Pressure - High	Partially	ESF Actuation, Main Steam Line Isolation Signal, Turbine trip and FWIS, AFW Pump Start, PORV actuation	SI (Containment Pressure-High 1): 2 of 3 (PZR Pressure Low): 2 of 4 (Steam line pressure low): 2 of 3 on 1 of 4 steam lines Steam Line Isolation (Containment Pressure-High 2): 2 of 3, Steam Line Pressure-Low, 2 of 3 on 1 of 4 steam lines Steam Line Pressure-Negative Rate-High, 2 of 3 on 1 of 4 steam lines Turbine Trip and Feedwater Isolation (SG Water Level-Low Low {Adverse and Normal Containment}) 2 of 4 channels on 1 of 4 generators Auxiliary Feedwater (SG Water Level-Low Low {Adverse and Normal Containment}) 2 of 4 channels on 1 of 4 generators Automatic Pressurizer PORV Actuation- Pressurizer Pressure - High, 2 of 4 channels	Same	Signals for containment pressure high 1 & 2, pressurizer pressure low, steamline pressure low, and SG Level low are explicitly modeled. The functions Steam Line Isolation – Steam Line Pressure – Negative Rate-High, Feedwater Isolation - SG Water Level-Low Low, and PORV Actuation- Pressurizer Pressure-High are not explicitly modeled in PRA, and a failure of a reactor trip breaker will be used as a conservative surrogate. Note, the PRA does not model/distinguish between normal and adverse containment environment. RICT will not be applied to function 9b. – Automatic Pressurizer PORV Actuation, Pressurizer Pressure – High (Notes 1 and 2).
3.3.2.F	One channel or train inoperable.	Steam Line Isolation Manual Initiation, ESFAS Interlocks Rx	Partially	Manual Steam Line Isolation, Rx Trip, P-4 functions: Trips	SLI Function: 1 of 2 Control Room pushbuttons Rx Trip, P-4	SLI Function: 1 of 2 Control Room push buttons	A channel of main steam isolation will be used as a conservative surrogate for the steam line isolation function.

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions							
TS LCO Action	**Tech Spec Description**	**SSCs Addressed by TS LCO Condition**	**Modeled in PRA**	**Function Addressed by TS LCO Condition**	**Design Success Criteria**	**PRA Success Criteria**	**Comments**
		Trip, P4 (2 per train, 2 trains)		the main turbine, Isolates MFW with coincident low Tavg, Prevents automatic reactuation of SI after a manual reset of SI, Allows arming of the steam dump valves and transfers the steam dump from the load rejection Tavg controller to the plant trip controller; and, Prevents opening of the MFW isolation valves if they were closed on SI or SG Water Level - High High.	functions 1 of 2 trains		The function Rx Trip, P-4 is not modeled in the PRA and will not be in the scope of RICT.
3.3.2.G	One train inoperable.	Automatic Actuation Logic and Actuation Relays (Steam Line Isolation, Turbine Trip and Feedwater Isolation, Auxiliary Feedwater)	Yes	ESF Actuation	One of two trains	Same	Signals for Automatic Actuation Logic and Actuation Relays (Steam Line Isolation, Turbine Trip and Feedwater Isolation, Auxiliary Feedwater) are explicitly modeled. (Notes 1 and 2)

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.3.2.I	One channel inoperable.	Turbine Trip and Feedwater Isolation (SG Water Level-High High – P-14)	Not explicitly	ESF Actuation, P-14: •Trips the main turbine •Trips the MFW pumps (PAE01A/1B) closing the pump discharge valves •Initiates feedwater isolation	Two of four on one of four Steam Generators	None	The function Turbine Trip – SG Water Level-High High is not explicitly modeled, but SG water level high-high signals for MFW Isolation is modeled. Loss of the associated channel will be used as a conservative surrogate in the RICT calculation. Also note that trip of the MFW pumps and closure of the pump discharge valves is not explicitly modeled. (Notes 1 and 2)
3.3.2.J	One channel inoperable.	Aux Feed, motor driven pump start on Trip of all main feed pumps	Not explicitly	AFW Pump Start	Two of four, one in the same separation group from each feed pump	None	This function is not explicitly modeled but a conservative surrogate representing auto actuation of MDAFPs (PRA credits signals from SG low level, LOOP and SI) has been selected in the RICT calculation. (Notes 1 and 2)
3.3.2.K	One channel inoperable.	Automatic Switchover to Containment Sump – Refueling Water Storage Tank (RWST) Level-Low Low coincident with Safety Injection.	Yes	ESF Actuation	Two of four	Same	The function Automatic Switchover to Containment Sump – Refueling Water Storage Tank (RWST) Level-Low Low is explicitly modeled. (Notes 1 and 2)

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.3.2.Q	One train inoperable.	Automatic Actuation Logic and Actuation Relays (BOP ESFAS) (Auxiliary Feedwater and Steam Generator Blowdown and Sample Line Isolation)	Partially	ESF Actuation	One of two trains	Same	The function Automatic Actuation Logic and Actuation Relays (BOP ESFAS) Steam Generator Blowdown and Sample Line Isolation is not explicitly modeled in the PRA, but a conservative surrogate representing auto actuation of MDAFPs (PRA credits signals from SG low level, LOOP and SI) has been selected in the RICT calculation.
3.3.2.R	One or both train(s) inoperable.	Loss of Offsite Power (Auxiliary Feedwater and Steam Generator Blowdown and Sample Line Isolation)	Partially	ESF Actuation, -Start of TDAFP signal on LOOP -SGBSIS signal on LOOP	One of two trains	Same	The function Loss of Offsite Power (Steam Generator Blowdown and Sample Line Isolation) is not explicitly modeled in the PRA, but a conservative surrogate representing auto actuation of TDAFP (PRA credits signals from SG low level and UV) has been selected in the RICT calculation. Note: RICT is only applicable to one train inoperable.
3.3.2.S	One train inoperable.	Automatic Actuation Logic and Actuation Relays (MSFIS) (Steam Line Isolation, Turbine Trip and Feedwater Isolation)	Yes	ESF Actuation	One of two trains	Same	The functions Automatic Actuation Logic and Actuation Relays (Steam Line Isolation, Turbine Trip and Feedwater Isolation) are explicitly modeled. (Notes 1 and 2)

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions							
TS LCO Action	**Tech Spec Description**	**SSCs Addressed by TS LCO Condition**	**Modeled in PRA**	**Function Addressed by TS LCO Condition**	**Design Success Criteria**	**PRA Success Criteria**	**Comments**
3.3.5.A	One or more Functions with one channel per bus inoperable.	Degraded Voltage and Loss of voltage sensors on safety related 4 kV buses	Yes	Diesel Generator – Loss of Voltage Start as well as 4 kV Bus load shedding and initiating sequencing.	Two of four channels per bus	Same	The function Degraded Voltage and Loss of voltage sensors on safety related 4 kV buses is explicitly modeled.
3.4.11.B	One PORV inoperable for reasons other than excessive seat leakage	Two PORVS and automatic actuation circuitry	Yes	RCS depressurization, once through core cooling (feed and bleed Automatic pressure relief during inadvertent ECCS actuation	Two PORVs	One PORV with One Centrifugal Charging pump OR Two PORVs with One SI pump	(Note 6)
3.4.11.C	One block valve inoperable.	Two PORV block valves	Yes	Isolate associated PORV	Two PORV Block valves closable.	Same	
3.5.2.A	One or more trains inoperable. <u>AND</u> At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available.	Two ECCS trains (ECCS train consists of one Centrifugal Charging, one Safety Injection, and one Residual Heat Removal subsystem.)	Yes	Emergency make up to the RCS via injection from the RWST to the cold legs, and recirculation from the containment sump.	3 ECCS subsystems between two trains such that at least 100% ECCS flow equivalent to a single operable ECCS train is available.	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.6.2.C	One or more containment air locks inoperable for reasons other than Condition A or B.	Containment Airlocks	Not explicitly	Containment integrity	One of two containment air lock doors closed.	None	The containment airlocks are not modeled but their unavailability will be conservatively analyzed as an early containment failure in the RICT calculation.
3.6.3.A	One or more penetration flow paths with one containment isolation valve inoperable except for containment purge valve leakage not within limit.	Two active or passive isolation devices on each fluid penetration line	Yes	Containment boundary and minimization of RCS inventory Loss	One of two isolation devices per penetration	Same	Selected CI valves are modeled and can be used as a conservative surrogate of the failure.
3.6.3.C	One or more penetration flow paths with one containment isolation valve inoperable.	See LCO Condition 3.6.3.A.					
3.6.6.A	One containment spray train inoperable.	Two Containment spray trains	No	Containment pressure + temperature control and fission product retention from atmosphere during a DBA	One of two trains	None	Containment sprays are not modeled for success in the Level 1 PRA or in the LERF PRA. Hydraulic analysis has been performed to show that success or failure of CS does not impact which sequences contribute to LERF.

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.6.6.C	One containment cooling train inoperable.	Two Containment cooling trains	No	Containment pressure + temperature control	One of two trains	None	Containment cooling is not modeled for success in the Level 1 PRA or in the LERF PRA. Hydraulic analysis has been performed to show that success or failure of containment cooling does not impact which sequences contribute to LERF.
3.7.2.A	One MSIV actuator train inoperable.	Main Steam Isolation Valves (MSIVs)	Not explicitly	Isolate Main Steam Lines	One MSIV closure per steam generator (one of two actuator trains)	None	Actuators are not explicitly modeled in PRA, but loss of the associated signal train will be used as a conservative surrogate in the RICT calculation.
3.7.2.B	Two MSIV actuator trains inoperable for different MSIVs when the inoperable actuator trains are not in the same separation group.	See LCO Condition 3.7.2.A.					
3.7.2.F	One MSIV inoperable in MODE 1.	Main Steam Isolation Valves (MSIVs)	Yes	Isolate Main Steam Lines	Closure of 3 of 4 MSIVs	Same	
3.7.4.A	One required ASD line inoperable for reasons other than excessive ASD seat leakage.	Automatic Steam Dump Valves (ASDs)	Yes	Plant cooldown to RHR entry conditions	Bounded by SGTR scenarios which require 2/4 ASDs available	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.7.4.B	Two required ASD lines inoperable for reasons other than excessive ASD seat leakage.	Automatic Steam Dump Valves (ASDs)	Yes	Plant cooldown to RHR entry conditions	Bounded by SGTR scenarios which require 2/4 ASDs available	Same	
3.7.5.A	One steam supply to turbine driven AFW pump inoperable.	TD AFW pump steam supply line and valves	Yes	Steam supply to TDAFP to supply feedwater to steam generators to remove RCS decay heat	One of two trains of steam supplies to TDAFP	Same	
3.7.5.B	One ESW supply to turbine driven AFW pump inoperable.	ESW supply line, including valves, to AFW pumps	Yes	Safety related water supply to TDAFP to supply feedwater to steam generators to remove RCS decay heat	One of two trains of ESW supplies to TDAFP	Same	
3.7.5.C	One AFW train inoperable for reasons other than Condition A or B.	Three AFW trains each comprised of one pump (two containing a motor driven AFW pump and the other containing a TDAFW pump), piping, valves, and controls	Yes	Supply feedwater to steam generators to remove RCS decay heat	One of three AFW (system AL) pump trains	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions							
TS LCO Action	**Tech Spec Description**	**SSCs Addressed by TS LCO Condition**	**Modeled in PRA**	**Function Addressed by TS LCO Condition**	**Design Success Criteria**	**PRA Success Criteria**	**Comments**
3.7.7.A	One CCW train inoperable.	Two CCW trains comprised of two full capacity pumps and surge tank with associated valves, piping, heat exchanger, instrumentation and controls.	Yes	Heat sink for removing process and operating heat from safety related components during a Design Basis Accident or transient	One of two CCW (EG system) trains available	Same	
3.7.8.A	One ESW train inoperable.	Two ESW trains comprised of a self-cleaning strainer, prelube tank, one 100% capacity pump, piping, valving, and instrumentation and pump room supply fan	Yes	The Essential Service Water (ESW) System, in conjunction with the Service Water System, provides a source of heat rejection for safety-related loads, emergency makeup to the spent fuel pool and component cooling water systems, and is the backup water supply to the auxiliary feedwater system.	One of two ESW (EF system) pump trains available	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.7.9.A	One cooling tower train inoperable.	Two UHS Cooling tower trains (2 cells per train) are required to dissipate the heat contained in the ESW system. UHS Cooling Tower Electrical Room Supply Fan must be operable per train	Yes	Ultimate heat sink availability for ESW 30 day mission time	One of two trains (2 cells per train)	One of two trains (1 cell per train) for 24 hour PRA mission time.	(Note 7)
3.8.1.A	One offsite circuit inoperable.	Two qualified circuits between the offsite transmission network and the onsite 1E AC Electrical Power Distribution System.	Yes	Provide power from offsite transmission network to onsite Class one buses.	One qualified circuit between the offsite transmission network and the onsite 1E AC Electrical Power Distribution System.	Same	
3.8.1.B	One DG inoperable.	Two EDGs capable of supplying onsite 1E AC Electrical Power Distribution System	Yes	Provide power to safety related buses when offsite power to them is lost.	1 of 2 EDGs	Same	
3.8.1.C	Two offsite circuits inoperable.	Two qualified circuits between the offsite transmission network and the onsite 1E AC Electrical Power Distribution System.	Yes	Provide power from offsite transmission network to onsite Class one buses.	One qualified circuit between the offsite transmission network and the onsite 1E AC Electrical Power Distribution System.	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.8.1.D	One offsite circuit inoperable. AND One DG inoperable.	Two qualified circuits between the offsite transmission network and the onsite 1E AC Electrical Power Distribution System. Two EDGs capable of supplying onsite 1E AC Electrical Power Distribution System	Yes	Provide power from offsite transmission network to onsite Class one buses and to provide power to safety related buses when offsite power to them is lost.	One qualified circuit between the offsite transmission network and the onsite 1E AC Electrical Power Distribution System. 1 of 2 EDGs.	Same	
3.8.1.F	One required LSELS inoperable.	One Load Shedder and Emergency Load Sequencer per 4.16kV Class 1E AC Bus	Yes	Required functions of LSELS are initiating a DG start upon a detected undervoltage condition, tripping of the incoming offsite power upon a detected undervoltage or degraded voltage condition, shedding of nonessential loads, and proper sequencing of loads	One of two LSELS available.	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.8.4.A	One DC electrical power subsystem inoperable.	Two DC electrical power subsystems each consisting of two DC batteries, two battery chargers, one swing battery charger, and all the associated control equipment and interconnecting cabling	Yes	Ensure availability of required DC power to shut down the reactor and maintain it in a safe condition after an Anticipated Operational Occurrence (AOO) or a postulated DBA	One of two DC electrical power subsystems available	Same	
3.8.7.A	One required inverter inoperable.	Two normal inverters and one swing inverter per train	Yes	Ensure the availability of AC electrical power for the systems instrumentation required to shut down the reactor and maintain it in a safe condition after an anticipated operational occurrence (AOO) or a postulated DBA.	At least one of two Inverter trains available. One train of inverters consists of either two normal or one normal and one swing inverter.	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.8.9.A	One AC electrical power distribution subsystem inoperable.	Two AC electrical power distribution subsystems with associated buses and load centers energized to their proper voltages	Yes	Ensure availability of required AC power to shut down the reactor and maintain it in a safe condition after an Anticipated Operational Occurrence or a postulated DBA	One of two AC electrical power distribution subsystems	Same	

Table E1-1: In Scope TS/LCO Conditions to Corresponding PRA Functions

TS LCO Action	Tech Spec Description	SSCs Addressed by TS LCO Condition	Modeled in PRA	Function Addressed by TS LCO Condition	Design Success Criteria	PRA Success Criteria	Comments
3.8.9.B	One AC vital bus subsystem inoperable.	Two AC vital bus subsystems with associated buses energized to their proper voltage, each from its associated normal source inverter or swing inverter, via inverted DC voltage or the alternate AC source (i.e., bypass constant voltage transformer).	Yes	Ensure availability of required AC vital bus electrical power to shut down the reactor and maintain it in a safe condition after an Anticipated Operational Occurrence or a postulated DBA	One of two AC vital bus distribution subsystems	Same	
3.8.9.C	One DC electrical power distribution subsystem inoperable.	Two DC electrical power distribution subsystems with associated buses energized to their proper voltage from either the associated battery or charger.	Yes	Ensure availability of required DC power to shut down the reactor and maintain it in a safe condition after an Anticipated Operational Occurrence or a postulated DBA	One of two DC electrical power distribution subsystems	Same	

Notes:

1. The reactor protection system is segmented into four distinct but interconnected modules: field transmitters and process sensors, Signal Process Control and Protection System, Solid State Protection System (SSPS), and reactor trip switchgears. Field transmitters provide measurements of the unit parameters to the Signal Process Control and Protection System via separate, redundant channels. The Signal Process Control and Protection System forwards outputs to the SSPS, which consists of two redundant trains, to initiate a reactor trip or actuate Engineering Safety Functions.
2. Depending on the measured parameter, three or four instrumentation channels are provided to ensure protective action when required and to prevent inadvertent isolation resulting from instrumentation malfunctions. The output trip signal of each instrumentation channel initiates a trip logic. Failure of any one trip logic does not result in an inadvertent trip. Generally, if a parameter is used only for input to the protection circuits, three channels with a two-out-of-three logic are sufficient to provide the required reliability and redundancy. If a parameter is used for input to the SSPS and a control function, four channels with a two-out-of-four logic are sufficient.
3. Each instrumentation channel provides input to both trains of the SSPS, which initiates a reactor trip on one-out-of-two logic. Each train of SSPS provides input to the Reactor Trip Breakers (RTBs) by de-energizing the RTB undervoltage coils, which trips open the RTBs, tripping the reactor. One-out-of-two open RTBs will trip the reactor.
4. Each RTB is equipped with a shunt trip device that is energized to trip the RTB open and an undervoltage coil device that is de-energized to trip the RTB open upon receipt of a manual reactor trip signal. Either device can trip the RTB open, thus providing a redundant and diverse trip mechanism. Two Manual Reactor Trip channels provide the signal from reactor trip switches located in the Main Control Room to the RTBs.
5. A trip breaker train consists of all trip breakers associated with a single Reactor Trip System logic train that are racked in, closed, and capable of supplying power to the Rod Control System.
6. PRA Success Criteria for feed and bleed cooling can be summarized as follows:

   Two feed and bleed (F&B) decay heat removal success criteria are utilized in the Callaway PRA:

   - If any one (1) of the four (4) higher-head ECCS pumps (in the injection phase) provides flow for successful F&B decay heat removal, then both pressurizer power-operated relief valves (PORVs) must open. Because a medium head (approximately 1500 psia shutoff head) safety injection pump (SIP) is credited as a potential “feed” source, both PORVs must open for the “bleed” path to provide faster depressurization to reach the shutoff head of the pumps.
   - If one (1) of the two centrifugal charging pumps (CCPs) is required (in the injection phase) for successful F&B decay heat removal, then only one (1) pressurizer PORV must open. Because only high head (approximately 2500 psia shutoff head) CCPs are credited as potential “feed” sources, only one PORV must open for the “bleed” path.

   Each PZR PORV requires power from its respective DC division to perform its safety function for feed and bleed.

7. PRA Success Criteria for the number of required cells in an Ultimate Heat Sink (UHS) cooling tower train utilized in the Callaway PRA is as follows:

   One cooling tower cell per train.

   Thermal analysis has been performed to show that success of a single cooling tower cell per train provides sufficient heat dissipation from the ESW system to ensure the UHS pond temperature limit is not exceeded for the PRA mission time of 24 hours.

Table E1-2: RICT Estimates[1,2,3]

Tech Spec	LCO Condition	RICT Estimate (Days) (1,2)
3.3.1.B	One Manual Reactor Trip channel inoperable	30.0
3.3.1.D	One Power Range Neutron Flux-High channel inoperable	30.0
3.3.1.E	One channel inoperable	30.0
3.3.1.K	One channel inoperable	30.0
3.3.1.M	One Low Fluid Oil Pressure Turbine Trip channel inoperable	30.0
3.3.1.P	One train inoperable	30.0
3.3.1.Q	One RTB train inoperable	30.0
3.3.1.U	One trip mechanism inoperable for one RTB	30.0
3.3.2.B	One channel or train inoperable	30.0
3.3.2.C	One train inoperable	30.0
3.3.2.D	One channel inoperable	30.0
3.3.2.F	One channel or train inoperable.	30.0
3.3.2.G	One train inoperable	30.0
3.3.2.I	One channel inoperable	30.0
3.3.2.J	One channel inoperable	30.0
3.3.2.K	One channel inoperable	30.0
3.3.2.Q	One train inoperable	30.0
3.3.2.R	One or both train(s) inoperable	30.0
3.3.2.S	One train inoperable	30.0
3.3.5.A	One or more Functions with one channel per bus inoperable	30.0
3.4.11.B	One PORV inoperable for reasons other than excessive seat leakage	30.0
3.4.11.C	One block valve inoperable	30.0
3.5.2.A	One or more trains inoperable AND At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available.	30.0
3.6.2.C	One or more containment air locks inoperable for reasons other than Condition A or B.	4.9
3.6.3.A	One or more penetration flow paths with one containment isolation valve inoperable except for containment purge valve leakage not within limit.	30.0
3.6.3.C	One or more penetration flow paths with one containment isolation valve inoperable.	30.0
3.7.2.A	One MSIV actuator train inoperable	30.0
3.7.2.B	Two MSIV actuator trains inoperable for different MSIVs when the inoperable actuator trains are not in the same separation group.	30.0
3.7.2.F	One MSIV inoperable in MODE 1.	30.0
3.7.4.A	One required ASD line inoperable for reasons other than excessive ASD seat leakage	30.0
3.7.4.B	Two required ASD lines inoperable for reasons other than excessive ASD seat leakage.	30.0
3.7.5.A	One steam supply to turbine driven AFW pump inoperable.	30.0
3.7.5.B	One ESW supply to turbine driven AFW pump inoperable.	30.0
3.7.5.C	One AFW train inoperable for reasons other than Condition A or B.	30.0
3.7.7.A	One CCW train inoperable	30.0

Table E1-2: RICT Estimates[1,2,3]

Tech Spec	LCO Condition	RICT Estimate (Days) (1,2)
3.7.8.A	One ESW train inoperable	16.1
3.7.9.A	One cooling tower train inoperable	30.0
3.8.1.A	One offsite circuit inoperable	30.0
3.8.1.B	One DG inoperable	30.0
3.8.1.C(2)	Two offsite circuits inoperable	1.1
3.8.1.D	One offsite circuit inoperable AND One DG inoperable	21.8
3.8.1.F	One required LSELS inoperable	30.0
3.8.4.A	One DC electrical power subsystem inoperable	6.0
3.8.7.A	One required inverter inoperable	5.7
3.8.9.A	One AC electrical power distribution subsystem inoperable	4.4
3.8.9.B	One AC vital bus subsystem inoperable	5.5
3.8.9.C	One DC electrical power distribution subsystem inoperable	6.0

Notes to Table E1-2:

1. RICTs presented in Table E1-2 were calculated using the current federated PRA models. Following 4b implementation, the actual RICT values, applying the CRMP tool, will be calculated using the actual plant configuration and the current revision of the PRA model representing the as built, as-operated condition of the plant, as required by NEI 06-09-A, Revision 0-A and the NRC safety evaluation, and may differ from the RICTs presented in this table.
2. RICTs are based on the internal events, internal flood, and internal fire, seismic, and high winds PRA model calculations. RICTs calculated to be greater than 30 days are capped at 30 days based on NEI 06-09-A, Revision 0-A. RICTs not capped at 30 days are rounded to nearest tenth of a day.
3. Per NEI 06-09-A, Revision 0-A, for plant configuration cases where the total CDF or LERF is greater than 1E-03/yr or 1E-04/yr, respectively, the RICT Program will not be entered.

2.0 ADDITIONAL JUSTIFICATION FOR SPECIFIC ACTIONS

This section contains the additional technical justification for the list of Required Actions from Table 1, “Conditions Requiring Additional Technical Justification,” of TSTF-505, Revision 2.

Table 1, Conditions Requiring Additional Technical Justification, of TSTF-505 Revision 2 (ADAMS Accession No. ML18183A493) contains a list of required actions that may be proposed for inclusion in the RICT Program, but require additional technical justification to be provided by the licensee.

The following eight conditions are proposed to be included in the scope of the RICT program, but are identified in Table 1 as requiring additional justification:

Condition 3.3.1.D, One Power Range Neutron Flux – High channel inoperable

Condition 3.3.1.Q, One RTB train inoperable

Condition 3.5.2.A, One or more trains inoperable AND At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available

Condition 3.6.2.C, “One or more containment air locks inoperable for reasons other than Condition A or B”

Condition 3.6.6.A, One containment spray train inoperable

Condition 3.6.6.C, One containment cooling train inoperable

Condition 3.7.2.F, One MSIV inoperable in MODE 1

Condition 3.7.4.B, Two required ASD lines inoperable for reasons other than excessive ASD seat leakage.

As some of the TSs vary between the TSTF-505 and the site TS, the table in Attachment 5 provides a cross-reference between Table 1 of TSTF-505, Revision 2, and the Callaway Plant, Unit No. 1, LCOs in the scope of the proposed RICT Program.

2.1 TS 3.3.1 – Reactor Trip System (RTS) Instrumentation

LCO: **The RTS instrumentation for each Function in Table 3.3.1-1 shall be OPERABLE.**

Condition D: **One Power Range Neutron Flux - High channel inoperable**

As indicated in Table E1-1, the Power Range Neutron Flux – High channels are not explicitly modeled in the Callaway PRA. The PRA models these channels as only one of many inputs into the reactor trip signal. Therefore, the failure of 1 of 2 reactor trip breakers provides a bounding surrogate for any equipment failure that would place the site in 3.3.1 D. As described in Section 7.2.2.3.1, "Neutron Flux," of the Callaway FSAR, Revision OL-25:

> Four power range neutron flux channels are provided for overpower protection. An isolated auctioneered high signal is derived by auctioneering the four channels for automatic rod control (automatic rod insertion only - automatic rod withdrawal no longer available). If any channel fails in such a way as to produce a low output, that channel is incapable of proper overpower protection but will not cause control rod movement as automatic rod withdrawal is no longer available. Two-out-of-four overpower trip logic will ensure an overpower trip if needed, even with an independent failure in another channel.

In addition, channel deviation signals in the nuclear instrumentation system (NIS), will give an alarm if any neutron flux channel deviates significantly from the average of the flux signals. Finally, an overpower signal from any one neutron flux intermediate or power range channel will block any rod withdrawal. The setpoints for these rod stops are below the reactor trip setpoints. These alarms and actions signify periodic monitoring of spatial power distribution and imposition of compensatory limits and reduced power.

Therefore, TS 3.3.1 Condition D meets the requirements for inclusion in the RICT Program.

2.2 TS 3.3.1 – Reactor Trip System (RTS) Instrumentation

LCO: **The RTS instrumentation for each Function in Table 3.3.1-1 shall be OPERABLE.**

Revised Condition Q: **One RTB train inoperable.**

As indicated in Table E1-1 of Enclosure 1, the RTB trains are explicitly modeled in the Callaway PRA. The PRA Success Criterion is the same as the Design success criteria which is one of two RTBs open. The completion time and bypass time delineated in TSTF-411 are not changed by this submittal, only modified by the allowed use of a RICT. The commitments made with respect to actions when an RTB train is inoperable are still applicable when the RICT program is not being utilized as permitted by this submittal.

During normal operation the output from the SSPS is a voltage signal that energizes the undervoltage coils in the RTBs and bypass breakers, if in use. When the required logic matrix combination is completed, the SSPS output voltage signal is removed, the undervoltage coils are de-energized, the breaker trip lever is actuated by the de-energized undervoltage coil, and the RTBs and bypass breakers are tripped open. This allows the shutdown rods and control rods to fall into the core. In addition to the de-energization of the undervoltage coils, each reactor trip breaker is also equipped with an automatic shunt trip device that is energized to trip the breaker open upon receipt of a reactor trip signal from the SSPS. Either the undervoltage coil or the shunt trip mechanism is sufficient by itself, thus providing a diverse trip mechanism.

As documented in the Callaway FSAR Section 7.7.1.11.1, the ATWS Mitigation System Actuation Circuit (AMSAC) is designed to provide protections in the event of a failure within the RTS system to provide a reactor trip. The AMSAC signal will initiate an AFAS (MD and TD), a turbine trip as well as close the steam generator blowdown isolation valves and close the steam generator sample isolation valves.

Therefore, TS 3.3.1 Condition Q meets the requirements for inclusion in the RICT Program.

2.3 TS 3.5.2 – ECCS – Operating

LCO: **Two ECCS trains shall be OPERABLE.**

Condition A: **One or more trains inoperable AND at least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available**

As indicated in Table E1-1, the ECCS trains are explicitly modeled in the Callaway PRA. The PRA success Criterion is the same as the Design Success Criteria which is, 3 ECCS subsystems between two trains such that at least 100% ECCS flow equivalent to a single operable ECCS train is available.

Due to the redundancy of trains and the diversity of subsystems, the inoperability of one component in a train does not render the ECCS incapable of performing its function. Neither does the inoperability of two different components, each in a different train, necessarily result in a loss of function for the ECCS.

Additionally, Callaway TS 3.5.2 Condition A requires**,** "One or more trains inoperable AND At least 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available." With less than 100% of the ECCS flow equivalent to a single OPERABLE ECCS train available, LCO 3.0.3 would be entered. Therefore, Condition A 100% of the ECCS flow stipulation prevents an ECCS loss of function from occurring due to two ECCS trains being inoperable in Condition A.

TSTF-505, Rev. 2, Table 1 states: "Licensee must justify that one *or more* ECCS trains inoperable is not a condition in which all required trains or subsystems of a TS required system are inoperable. Acceptable justification is TS Condition requiring 100% flow equivalent to a single ECCS train."

Therefore, TS 3.5.2 Condition A meets the requirements for inclusion in the RICT Program.

2.4 TS 3.6.2 – Containment Air Locks

LCO: **Two containment air locks shall be OPERABLE.**

Condition C: **One or more containment air locks inoperable for reasons other than Condition A or B.**

As indicated in Table E1-1 of Enclosure 1, the containment air locks are not explicitly modeled in the Callaway PRA. Since the containment airlocks are not modeled, there are no explicit PRA Success Criteria. The Design Success Criterion is: One of two containment air lock doors closed.

Since the containment airlocks are not modeled, their unavailability will be conservatively analyzed as an early containment failure as a conservative surrogate in the RICT calculation.

Each containment air lock forms part of the containment pressure boundary. As part of the containment pressure boundary, the air lock safety function is related to control of the containment leakage rate resulting from a DBA. Thus, each air lock's structural integrity and leak tightness are essential to the successful mitigation of such an event.

Compliance with the remaining portions of LCO Condition 3.6.2 ensures that there is a physical barrier (i.e., closed door) and an acceptable overall leakage from containment. Thus, the function is still maintained. Required Action C.1 of LCO Condition 3.6.2 requires the condition to be assessed in accordance with TS 3.6.1, “Containment Integrity” (i.e., “Initiate action to evaluate overall containment leakage rate per LCO 3.6.1” with a Completion Time of Immediately). If containment leakage exceeds LCO 3.6.1 limits and cannot be restored to OPERABLE within 1 hour, the plant is taken to Mode 3 within 6 hours.

Therefore, TS 3.6.2 Condition C meets the requirements for inclusion in the RICT Program.

2.5 TS 3.6.6 – Containment Spray and Cooling Systems

LCO: **Two containment spray trains and two containment cooling trains shall be OPERABLE.**

Condition A: **One containment spray train inoperable**

Condition C: **One containment cooling train inoperable**

The Containment Spray and Containment Cooling systems provide containment atmosphere cooling to limit post-accident pressure and temperature in containment to less than the design values. Each train of Containment Spray consists of one pump, spray headers, nozzles, valves and associated piping. Each train of Containment Cooling consists of two fan coil units and associated ducting. Application of the RICT program to the referenced 3.6.6 A and C Conditions would require that one train remain operable and thus does not represent a loss of function during any proposed RICT application.

Containment sprays and Containment Cooling are not modeled for success in the Level 1 PRA or in the LERF PRA. Hydraulic analysis has been performed using MAAP to show that success or failure of Containment Spray and Containment Cooling does not impact which sequences contribute to LERF. While Containment Spray operation could impact the timing of swapping over to containment recirculation, the increased rate of RWST depletion is conservatively considered within the PRA model where appropriate.

The Callaway LERF model was developed using the guidance within WCAP-16341-P which is consistent with NUREG/CR-6595 Rev. 1. As stated within these and other documents (NUREG-1524, NUREG-1150, NUREG/CR-6338), Containment Cooling is not important for large, dry PWRs such as Callaway. These generic analyses were confirmed with Callaway-specific MAAP analysis. This plant specific work indicated that Containment Spray was only effective in fission product mitigation in a small subset of the core damage frequency progressing to LERF, and the majority of core damage frequency is associated with late containment failure. Current MAAP analyses without credit for Containment Spray and Cooling shows that containment does not fail early and thus LERF would not change due to any operation of either system.

As Containment Spray and Cooling trains are not modeled in the PRA, RICT application to these LCO's is dependent on the delta-risk indicated by the plant state at the time of LCO entry. Mapping will be added to the CRM model which will allow operators to enter these LCO's and take the applicable equipment OOS, but where there is no direct delta-risk, the 30 day back stop would apply. If other equipment were OOS at the time, that delta-risk would be evaluated and a commensurate RICT would be applied. The hydraulic analyses discussed within this section would remain applicable to any RICT entry. The risk at the time of implementation of RICT would represent the likelihood of a core damage state to occur.

Therefore, TS 3.6.6 Conditions A and C meet the requirements for inclusion in the RICT Program.

2.6 TS 3.7.2 – Main Steam Isolation Valves (MSIVs), Main Steam Isolation Valve Bypass Valves (MSIVBVs), and Main Steam Low Point Drain Isolation Valves (MSLPDIVs)

LCO: **The MSIV and its associated actuator trains, the MSIVBV, and the MSLPDIV in each of the four main steam lines shall be OPERABLE.**

Condition F: **One MSIV inoperable in MODE 1**

As indicated in Table E1-1 of Enclosure 1, the MSIVs are explicitly modeled in the Callaway PRA. The Design Success Criteria is Closure of 3 of 4 MSIVs which matches the PRA success criteria.

The MSIVs isolate steam flow from the secondary side of the steam generators following a High Energy Line Break (HELB). MSIV closure terminates flow from the unaffected (intact) steam generators.

The design basis of the MSIVs is established by the containment analysis for the large steam line break (SLB) inside containment, discussed in FSAR Section 6.2.1.4 (Ref. 5). It is also affected by the accident analysis of the SLB events presented in the FSAR, Section 15.1.5. The design precludes the blowdown of more than one steam generator, assuming a single active component failure (e.g., the failure of one MSIV to close on demand). The postulated accidents (including the main steam line break, the feed water line break, and the steam generator tube rupture) assume the MSIVs function to isolate the secondary system to ensure the primary success path for steamline and feedline isolation and for delivery of required auxiliary feedwater flow.

As described in FSAR Section 10.3.1, Revision OL-25, there is one MSIV on each of the four loops to the SGs. FSAR Section 15.1.5.2 provides information regarding an alternate method of preventing blowdown of more than one steam generator:

> Steam release from more than one steam generator will be prevented by automatic trip of the isolation valves in the steamlines by low steamline pressure signals, high-high containment pressure signals, or by high negative steamline pressure rate signals.
>
> Even with the failure of one valve, release is limited by main steam isolation valve closure for the other steam generators while the one generator blows down.

From FSAR 15.1.5.1 regarding MSIV's:

> Isolation valves are provided in each steamline. For breaks down-stream of the isolation valves, closure of all valves would completely terminate the blowdown. For any break, in any location, no more than one steam generator would experience an uncontrolled blowdown, even if one of the isolation valves fails to close. A description of steamline isolation is included in FSAR Section 10.3. In the analysis, these valves are assumed to fully close within 17 seconds upon receipt of a steamline isolation signal following a large break in a steamline. The 17 seconds includes a 2 second signal processing delay assumption. Additionally, an engineering evaluation was completed to support an increase in the main steam isolation valve stroke delay up to 60 seconds for steam generator pressures below that which corresponds to the P-11 permissive set point. This evaluation demonstrated that the acceptance criteria continue to be met for this scenario. More information on this engineering evaluation can be found in Reference 6.

Therefore, TS 3.7.2 Condition F meets the requirements for inclusion in the RICT Program.

2.7 TS 3.7.4 – Atmospheric Steam Dump Valves (ASDs)

LCO: **Four ASD lines shall be OPERABLE.**

Condition B: **Two required ASD lines inoperable for reasons other than excessive ASD seat leakage**

As indicated in Table E1-1 of Enclosure 1, the ASD lines are explicitly modeled in the Callaway PRA. The PRA success Criterion is the same as the Design Success Criteria which is two of four ASDs open.

Based on the design configuration, the TS markup for Condition 3.7.4.A.1 and B.1 are revised to include a note described in Table 1 (i.e., not applicable when more than two required SG PORV lines are inoperable.). The TS Bases are revised to describe the note and other editorial changes.

Revised TS and Bases pages are provided in Attachments 2, 3 and 4.

Therefore, TS 3.7.4 Condition B meets the requirements for inclusion in the RICT Program.

3.0 EVALUATION OF INSTRUMENTATION AND CONTROL SYSTEMS

The following Instrumentation Technical Specifications Sections are included in the TSTF-505 application for the Callaway Plant, Unit No. 1.

The Callaway Plant, Unit No. 1, Technical Specifications 3.3, “INSTRUMENTATION”, LCOs were developed to assure that the Callaway Plant, Unit No. 1, facility maintains necessary redundancy and diversity. The reactor protection systems are designed in accordance with IEEE 279-1968. Furthermore, it is shown that the intent of the applicable criteria and codes at the time of construction, such as the GDCs referenced in Sections 1.2 and 1.5 of the Callaway Plant, Unit No. 1, Final Safety Analysis Report and IEEE 279-1971 (Ref. 7). The Engineered Safety Features Actuation System meets the single failure criterion as defined in Institute of Electrical and Electronics Engineers (IEEE) Standard 279-1971.

TSTF-505 (Reference 4) sets forth the following as guidance for what is to be included in this enclosure:

> The description of proposed changes to the protective instrumentation and control features in TS Section 3.3, “Instrumentation,” should confirm that at least one redundant or diverse means (other automatic features or manual action) to accomplish the safety functions (for example, reactor trip, SI, containment isolation, etc.) remains available during use of the RICT, consistent with the defense-in-depth philosophy as specified in RG 1.174. (Note that for each application, the staff may selectively audit the licensing basis of the most risk-significant functions with proposed RICTs to verify that such diverse means exist.)

The following sections provide the justification that defense-in-depth is maintained for the applicable functions throughout the application of the RICT Program.

3.1 Reactor Trip System (RTS)

Reference: TS 3.3.1, Reactor Trip System (RTS) Instrumentation

The RTS design creates defense-in-depth due to the redundancy of the channels for each function.

- Each function has multiple channels.
- Each function will cause a reactor trip with 1/2, 2/3, or 2/4 channels tripped.
- A bypassed channel does not trip. It reduces the number of total available channels by 1, e.g., from 2/4 to 2/3.
- When applicable, if 1 channel in the function is out of service, then the 1 channel can be placed in trip, reducing the number of channels required to actuate the function; e.g., from 2/4 to 1/3.

The RTS also employs diversity in the number and variety of different inputs which will initiate a reactor trip. A given reactor trip will typically be accompanied by several diverse reactor trip inputs from the RTS.

Diverse inputs trip the reactor (FSAR Table 7.2-1).

- Power range high neutron flux (low setting) – 2/4
- Power range high neutron flux (high setting) – 2/4
- Intermediate range high neutron flux – 1/2
- Source range high high neutron flux – 1/2
- Power range high positive neutron flux rate – 2/4
- Overtemperature ΔT – 2/4
- Overpower ΔT – 2/4
- Pressurizer low pressure – 2/4 when above 10% reactor power
- Pressurizer high pressure – 2/4
- Pressurizer high water level – 2/3 when above 10% reactor power
- Low reactor coolant flow – 2/3 in any loop when reactor power > 48%; 2/3 in any two loops when reactor power > 10%
- Reactor coolant pump undervoltage – 1/2 in both busses when above 10% reactor power
- Reactor coolant pump underfrequency – 1/2 in both busses when above 10% reactor power
- Low-low steam generator water level – 2/4 in any loop
- Safety injection signal – coincident with actuation of safety injection
- Turbine trip (anticipatory)
  -Low trip fluid pressure – 2/3
  -Turbine stop – 4/4
- Manual – 1/2

See FSAR Table 7.2-4 for accident assumptions.

3.2 Engineered Safety Features Actuation System (ESFAS)

Reference: TS 3.3.2, Engineered Safety Feature Actuation System (ESFAS) Instrumentation

The ESFAS design creates defense-in-depth due to the redundancy of the channels for each function.

- Each function has multiple channels.

- Each function will cause a reactor trip with 1/2, 2/3, or 2/4 tripped signals.

- A bypassed channel does not trip. It reduces the number of total available channels by 1; e.g., from 2/4 to 2/3.

- When applicable, if 1 channel in the function is out of service, then the 1 channel can be placed in trip, reducing the number of channels required to actuate the function; e.g., from 2/4 to 1/3.

Inputs create diverse equipment response (FSAR Table 7.3-1 and 7.3-2, FSAR Section 7.3.1, and TS Bases 3.3.2).

- Safety Injection
  - Manual – 1/2
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Containment Pressure - High 1 – 2/3
  - Pressurizer Pressure - Low – 2/4
  - Steamline Pressure Low – 2/3 in one steam line
- Containment Spray
  - Manual – 1/2 switches at 2/2 locations
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Containment Pressure High 3 – 2/4
- Containment Isolation (Phase A)
  - Manual – 1/2
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Any SI Signal
- Containment Isolation (Phase B)
  - Manual – 1/2 switches at 2/2 locations
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Containment Pressure High 3 – 2/4
- Steamline Isolation
  - Manual – 1/2
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Automatic Actuation Logic and Actuation Relays (MSFIS) – 1/2 trains
  - Containment Pressure High 2 – 2/3
  - Steam Line Pressure Low – 2/3 in one steam line (Can be blocked with Pressurizer Pressure below 1970 psig)
  - Steam Pressure Negative Rate High – 2/3 in one steamline (Interlocked when Steam Line Pressure Low is blocked below 1970 psig)
- Turbine Trip and Feedwater Isolation
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Automatic Actuation Logic and Actuation Relays (MSFIS) – 1/2 trains
  - Steam Generator Water Level - High High (P-14) - 2/4 in one Steam Generator
  - Any SI Signal
  - SG Water Level Low Low (Adverse Containment Environment) - 2/4 per SG
  - SG Water Level Low Low (Normal Containment Environment) - 2/4 per SG
  - SG Water Level Low-Low Containment Pressure Environmental Allowance Modifier - 2/4 EAM Channels

- Auxiliary Feedwater
  - Manual – 1/pump
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Automatic Actuation Logic and Actuation Relays (BOP ESFAS) – 1/2 trains
  - SG Water Level Low Low (Adverse Containment Environment) - 2/4 per SG
  - SG Water Level Low Low (Normal Containment Environment) - 2/4 per SG
  - SG Water Level Low-Low Containment Pressure Environmental Allowance Modifier - 2/4 EAM Channels
  - Any SI Signal
  - Loss of Offsite Power – Starts Turbine Driven Aux Feed Pump - 1/2 trains
  - Trip of all main feed pumps – Starts Motor Driven Aux Feed Pump - Two of four, one in the same separation group from each feed pump
  - Auxiliary Feedwater Pump Suction Transfer on Suction Pressure – Low – 2/3
- Automatic Switchover to Containment Sump
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Refueling Water Storage Tank (RWST) Level Low Low Coincident with Safety Injection Signal present – 2/4
- ESFAS Interlocks
  - Reactor Trip, P-4 – 1 per train/2 trains
  - Pressurizer Pressure, P-11 - 2/3
- Automatic Pressurizer PORV Actuation
  - Automatic Actuation Logic and Actuation Relays (SSPS) – 1/2 trains
  - Pressurizer Pressure - High– 2/4
- Steam Generator Blowdown and Sample Line Isolation
  - Manual – 1 per MDAFW pump
  - Automatic Actuation Logic and Actuation Relays (BOP ESFAS) – 1/2 trains
  - Any SI Signal
  - Loss of Offsite Power – SGBSIS (isolation signal) - 1/2 trains

3.3 Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

Reference: TS 3.3.5, Loss of Power (LOP) Diesel Generator (DG) Start Instrumentation

Each diesel generator has a starting control system, initiated either manually or automatically, which, when energized from the 125-VDC distribution bus of each diesel generator's own ESF division, provides an independent emergency source of power in the event of a complete loss of offsite power with sufficient capacity to supply all of the electrical loads that are required for reactor safe shutdown either with or without a loss-of-coolant accident (LOCA) (FSAR 8.3.1.1.2.2).

The LOP DG Start Instrumentation design creates defense-in-depth due to the redundancy of the channels for each function.

- Controls and circuitry for starting and loading each redundant diesel generator set are electrically and physically independent.
- A diesel generator is started by any one of the following (FSAR 8.3.1.1.3):
  - Receipt of a safety injection signal (SIS)
  - Loss of voltage to the respective 4.16-kV Class 1E bus to which each generator is connected
  - Manual - Remote switch actuation (main control room)
  - Manual - Local switch actuation (diesel generator room)
  - Emergency Manual - Local switch actuation (diesel generator room)

Diverse inputs start the diesel generators.

- Manual
- Any SI Signal
- Loss of Power (LOP) signal on 4.16-kV Class 1E bus served by the diesel generator (1/2 bus). LOP signal is generated by:
  - Degraded voltage relays if voltage is below 90% after a longer time delay (2/4 channels)
  - Undervoltage relays if voltage is below 70% for a short time delay (2/4 channels)

4.0 REFERENCES

1. NRC Letter from Jennifer M. Golder to Biff Bradley (NEI), "Final Safety Evaluation for Nuclear Energy Institute (NEI) Topical Report (TR) NEI 06-09, 'Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines,'" May 17, 2007 (ADAMS Accession No. ML071200238).

2. Nuclear Energy Institute (NEI) Topical Report (TR) NEI 06-09-A, "Risk-Informed Technical Specifications Initiative 4b, Risk-Managed Technical Specifications (RMTS) Guidelines," Revision 0, October 12, 2012 (ADAMS Accession No. ML12286A322).

3. NUREG/CR-5500, Volume 2, "Reliability Study: Westinghouse Reactor Protection System, 1984–1995," December 1998.

4. TSTF-505-A, Rev. 2, "Technical Specifications Task Force Improved Standard Technical Specifications Change Traveler," November 2018.

5. Final Safety Analysis Report (FSAR) – Callaway Nuclear Power Plant, Unit 1, Revision OL-25.

6. SCP-07-19, "Main Steam Isolation Valve (MSIV) Stroke Time Evaluation Phase 2 Report Revision 0," February 16, 2007.

7. Institute of Electrical and Electronics Engineers (IEEE) Standard 279-1971, "Criteria for Protection Systems for Nuclear Power Generating Stations", June 3, 1971.