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10 CFR 50.90

1CAN092301

September 21, 2023

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Supplemental Information - Adopt Risk-Informed Completion Times TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4"

Arkansas Nuclear One – Unit 1
NRC Docket No. 50-313
Renewed Facility Operating License No. DPR-51

By letter dated December 22, 2022 (Reference 1), Entergy Operations, Inc. (Entergy) requested to change the Arkansas Nuclear One, Unit 1 (ANO-1) Technical Specification (TS). The proposed amendment would modify TS requirements to permit the use of Risk Informed Completion Times (RICT) in accordance with TSTF-505, Revision 2, "Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4b" (ML18253A085), dated November 21, 2018.

By letter dated May 10, 2023 (Reference 2), the NRC notified Entergy of their intent to conduct a regulatory virtual audit from July 11 through July 13, 2023, with Entergy staff in support of the License Amendment Request (LAR) in Reference 1. The letter contains a virtual audit plan with an initial audit items list of information to be placed on an online portal.

By letter dated June 14, 2023 (Reference 3), the NRC provided an initial list of audit questions to be answered and discussed during the virtual audit. The responses to these questions were uploaded to the audit portal prior to the formal audit, which occurred on July 11 and 12. At the conclusion of the audit on July 12, the NRC requested that Entergy respond in the form of a supplement to selected audit questions, either for clarification, to add or remove detail, or to formally document Entergy's responses to the questions. A clarification call was held on August 30, 2023 to discuss the responses to questions APLC-01 Part b, EICB Supplemental Request 1.a, and APLA Question 01.

This letter is a supplement to the Reference 1 LAR. Attachment 1 to this letter provides a response to the audit questions posed by the NRC staff during the regulatory virtual audit.

Attachments 2 and 3 to this letter provide the TS markups and retyped TS, respectively, to address the requested supplemental information and should be used to replace the related pages in Reference 1, Attachments 2 and 3. Attachment 4 consists of an abbreviated Table E1-1, "In Scope TS/LCO Conditions to Corresponding PRA Functions," which incorporates key aspects of the responses to APLA 06 a) through f). The information provided in Attachments 2, 3, and 4 to this letter supersedes the information provided in Attachments 2 and 3 of Reference 1 for TS pages and Enclosure 1, Table E1-1 of Reference 1. All other information in Attachments 2 and 3 of Reference 1 and the unaffected portion of Enclosure 1, Table E1-1 of Reference 1 remain unchanged.

Entergy has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the NRC in Reference 1. The supplemental information provided in this letter does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. Furthermore, the supplemental information provided in this letter does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

This letter contains no new regulatory commitments.

In accordance with 10 CFR 50.91, "Notice for Public Comment; State Consultation," Entergy is notifying the State of Arkansas a copy of this letter and attachments to the designated State Official.

If there are any questions or if additional information is needed, please contact Riley Keele, Manager, Regulatory Assurance, Arkansas Nuclear One, at 479-858-7826.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 21st day of September 2023.

Sincerely,

Phil Couture

PC/mar

Attachments:

1. Responses to NRC Audit Questions
2. Technical Specification Page Markups
3. Retyped Technical Specification Pages
4. Modified Entries to Table E1-1, "In Scope TS/LCO Conditions to Corresponding PRA Functions"

References:

1) Letter from Entergy to NRC, "License Amendment Request to Revise Technical Specifications to Adopt Risk-Informed Completion Times TSTF-505, Revision 2, 'Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4' " (ML22356A249) (1CAN122201) dated December 22, 2022

2) Letter from T. Wengert (Senior Project Manager, U.S. Nuclear Regulatory Commission) to Arkansas Nuclear One, Unit 1 (ANO-1) – Regulatory Audit Plan in Support of License Amendment Request to Revise Technical Specifications to Adopt Risk-Informed Completion Times (EPID L-2022-LLA-0197) (ML23121A301) (1CNA052301) dated May 10, 2023

3) Email from T. Wengert (Senior Project Manager, U.S. Nuclear Regulatory Commission) to Entergy, "Audit Questions – License Amendment Request to Revise Technical Specifications to Adopt TSTF-505, Revision 2" (ML23166A013) (1CNA062301) dated June 14, 2023

cc: NRC Region IV Regional Administrator

NRC Senior Resident Inspector – Arkansas Nuclear One

NRC Project Manager – Arkansas Nuclear One

Designated Arkansas State Official

**Attachment 1**

**1CAN092301**

**Responses to NRC Audit Questions**

## RESPONSES TO NRC AUDIT QUESTIONS

**NRC/NRR/PRA Licensing Branch (APLA) Question 01 – Digital Instrumentation and Control (I&C) Modeling**

Concerning the quality of the PRA model, Nuclear Energy Institute (NEI) 06-09-A, "Risk- Informed Technical Specifications Initiative 4b Risk-Managed Technical Specifications (RMTS) Guidelines," Revision 0-A (ML12286A322), states that Regulatory Guide (RG) 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" and RG 1.200, "Acceptability of Probabilistic Risk Assessment Results for Risk-Informed Activities" define the quality of the PRA in terms of its scope, level of detail, and technical adequacy. The quality must be compatible with the safety implications of the proposed TS change and the role the PRA plays in justifying the change.

Regarding digital I&C, the NRC staff notes the lack of consensus in industry guidance for modeling these systems in plant PRAs to be used to support risk-informed regulatory applications. In addition, known modeling challenges exist, such as the lack of industry data for digital I&C components, the difference between digital and analog system failure modes, and the complexities associated with modeling software failures, including common-cause software failures. Also, although reliability data from vendor tests may be available, this source of data is not a substitute for in-the-field operational data. Given these challenges, the uncertainty associated with modeling a digital I&C system could impact the [risk informed completion time] RICT program. Therefore, address the following:

a) Clarify whether digital I&C systems are credited in the PRA models that will be used in the RICT program.

b) If digital I&C systems are credited in the PRA models that will be used in the RICT program, provide justification (e.g., describe and provide the results of a sensitivity study) that demonstrates the modeling uncertainty associated with crediting digital I&C systems has an inconsequential impact on the RICT calculations.

c) Alternatively, if a justification is not provided, identify which LCOs are determined to be impacted by digital I&C systems modeling for which risk management actions (RMAs) will be applied during a RICT. Explain and justify the criteria used to determine what level of impact to the RICT calculation requires additional RMAs.

<u>*Entergy Response:*</u>

a) The ANO PRA does not include any digital I&C systems.

The Engineered Safeguards Actuation System (ESAS), however, includes a digital trip basic event which applies the type code associated with process logic components for the RPS system. For the ESAS system, the PRA models the analog inputs and the associated relays and power supplies used to initiate the ESAS signals.

The ANO-1 ESAS system is comprised of three redundant "analog" channels and four odd and even "digital" actuation channels, for a total of eight actuation channels. It is important to note that ANO-1 utilizes the Bailey Meter Company 881 System for ESAS. This is a vintage electronic system and does not contain any computerized, "digital" components.

The three "analog" channels of the system detect RCS pressure and Reactor Building pressure. The "digital" channels are only referred to as digital since they have two states: standby and actuated (digitally "off" or "on"). The digital channels also contain the coincidence logic used to actuate the digital channels and thus the ES equipment. Therefore, the concerns and failure modes of this system are typical of traditional analog systems and not considered computerized digital I&C.

b) The ANO PRA does not include any digital I&C systems.

c) ESAS LCO 3.3.7 is not within the scope of this license amendment request. See a) and b) above for why digital I&C system modeling is not a concern with respect to the systems described in this license amendment request.

**APLA Question 02 – Consideration of Shared Systems in RICT Calculations**

RG 1.200, Revision 2, states, in part: "The base PRA serves as the foundational representation of the as-built and as-operated plant necessary to support an application."

The LAR does not appear to address the existence of crossties between units. However, the NRC staff has reviewed system documents in the portal that have shared systems. The NRC staff notes that for some of these systems, it appears the sharing of a system is not consistent between units. It appears that some operational aspects, such as alternate alignments, were excluded from the PRA models. For multi-unit events (e.g., loss of offsite power and seismic events), credit for a shared system may be limited to one unit.

Clarify what systems are shared, how they are shared, and whether they can support the other unit in an accident. Explain how the shared systems are credited for each unit in the PRA models. This discussion should also address the following:

a) Explain whether shared systems are credited in the internal events, including flood and fire PRA models for both units and, if so, identify those systems.

b) If shared systems are credited in the Real Time Risk (RTR) model that supports the RICT calculations, then explain how the shared system is modelled for each unit in a dual unit event demonstrating that shared systems are not over-credited in the PRA models.

c) If a shared system is credited in the RTR model that supports the RICT calculations and the impact of events that can create a concurrent demand for the system shared by both units is not addressed in the PRA models, then justify that this exclusion has an inconsequential impact the RICT calculations.

*Entergy Response:*

a) Shared systems between units are credited in the PRA models. Specific credited systems include Common Feedwater (CFW), the Alternate AC Diesel Generator (AAC), cross-tie to the U1 4160 V vital buses A3 and A4 through 2A9 to the U2 vital 4160 V buses, Startup Transformer

No. 2 (SU2), Instrument Air (IA), backup DC power to non-vital busses A1, A2 (4160V), and H1 and H2 (6900V); and portable Flexible equipment (FLEX).

b) CFW: The CFW system is designed to provide an independent feedwater source to the ANO-1 or ANO-2 Steam Generators for the purpose of reactor coolant system (RCS) heat removal following the loss of primary (Main and Emergency Feedwater) and auxiliary feedwater (AFW). The CFW system is normally in standby and requires manual actuation, as it is isolated from the emergency feedwater (EFW) system during power operation. By design, only one CFW pump can be operated at any given time. The CFW system was added to mitigate fire related events and the demand for CFW on both units would require multiple and simultaneous fires at the same time which is not modeled per NUREG/CR-6850. The ANO-1 model does not model a dual-unit total loss of feedwater/emergency feedwater event.

AAC: The AAC diesel generator is designed as a stand-alone power source with a requirement to provide the load of one of the four safety busses (two on each unit). Any combination of Unit 1 and Unit 2 vital and non-vital buses may be energized as long as total load remains < 4400 kW, 4600 kW for 500 hours, or 5320 kW for 30 minutes. The simultaneous demand of the AAC on both units would require multiple failures of the opposite unit's emergency diesel generator (EDG) system, in addition to the RICT configuration, to result in a dual unit SBO event. The electrical system for ANO-1 is electrically self-sufficient and is independent of the Unit 2 power sources. As a result, the ANO-1 Full Power Internal Events (FPIE) model does not model the failure of the AAC in the low likelihood scenario of a dual unit SBO event.

Cross tie of the 4kV buses through 2A9: This cross tie is currently undeveloped for the ANO-1 PRA model and would not be credited in a dual unit Loss of Offsite Power (LOOP).

SU2: Startup Transformer No. 2 is shared by both Unit 1 and Unit 2. As a result, only a portion of each unit's loads can be powered from SU2 without overloading the transformer. The PRA models the appropriate load shedding when supplied by SU2.

IA: The success criteria for each top event is to provide air from one Instrument Air compressor to the IA header. Success is any one of the four primary compressors (two for Unit 1 and two for Unit 2) maintaining header pressure. The unit cross tie is normally open, and any one of the four compressors has sufficient capacity to support/maintain header pressure. Unavailability of specific air compressors can be represented in both unit PRA models through the RTR tool simultaneously, and specific flags for which air compressor(s) are in service are included in the PRA models. Further, loss of instrument air is modeled as a dual unit initiating event in both Unit PRAs.

Backup DC to Non-vital 4160 V / 6900 V buses: The backup DC to the non-vital buses is a redundant DC source designed to mitigate a fire induced event resulting in loss of control power to the non-vital buses A1, A2, H1, and H2 and ensure DC control power is available to trip the reactor coolant pumps on loss of seal cooling. The cross-unit supply is from a non-vital bus on the opposite unit. The new DC system is also modeled in the FPIE and Internal Flooding (IF) models as the as-built, as-operated plant. Dual-unit LOOP would result in a loss of the backup DC power supplies. However, the normal DC supply remains available resulting in the system only being important for Fire scenarios. The failure mode of a dual-unit trip is not modeled for this system.

FLEX: Only one train of the two redundant FLEX trains is credited in the PRA.

c) As described in part (b), multiple additional equipment failures would be required before the systems would be unavailable due to a dual unit demand. Simplification of PRA modeling of dual unit impacts are low likelihood sequences and will have minimal impacts in the RICT calculations as no one initiating event can lead to the demand of the shared system simultaneously. A summary of the modeling/redundancies is provided:

AAC: The electrical systems are independent between units and would require a dual unit SBO or transient requiring any combination of Unit 1 and Unit 2 vital and non-vital buses total load greater than 4400 kW, 4600 kW for 500 hours, or 5320 kW for 30 minutes.

CFW: Would require a total loss of all feedwater and emergency feedwater on both units.

SU2: It is designed to supply power to both units and the PRA models the allowed load configurations.

IA: The Real Time Risk (RTR) models the potential failures of the shared system and the associated impact.

Back up DC: Back up DC supply is supplied by two separate sources (one from each unit) in addition to the normal DC supply. Scenario would require multiple simultaneous fires to result in a dual unit trip and disable the normal DC supply to both unit's non-vital buses. This is beyond the scope of NUREG/CR-6850.

FLEX: Only one train of portable equipment is modeled while two exist.

**APLA Question 03 – Impact of Seasonal Variations**

The Tier 3 assessment in RG 1.177, "An Approach for Plant-specific, Risk-informed Decision- making: Technical Specifications," Revision 2 (ML20164A034), stipulates that a licensee should develop a program that ensures the risk impact of out-of-service equipment is appropriately evaluated prior to performing any maintenance activity. NEI 06-09-A and its associated NRC SE (ML071200238) state that, for the impact of seasonal changes, either conservative assumptions should be made, or the PRA should be "adjusted appropriately to reflect the current (e.g., seasonal or time of cycle) configuration."

The LAR does not appear to address modeling adjustments needed to account for seasonal and time of cycle dependencies and what kind of adjustments will be made. Therefore, address the following to clarify the treatment of seasonal and time of cycle variations:

a) Explain how the RICT calculations address changes in PRA data points, basic events, and structures, systems, and component (SSC) operability constraints as a result of extreme weather conditions, seasonal variations, other environmental factors, or time of cycle. Also, explain how these adjustments are made in the configuration risk management program

(CRMP) model and how this approach is consistent with the guidance in NEI 06-09-A and its associated NRC final SE.

b) Describe the criteria used to determine when PRA adjustments due to extreme weather conditions, seasonal variations, other environmental factors, or time of cycle variations need to be made in the CRMP model and what mechanism initiates these changes.

*Entergy Response:*

a) For extreme weather and related emergent weather-related conditions, the ANO models are built with the option to modify initiating events, which is already in place for the 10 CFR 50.65(a)(4) program. The CRMP model has settings for severe weather (severe thunderstorm warning) as well as settings for tornado watch, tornado warning, and grid instability. Fault tree logic is used to increase the value of various initiating events when one of these severe weather flags is set. Adjustments made in the CRMP model that adjust configuration risk will cascade to the RICT configuration risk for the duration of the adjustment.

For seasonal variations, the success criteria notebook and system notebooks were reviewed for the ANO-1 models, and no seasonal changes in success were identified. As noted in Enclosure 8 of the LAR, the CRMP model used for the RICT Program is required to either conservatively model seasonal variations or to include the capability to account for the variations if determined to impact the calculated RICT time. While no current seasonal changes are identified, seasonal changes will continue to be evaluated in updates to the CRMP model for the RICT Program.

For changes in success criteria based on the time in the core operating cycle (i.e., impact on anticipated transient without scram (ATWS) pressure relief), changes will be addressed in the CRMP model used for the RICT program. The ANO-1 ATWS analysis (Reference 1) develops a fraction for the time in core cycle for which moderator temperature coefficient (MTC) is not sufficiently negative. This probability is associated with core damage for ATWS scenarios. The existing analysis is conservative and generally assumes core damage for the majority of the core cycle. Given the low relative risk of ATWS scenarios to the risk profile, this assumption will be evaluated for impact to the calculated RICT times and adjusted to ensure conservative representation in the RTR for implementation as required.

b) For emergent extreme weather, the Operators are directed to evaluate severe weather through guidance in procedure COPD024 (Reference 2), consistent with 10 CFR 50.65(a)(4) risk management practices. Operations is trained on adjusting the settings within the CRMP model. In addition to the quantitative adjustment, a qualitative elevation of 10 CFR 50.65(a)(4) risk level is directed.

For seasonal variations and time in core cycle, adjustments to the CRMP model will be assessed and implemented in developing the model for RICT implementation. These adjustments and assumptions are expected to be evaluated as part of the CRMP update process following updates to the associated PRA models and modified as required.

**APLA Question 06 – In-Scope LCOs and Corresponding PRA Modeling**

The NRC's SE for NEI 06-09-A specifies that the LAR should provide a comparison of the TS functions to the PRA modeled functions to show that the PRA modeling is consistent with the licensing basis assumptions or to provide a basis for when there is a difference. Table E1-1, "In Scope TS/LCO Conditions to Corresponding PRA Functions" of LAR Enclosure 1 identifies each LCO in the TSs proposed for inclusion in the RICT program. The table also describes whether the systems and components covered by the LCO are modeled in the PRA and, if so, presents both the design success criteria and PRA success criteria. For certain LCOs, the table explains that the associated SSCs are not modeled in the PRAs but will be represented using a surrogate event that fails the function performed by the SSC. For some LCOs, the LAR did not provide an adequate description for the NRC staff to conclude that the PRA modeling will be sufficient.

a) Regarding Improved Technical Specification (ITS) LCO 3.3.1.B, LAR Table E1-1 states that, for any reactor protection system (RPS) instrumentation not modeled, the RPS channel logic that is modeled will be used as a surrogate. It is unclear to the NRC staff what surrogates will be used for each affected function and if they are bounding and conservative.

    i) Clarify which component of RPS channel logic will be used as a surrogate for each of the RPS instruments affected.

    ii) Provide justification that the surrogate conservatively bounds each of the RPS instruments.

b) Regarding ITS LCO 3.3.6.A, Table E1-1 states that, for engineered safeguards actuation system (ESAS) manual initiation, that either ESAS master relays, operator actions, or automatic actuations for the related function that is modeled will be used as a surrogate. It is unclear to the NRC staff what surrogates will be used for this affected function and if they are bounding and conservative.

    i) Clarify which of the three listed items will be used as a surrogate for the ESAS function affected.

    ii) Provide justification that the surrogate conservatively bounds the ESAS function.

c) Regarding ITS LCO 3.3.12.A and 3.3.12.B, Table E1-1 states that, for emergency feedwater initiation and control system (EFIC) manual initiation, that either EFIC/Main Steam Line Isolation master relays, operator actions, or automatic actuations for the related function that is modeled will be used as a surrogate. It is unclear to the NRC staff what surrogates will be used for each affected function and if they are bounding and conservative.

    i) Clarify which of the three listed items will be used as a surrogate for the ESAS function affected.

    ii) Provide justification that the surrogate conservatively bounds the EFIC function.

d) Regarding ITS LCO 3.6.2.C, Table E1-1 states that, for any reactor building air lock not modeled, a pre-existing containment failure event that is modeled will be used as a surrogate. It is unclear to the NRC staff what surrogates will be used for each affected function and if they are bounding and conservative.

i) Clarify which containment failure event will be used as a surrogate for each of the system isolation functions affected.

ii) Provide justification that the surrogate conservatively bounds each of the air lock functions.

e) Regarding ITS LCO 3.6.3.A and 3.6.3.C, Table E1-1 states that, for any reactor building isolation valves not modeled, a representative leak event that is modeled will be used as a surrogate. In the LAR, the licensee also states that multiple conditions regarding these LCOs will use a representative surrogate. It is unclear to the NRC staff which pathways will be used for each affected function and if they are bounding and conservative.

i) Clarify which representative leak event will be used as a surrogate for each of the system isolation functions affected.

ii) Provide justification that the surrogate conservatively bounds each of the isolation functions.

f) Regarding ITS LCO 3.6.6.A, (i.e., ANO-1 TS 3.6.5.A), Table E1-1 states that the reactor building coolers can be modeled as a surrogate for the reactor building spray system affected function. It is unclear to the NRC staff what surrogates will be used for this affected function and if they are bounding and conservative.

i) Clarify which component of reactor building coolers will be used as a surrogate for the reactor building spray function affected.

ii) Provide justification that the surrogate conservatively bounds the reactor building spray functions.

*Entergy Response:*

*Note that a modified, abbreviated Table E1-1 is included as Attachment 4 to this letter, which incorporates key aspects of the responses to APLA 06 a) through f).*

a)

a.i) All four trip circuits of the RPS system are modeled (A, B, C, D). Table 3.3.1-1 of the ANO-1 TS (provided below) lists all of the applicable instruments that feed the four RPS channels. Not every instrument circuit is modeled in the PRA. Only the RPS pressure transmitters (function 4 see Table 3.3.1-1) and RCS temperature elements (Function 2 see Table 3.3.1-1) are included in the PRA model. All remaining instruments are conservatively not modeled.

The surrogate event utilized for each non-modeled RPS instrument is the overall channel trip circuit failure event.

Table 3.3.1-1
Reactor Protection System Instrumentation

| FUNCTION | APPLICABLE MODES OR OTHER SPECIFIED CONDITIONS | CONDITIONS REFERENCED FROM REQUIRED ACTION C.1 | SURVEILLANCE REQUIREMENTS | ALLOWABLE VALUE |
|---|---|---|---|---|
| 1. Nuclear Overpower – | | | | |
| a. High Setpoint | 1,2[(a)],3[(d)] | D | SR 3.3.1.1<br>SR 3.3.1.2<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≤ 104.9% RTP |
| b. Low Setpoint | 2[(b)],3[(b)]<br>4[(b)],5[(b)] | E | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≤ 5% RTP |
| 2. RCS High Outlet Temperature | 1,2 | D | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≤ 618 °F |
| 3. RCS High Pressure | 1,2[(a)],3[(d)] | D | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≤ 2355 psig |
| 4. RCS Low Pressure | 1,2[(a)] | D | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≥ 1800 psig |
| 5. RCS Variable Low Pressure | 1,2[(a)] | D | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | As specified in the COLR |
| 6. Reactor Building High Pressure | 1,2,3[(c)] | D | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≤ 18.7 psia |
| 7. Reactor Coolant Pump to Power | 1,2[(a)] | D | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≤ 55% RTP with one pump operating in each loop. |
| 8. Nuclear Overpower RCS Flow and Measured AXIAL POWER IMBALANCE | 1,2[(a)] | D | SR 3.3.1.1<br>SR 3.3.1.3<br>SR 3.3.1.4<br>SR 3.3.1.5 | As specified in the COLR |
| 9. Main Turbine Trip (Oil Pressure) | ≥ 45% RTP | F | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≥ 40.5 psig |
| 10. Loss of Main Feedwater Pumps (Control Oil Pressure) | ≥ 10% RTP | G | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≥ 55.5 psig |
| 11. Shutdown Bypass RCS High Pressure | 2[(b)],3[(b)]<br>4[(b)],5[(b)] | E | SR 3.3.1.1<br>SR 3.3.1.4<br>SR 3.3.1.5 | ≤ 1720 psig |

(a) When not in shutdown bypass operation.
(b) During shutdown bypass operation with any CRD trip breaker in the closed position and the CRD System capable of rod withdrawal.
(c) With any CRD trip breaker in the closed position and the CRD System capable of rod withdrawal.
(d) With any CRD trip breaker in the closed position, the CRD system capable of rod withdrawal, and not in shutdown bypass operation.

a.ii) Since all four channels are explicitly modeled, and each channel monitors multiple inputs for reactor protection, use of the channel failure event is a conservative surrogate for individual instruments as this would assume all inputs to the channel are failed, instead of a single monitoring instrument. All combinations of two of four RPS instrument channels (A, B, C, and D) were failed as a surrogate for the failure of the RPS instruments in the Enclosure 1 sample calculations.

b)

b.i) The manual initiation for every ESAS function is not modeled for every PRA function. For functions where the manual initiation is modeled, no surrogate is needed. For functions where the manual initiation is not modeled the sample RICT calculations failed a train of automatic initiation using the events associated with master relays or automatic functions as surrogate modeling.

b.ii) The failure rate of the operator action to manually initiate the ESAS logic is conservative relative to the failure rates of the automatic system and its designed redundancies. As a result, failing the automatic functions is a conservative surrogate relative to the manual function.

c)

c.i) The manual initiation for every EFIC function is not modeled for every PRA function. For functions where the manual initiation is model, no surrogate is needed. For functions where the manual initiation is not modeled the sample RICT calculations failed a train of automatic initiation using the events associated with master relays or automatic functions as surrogate modeling.

c.ii) The failure rate of the operator action to manually initiate the EFIC logic is conservative relative to the failure rates of the automatic system and its designed redundancies. As a result, failing the automatic functions is a conservative surrogate relative to the manual function.

d)

d.i) Event L2TEAR (BE for likelihood of pre-existing containment flaws that cause an Isolation Fail) is used as a surrogate for all affected system isolation functions.

d.ii) This event assumes there is a pre-existing containment flaw at the time of the accident. Therefore, the RICT calculations go straight to bypass. This is bounding until a published failure rate for the intact air lock function becomes available for industry use.

e)

e.i) Penetrations with less than 2" are screened from the PRA function.

For Penetrations 2" or larger the RICT estimates can use modeled penetrations as a surrogate using a conservative risk estimate based on the failure rates of the other isolation valve in series. For multiple open penetrations, surrogate modeling can be added that sums up the failure probabilities of the remaining isolation valve types.

e.ii) SSCs for penetrations with less than 2" diameters are not modeled, but the failure of SSCs for penetrations with diameters greater than or equal to 2" would be more consequential than that of penetrations with diameters less than 2" thereby bounding the risk estimates. A conservative or actual failure rate for the isolable penetration valve can be used.

f)

f.i) The failures of one train of reactor building coolers (units VSF-1A and VSF-1C or VSF-1B and VSF-1D) can be used as a PRA surrogate for the failure of one RB spray train.

f.ii) The RB sprays are not included in the PRA success criteria. Thermal hydraulic analysis concluded that that RB Cooling System is sufficient for reducing post-accident building pressure following a loss of coolant accident (LOCA). Therefore, the PRA conservatively models only the RB Cooling System's function for maintaining RB integrity and reducing the driving force of leakage of radioactive materials from the RB in the PRA. However, the functions between the RB Cooling System and RB Spray System are not completely equivalent. The RB Cooling System does not support the design function of the RB Spray System which scrubs radioactive Iodine from the RB atmosphere and reduces the concentration of fission products in the RB leakage. The PRA accident analysis considers the concentration of radioactive material for determining which accident sequences represent a large early release and are subsequently included in the LERF model. Thermal hydraulic calculations were performed and determined that crediting the RB sprays had minimal impact on the LERF accident analysis and timing sequences associated with the concentration of radioactive material at the time of the accident and crediting the RB sprays has minimal impact on the baseline risk and LERF analysis. In summary, since all the RB spray functions can be accounted for in the PRA, the RB coolers provide a justifiable surrogate for the RB Spray System for reducing post-accident RB pressure and the not modeled RB spray scrubbing function would have no impact on the risk assessment for the RICT program had it been included in the PRA accident analysis.

**APLA Question 07 – Systems Not Credited in the Fire PRA**

RG 1.200 states in part: "NRC reviewers, [will] focus their review on key assumptions and areas identified by peer reviewers as being of concern and relevant to the application." The NRC staff evaluates the acceptability of the PRA for each new risk-informed application and as discussed in RG 1.174, recognizes that the acceptable technical adequacy of risk analyses necessary to support regulatory decision-making may vary with the relative weight given to the risk assessment element of the decision-making process. The NRC staff notes that the calculated results of the PRA are used directly to calculate a RICT, which subsequently determines how long SSCs (both individual SSCs and multiple, unrelated SSCs) controlled by technical specifications can remain inoperable. Therefore, the PRA results are given a very high weight in a TSTF-505 application and the NRC staff requests additional information on the following issues that have been previously identified as potentially key fire PRA assumptions.

In reviewing the ANO-1 Uncertainty Analysis [PSA-ANO1-06-4B-SOU] provided on the portal, the NRC staff noted that a sensitivity was performed on fire PRA assumption of failing components with unknown cable locations. The sensitivity study results demonstrated a significant impact on a few of the RICT program LCOs.

The NRC staff notes that some conservative PRA modeling could have a nonconservative impact on the RICT calculations. If an SSC is part of a system not credited in the fire PRA or it is supported by a system that is assumed to always fail, then the risk increases due to taking that SSC out of service are masked. Therefore, address the following:

a) Identify the SSCs that are assumed to be always failed in the fire PRA, or are not included in the fire PRA, due to lack of cable tracing or other reasons.

b) Justify that this assumption has an inconsequential impact on the RICT calculations.

c) If, in response to part (b) above, it cannot be determined that the cited assumption has an inconsequential impact on the estimated RICTs, then identify what programmatic changes will be considered to compensate for this uncertainty and the basis for their consideration (e.g., identification of additional RMAs).

*Entergy Response:*

a) The following table of components are failed in the Fire PRA (FPRA) due to lack of cable selection.

| Component | Component Description |
|---|---|
| 2C-27A | Instrument Air Compressor 2C-27A |
| 2C-27B | Instrument Air Compressor 2C-27B |
| 2CV-3004 | Instrument Air Crosstie to Unit 1 AOV 2CV-3004 |
| 2CV-3015 | Instrument Air Unit 1 - Unit 2 Crosstie AOV 2CV-3015 |
| 2M-70 | Instrument Air Dryer 2M-70 |
| 2M-76 | Instrument Air Dryer 2M-76 |
| 152-115 | 4160V AC BREAKER 152-115 TRANSFERS OPEN |
| X-7 | 4160/480V TRANSFORMER X7 FAULT |
| B-7 | 480V LCC B7 FAULT |
| 52-712 | AC BREAKER 52-712 TRANSFERS OPEN |
| 52-723 | AC BREAKER 52-723 TRANSFERS OPEN |
| 52-724 | AC BREAKER 52-724 TRANSFERS OPEN |
| 52-513 | AC BREAKER 52-513 FAILS TO CLOSE |
| 52-613 | AC BREAKER 52-613 FAILS TO CLOSE |
| FLEX DG | FLEX Diesel Generator |
| B-1 | 480 VAC Load Center B-1 |
| B-12 | 480 VAC Motor Control Center B-12 |
| B-2 | 480 VAC Load Center B-2 |
| B-21 | 480 VAC Motor Control Center B-21 |
| B-22 | 480 VAC Motor Control Center B-22 |
| B-25 | 480 VAC Motor Control Center B-25 |
| B-31 | 480 VAC Motor Control Center B-31 |
| C-28A | Instrument Air Compressor C-28A |
| C-28B | Instrument Air Compressor C-28B |

| Component | Component Description |
|---|---|
| C-5A | Condenser Vacuum Pump C-5A |
| C-5B | Condenser Vacuum Pump C-5B |
| CV-1049 | MOV CV-1049 TRANSFERS OPEN |
| CV-1246 | Makeup Filter F-3A Inlet AOV CV-1246 |
| CV-1247 | Makeup Filter F-3B Inlet AOV CV-1247 |
| CV-1248 | Letdown / Bleed 3-Way MOV CV-1248 |
| CV-1249 | Batch Controller Flow AOV CV-1249 |
| CV-1250 | Condensate / Boric Acid Makeup Block AOV CV-1250 |
| CV-2214 | Reactor Coolant Pumps Seal Cooler and Letdown Coolers Nuclear ICW Return Isolation MOV CV-2214 |
| CV-2215 | Reactor Coolant Pumps Seal Cooler and Letdown Coolers ICW RB Return Isolation MOV CV-2215 |
| CV-2216 | Letdown Cooler E-29A Supply Isolation MOV CV-2216 |
| CV-2217 | Letdown Cooler E-29B Supply Isolation MOV CV-2217 |
| CV-2228 | Condensate to Intermediate Cooling Water Surge Tank T-37A AOV CV-2228 |
| CV-2229 | Condensate to Intermediate Cooling Water Surge Tank T-37B AOV CV-2229 |
| CV-2233 | Reactor Coolant Pumps Seals Cooler and Letdown Coolers Nuclear ICW Supply Isolation AOV CV-2233 |
| CV-2238 | Intermediate Cooling Water Pumps Discharge Crossover AOV CV-2238 |
| CV-2239 | Intermediate Cooling Water Pumps Discharge Crossover AOV CV-2239 |
| CV-2240 | Intermediate Cooling Water Pumps Suction Crossover AOV CV-2240 |
| CV-2241 | Intermediate Cooling Water Pumps Suction Crossover AOV CV-2241 |
| CV-2400 | Reactor Building Spray Train B Block MOV CV-2400 |
| CV-2401 | Reactor Building Spray Train A Block MOV CV-2401 |
| CV-2622 | Low Load Control AOV CV-2622 |
| CV-2623 | Startup Feedwater Control AOV CV-2623 |
| CV-2624 | Low Load Block MOV CV-2624 |
| CV-2625 | Main Feedwater Block MOV CV-2625 |
| CV-2672 | Steam Generator B Main Feedwater Low Load Control AOV CV-2672 |
| CV-2673 | Startup Feedwater Control AOV CV-2673 |
| CV-2674 | Low Load Block MOV CV-2674 |
| CV-2675 | Main Feedwater to Steam Generator E-24B Block MOV CV-2675 |
| CV-2827 | Feedwater Crossover MOV CV-2827 |
| CV-2905 | Gland Sealing Steam Condenser AOV CV-2905 |
| CV-3617 | Circulating Water Pump P-3D Discharge MOV CV-3617 |
| CV-3621 | Circulating Water Pump P-3C Discharge MOV CV-3621 |
| CV-3625 | Circulating Water Pump P-3B Discharge MOV CV-3625 |
| CV-3629 | Circulating Water Pump P-3A Discharge MOV CV-3629 |
| CV-3643-XC | Auxiliary Cooling Water Loop Isolation MOV CV-3643 |
| CV-3811-XC | Service Water Loop 2 Supply to Intermediate Cooling Water Coolers MOV CV-3811 |
| CV-3812 | Service Water to VCC-2A and VCC-2B MOV CV-3812 |
| CV-3813 | Service Water Loop 2 Supply to VCC-2C and VCC-2D MOV CV-3813 |

| Component | Component Description |
|---|---|
| CV-3814 | Service Water Outlet to VCC-2A  and VCC-2B MOV CV-3814 |
| CV-3815 | VCC-2C / VCC-2D Outlet MOV CV-3815 |
| CV-3820-XC | Service Water Loop 1 Supply to Intermediate Cooling Water Coolers Isolation MOV CV-3820 |
| CV-4803 | Containment Isolation MOV CV-4803 |
| CV-4804 | Containment Penetration 11 Isolation AOV CV-4804 |
| CV-6687 | Steam Generator E-24B to E-11A Turbine Bypass Valve AOV CV-6687 |
| CV-6688 | Steam Generator E-24B to E-11A Turbine Bypass Valve AOV CV-6688 |
| CV-6689 | Steam Generator E-24A to E-11B Turbine Bypass Valve AOV CV-6889 |
| CV-6690 | Steam Generator E-24A to E-11B Turbine Bypass Valve AOV CV-6890 |
| CV-7470 | Reactor Building Cooling Unit VSF-1A Backdraft Damper CV-7470 |
| CV-7471 | Reactor Building Cooling Unit VSF-1B Backdraft Damper CV-7471 |
| CV-7472 | Reactor Building Cooling Unit VSF-1C Backdraft Damper CV-7472 |
| CV-7473 | Reactor Building Cooling Unit VSF-1D Backdraft Damper CV-7473 |
| H-1 | 6900 VAC Switchgear H-1 |
| H1-1 | 6900 VAC Circuit Breaker H1-1 |
| H1-2 | 6900 VAC Circuit Breaker H1-2 |
| H-2 | 6900 VAC Switchgear H-2 |
| H2-1 | 6900 VAC Circuit Breaker H2-1 |
| H2-2 | 6900 VAC Circuit Breaker H2-2 |
| PS-2286 | PS-2286 Fails High (>=105 psi) |
| PS-2296 | PS-2296 Fails High (>=105 psi) |
| PS-2285 | PS-2285 Fails Low (<=45 psi) |
| PS-2295 | PS-2295 Fails Low (<=45 psi) |
| P-114A | ICW BOOSTER PUMP P-114A IFAILS TO RUN |
| P-114B | ICW BOOSTER PUMP P-114B IFAILS TO RUN |
| P-114B | ICW BOOSTER PUMP P-114B IFAILS TO START |
| CV-2287 | MOV CV-2287 FAILS TO OPEN |
| CV-2287 | MOV CV-2287 TRANSFERS CLOSED |
| LT-2609 | Steam Generator B Rapid Feedwater Reduction Level Transmitter LT-2609 |
| LT-2659 | Steam Generator A Compensator Level Loop Level Transmitter LT-2659 |
| M-14 | Instrument Air Dryer M-14 |
| M-15 | Instrument Air Dryer M-15 |
| P-1A | Turbine Driven Main Feedwater Pump P-1A |
| P-1B | Turbine Driven Main Feedwater Pump P-1B |
| P-26A | Turbine Driven Main Feedwater Pump P-1A Lube Oil Pump P-26A |
| P-26B | Turbine Driven Main Feedwater Pump P-1B Lube Oil Pump P-26B |
| P-27A | Turbine Driven Main Feedwater Pump P-1A Lube Oil Pump P-27A |
| P-27B | Turbine Driven Main Feedwater Pump P-1B Lube Oil Pump P-27B |
| P-2A | Condensate Pump P-2A |
| P-2B | Condensate Pump P-2B |
| P-2C | Condensate Pump P-2C |

| Component | Component Description |
|---|---|
| P-31A | CV Pump Seal Recirculation Pump P-31A |
| P-31B | CV Pump Seal Recirculation Pump P-31B |
| P-32A-FTR | Reactor Coolant Pump P-32A |
| P-32B-FTR | Reactor Coolant Pump P-32B |
| P-32C-FTR | Reactor Coolant Pump P-32C |
| P-32D-FTR | Reactor Coolant Pump P-32D |
| P-33A | Intermediate Cooling Water Pump P-33A |
| P-33B | Intermediate Cooling Water Pump P-33B |
| P-33C | Intermediate Cooling Water Pump P-33C |
| P-39A | Boric Acid Pump P-39A |
| P-39B | Boric Acid Pump P-39B |
| P-3A | Circulating Water Pump P-3A |
| P-3B | Circulating Water Pump P-3B |
| P-3C | Circulating Water Pump P-3C |
| P-3D | Circulating Water Pump P-3D |
| P-75 | Auxiliary Feedwater Pump P-75 |
| PCV-2836-B | Bearings Cooling Supply PCV-2836 Control Air Regulator PCV-2836-B |
| PS-2230 | Intermediate Cooling Water Pump P-33A Discharge Pressure Switch PS-2230 |
| PS-2231 | Intermediate Cooling Water Pump P-33B Discharge Pressure Switch PS-2231 |
| PS-2232 | Intermediate Cooling Water Pump P-33C Discharge Pressure Switch PS-2232 |
| SG-5 | Sluice Gate SG-5 |
| SG-6 | Sluice Gate SG-6 |
| SG-7 | Sluice Gate SG-7 |
| SV-1066 | Quench Tank SOV SV-1066 |
| SV-3652 | Condenser Vacuum Pump C-5A CV-3651 / CV-3652 Air Supply SOV SV-3652 |
| SV-3662 | Condenser Vacuum Pump C-5B CV-3661 / CV-3662 Air Supply SOV SV-3662 |
| SV-7410 | VSF-1A Chiller Bypass Damper SOV SV-7410 |
| SV-7411 | VSF-1B Chiller Bypass Damper SOV SV-7411 |
| SV-7412 | VSF-1C Chiller Bypass Damper SOV SV-7412 |
| SV-7413 | VSF-1D Chiller Bypass Damper SOV SV-7413 |
| VSF-1A | Reactor Building Cooler Fan VSF-1A |
| VSF-1B | Reactor Building Cooler Fan VSF-1B |
| VSF-1C | Reactor Building Cooler Fan VSF-1C |
| VSF-1D | Reactor Building Cooler Fan VSF-1D |
| X-04 | Unit 1 Startup Transformer X-04 (Startup Transformer 2) |

b) A sensitivity was performed in Section 8.1 of PSA-ANO1-06-4B-SOU (Reference 3) that removed the ‘always failed’ mapping and quantified the RICT calculations assuming the component was always available (i.e., not impacted by fire induced damage). The results for each LCO in the RICT program are documented in Table 8.1-2 of Reference 3. In all cases the allowable RICT times increased which was expected since many of the components are not associated with LCOs within the RICT scope or used for mitigating transients following a reactor trip (i.e., Balance of Plant equipment).

In most cases, the increase was minimal. However, it was noted that LCO 3.6.3 and 3.8.1 had a significant increase in allowable RICT Times due to an Unknown Location (UNL) component. Those UNL components are being reviewed and included in the next FPRA update to support the usage of the RICT program.

c) As shown in the sensitivity, the UNLs do not have a detrimental impact on the RICT program. RMAs associated with the specific LCOs will be implemented to mitigate any uncertainty in the analysis.

**NRC/NRR/PRA Licensing Branch C (APLC) Question 01 – Determination of the High Winds CDF and LERF Penalty**

Section 2.3.1, Item 7, of NEI 06-09, Revision 0-A, states, in part, that the "impact of other external events risk shall be addressed in the RMTS program," and explains that one method to do this is by "performing a reasonable bounding analysis and applying it along with the internal events risk contribution in calculating the configuration risk and the associated RICT." The NRC staff's safety evaluation for NEI 06-09 states, in part, that "[w]here PRA models are not available, conservative or bounding analyses may be performed to quantify the risk impact and support the calculation of the RICT."

Section 4.2 of LAR Enclosure 4 provides the results of the development of Core Damage Frequency (CDF) and Large Early Release Frequency (LERF) penalty factors to include in RICT calculations to bound the impact of tornado-generated missiles for certain maintenance or LCO configurations. It is stated that these penalty factors are "conservative." However, only the results of this assessment are provided; no description is provided of the methodology, input, and assumptions used to develop the risk model and to justify that the results are conservative. Provide the following:

a) Identify the SSCs that are the tornado missile risk targets for the development of the tornado-generated missile CDF and LERF penalty factors for the RICT calculations and provide justification for why these were selected for evaluation.

b) A description of the approach used for the development of the tornado-generated missile CDF and LERF penalty factors for the RICT calculations with justification for the results of the approach being conservative. The description and justification should (i) include information about the tornado missile failure frequencies, conditional failure probabilities for impacted SSCs, and the plant response model, and (ii) identify any deviations from the Tornado Missile Risk Evaluator methodology approved for use for ANO-1 (ML20135H141).

An additional item was requested by NRC after reviewing the response to APLC-01. Item (2).b on page 3 of RIS 2008-14, "Use of TORMIS Computer Code for Assessment of Tornado Missile Protection" is an example of licensee deviation from the approved TORMIS methodology in previous TORMIS analyses. Specifically, failing to address missile tumbling when modeling targets.

Question: Was missile tumbling addressed in the ANO-1 TORMIS calculations?

*Entergy Response:*

a) The tornado missile target SSCs used to develop the penalty ΔCDF and ΔLERF penalty factors are:

- Non-conformances identified in Table 1 of the Tornado Missile Risk Evaluator (TMRE) LAR (Reference 6).

- Conforming but vulnerable SSCs identified during the TMRE Vulnerable SSC Walkdown and documented in the TMRE Unit 1 EEFP calculation (Reference 7).

A plant walkdown was performed in support of the penalty factor development to review the risk-significant targets. As a result of the walkdown and review of plant documents, several of the conforming but vulnerable SSCs selected as targets for the TMRE were determined to not be vulnerable due to adequate barriers (e.g., modifications made after the TMRE was developed) or due to geometry (i.e., no line of site from missile source to the target). Note that all of these targets were determined to meet the ANO-1 design/licensing bases but were conservatively added to the TMRE model. The eliminated targets should not have been considered targets using the TMRE methodology; some barriers were conservatively not credited, or barriers were added subsequent to the original TMRE model being finalized.

Only vulnerable but conforming SSCs were removed from the TMRE model used to calculate the penalty factors (i.e., the Conservative Tornado Risk Model (CTRM)); all non-conforming SSCs (from Table 1 of Reference 6) remain in the model. The following targets were eliminated from the CTRM used for the development of the penalty factors, since all penetrations to these rooms are adequately protected against tornado missiles.

- Room 100 (Scenario 100-A) – Penetrations 4kV Switchgear Room Wall
- Room 129 (Scenario 129-A) – Penetrations in Control Room Wall
- Room 97 (Scenario 97-EL) – Penetrations in the Cable Spreading Room Wall
- Room 99 (Scenario 99-A) – 4kV Switchgear Room Wall

Additionally, several targets were re-evaluated to remove *excess* conservatism (e.g., assuming that a missile penetrating a small opening fails all the SSCs in a room). This is discussed further in the response to part b).

b) A CTRM was developed to support the development of the ΔCDF and ΔLERF, as mentioned in Section 4.2 of Enclosure 4 to the TSTF-505 LAR (Reference 8). The CTRM is based on the ANO-1 TMRE model that was documented in the TMRE LAR (Reference 6). Several updates and changes were made in developing the CTRM, following the methods described in NEI 17-02, with some exceptions. The following discusses a high-level overview of the changes, details for exceptions to the NEI 17-02 methodology, other changes made (in accordance with NEI 17-02 methodology), and justification for the CTRM approach being conservative.

Overview of CTRM

The major changes to the ANO-1 TMRE are:

- The most recent ANO-1 Internal Events PRA model (Revision 6) was used as the basis for the CTRM; this is the same internal events model that was used for the TSTF-505 LAR. The methods used to create the CTRM followed NEI 17-02 guidance for modifying the internal events PRA to create the CTRM; the CTRM model development process is not unique.

- The most recent cable data from Revision 6 of the ANO-1 Fire PRA (e.g., cable locations, affected SSCs) was used for target mapping.

- Select target missile failure probabilities were updated, following the methods in NEI 17-02. There are approximately 80 TMRE targets/scenarios; only 30% of the targets/scenarios were changed from the TMRE. Since most of the targets in the ANO-1 TMRE model are conforming, conservative treatment of those targets did not significantly affect the increase in risk associated with non-conforming targets in the TMRE. However, the very conservative treatment of conforming targets has a significant impact on the total tornado missile CDF.

  - Added credit for robust capabilities of the targets and/or barriers that were conservatively not accounted for in the TMRE.

  - Updated target areas to be more realistic. The original TMRE model conservatively included the areas of penetrations into rooms that were adequately shielded from tornado missiles,

  - Re-evaluated target-to-SSC mapping, primarily to remove excessive conservatism in target correlation. Many TMRE targets included the assumption that all SSCs in a room are failed due to a single missile penetrating any opening (including small/limited penetrations).

- Removed four targets/scenarios, as discussed in the response to part a), above.

- Used plant specific TORMIS failure probabilities for a limited set of targets, in lieu of the failure probabilities calculated using NEI 17-02 methods. TORMIS failure probabilities were determined for select targets that were risk significant and could be modeled less conservatively using TORMIS (as compared to TMRE). Although TORMIS provides more realistic failure probabilities for tornado missile targets, it is still a conservative method and the CTRM remains conservative and appropriate for determining the ΔCDF and ΔLERF penalty factors. The targets with TORMIS failure probabilities in the CTRM are:

  - Door 56 to Corridor 98

  - BWST (T-03)

  - EDG K4A and K4B Exhaust Stacks

  - Fuel Oil Storage Tanks – FOST (T-57) Vents
  - Correlated Failure of EDG Exhaust Stacks (new target)

- Added one scenario (correlated failure of both EDG exhaust stacks by a single missile)
- Credited some control room operator actions that were conservatively assumed to fail in the TMRE but should not be affected using NEI 17-02 methods. Operator actions performed in the control room are unaffected in the NEI 17-02 methods.

<u>CTRM Conservatism</u>

The ANO-1 CTRM is still considered demonstrably conservative and appropriate for use in developing the ΔCDF and ΔLERF. In addition to the general conservative nature of the NEI 17-02 methodology (e.g., no recovery of offsite power), the method was conservatively applied in the ANO-1 TMRE (e.g., many unnecessarily correlated targets, no credit for robustness for many targets). As described above, conservative treatment of vulnerable but conforming targets in the TMRE did not significantly impact the risk associated with non-conforming SSCs. Therefore, there was little incentive to be less conservative (i.e., requiring more effort) in modeling target failure impacts and probabilities.

The following are key conservative aspects of the ANO-1 CTRM, including conservative aspects of the NEI 17-02 method as applicable specifically to ANO-1.

- The AAC is very important in tornado-induced LOOP scenarios. However, the AAC failure probability in the CTRM is 1.0 (as required by NEI 17-02) since the cooling unit for the AAC is unprotected. However, the cooling unit could survive some F'2 winds.
- Most of the targets at ANO are cables and conduits. Missile induced failures of cables and conduits are inherently conservative in the NEI 17-02 methodology. Further, the NEI 17-02 method was applied conservatively in the ANO-1 TMRE and CTRM. Conservative assumptions in modeling cables and conduits include[1]: (a) 100% of missiles can damage single or multiple cable, (b) all cables in one or multiple collocated cable trays are failed by a single missile hit (c) cables inside conduits will fail regardless of the missile striking the conduit and (d) cables are not shielded by structural members.
- Many targets consist of multiple correlated SSCs, when un-correlated targets could potentially be justified. Most notable of the correlations are the assumptions that all SSCs in a room are considered to fail due to a single missile, when the vulnerable openings are small and many targets not in the line of site of the openings and/or adequately shielded. Additionally, 100% of the missile inventory is often assumed to cause the failure of correlated targets, when only a percentage of missiles would be large or energetic enough to cause the failure of multiple targets in a single strike.

[1] No research is available to quantify the amount of conservatism inherent in the treatment of cable failures in the TMRE or other tornado missile risk assessments.

- Many of the targets are in the Auxiliary Building (AB) and can only be hit by missiles originating in or traveling through the Turbine Building (TB) and passing through penetrations (e.g., electrical, ventilation, doors) in the reinforced concrete wall between the AB and the TB (on the ground and mezzanine levels). There are many obstructions in the TB that would stop, damage, or slow down missiles; assuming that all missiles are capable of going through the TB (especially on the ground and mezzanine levels) and then penetrating openings to strike and damage targets interior to the AB is very conservative.

- Robustness is not credited for certain targets when it could be, based on the NEI 17-02 method. This includes not crediting barriers which would prevent any missiles from striking certain targets (e.g., 1" plate steel).

- It is assumed that a small steam line break occurs with a probability of 1.0, which requires MSIV closure for every scenario.

- No credit is taken for FLEX, even though it is designed to function following a tornado, proceduralized, and trained on.

<u>CTRM Results and Penalty Factor Development</u>

The CTRM is developed to conservatively estimate the CDF and LERF associated with tornado missiles at ANO-1. As such, cutsets from the CTRM that do not include tornado missile failures are excluded from the results. Tornado-induced LOOPs without offsite power recovery and only random equipment and/or operator action failures (i.e., no tornado missile failures) are accounted for in the internal events weather-related LOOP cutsets; therefore, they are not included in the CTRM results.

As a result of the changes described in this response, the CTRM average maintenance CDF is significantly lower than the TMRE (Degraded Case) CDF for ANO-1. A large portion of the CDF reduction (~7.5E-6/yr) is a result of eliminating the scenarios discussed in the response to part a). Other significant reductions in CDF between the TMRE and CTRM are a result of scenario refinement, such as for Room 128 (developed multiple scenarios to be more realistic), the MSIVs (refined correlated target and added individual targets) and the TORMIS targets (e.g., Door 56 and the BWST).

Section 4.2 of the LAR Enclosure 4 describes the results of quantifying the CTRM for various LCO configurations, and the basis for the ΔCDF and ΔLERF penalty factors.

Report PSA-ANOC-06-4B-TORMIS, "Tornado Missile and Pressure Fragilities for Select ANO SSCs, Rev 0" (Reference 5) documents the TORMIS analysis used to support the ANO-1 Conservative Tornado Risk Model. Item 6 in Section 7.2.1 states:

> *"Each dimension of SSC's analyzed in this missile fragility analysis is then increased for offset hit (tumbling missiles) in each (x, y, z) free direction. For ANO, this increase was 1.5 feet in each free direction (see discussion below). Thus, a target with 2 free*

*directions in the X direction is increased by a total of 3 feet in length in the X direction. A target that has one side restrained in one side in the X direction (for example, that target is protected from offset hits by an YZ concrete barrier on one side) only sees an offset hit increase of 1.5 feet in the X direction. Similarly, safety targets that rest on the ground plane are increased only 1.5 feet in the Z direction to reflect the fact that missiles cannot hit the target from below the ground plane. Refer to Reference 4 for figures on offset hit modeling.*

**NRC/NRR/Electrical Engineering Branch (EEEB) Question 01– TS LCO 3.8.1, Conditions A, B, and C**

General Design Criterion (GDC) 17 requires, in part, that both offsite and onsite electrical power systems be provided. LCO 3.8.1, Conditions A, B, and C are exclusively for the inoperability of one offsite circuit, one diesel generator (DG), and two offsite circuits, respectively.

ANO-1 Safety Analysis Report (SAR) Amendment 30 (ML21288A074), Section 8.3.1.1.2, states that there are two offsite sources for ANO-1, Startup Transformers 1 and 2, that provide safe shutdown for ANO-1 and maintain it in a safe shutdown condition. For loss of one offsite power source with the main generator unavailable, the available offsite power source is sufficient for unit safe shutdown. TS Bases 3.8.1, "Background", states that for the loss of offsite power to the startup transformer supplying ANO-1, an undervoltage condition trips its associated bus feeder breakers, the feeder breakers for the alternate Startup Transformer automatically close allowing it to supply ANO-1 at reduced load (if Startup Transformer 2 is supplying ANO-1). Upon loss of the normal (main generator) and the standby power sources (both offsite sources), each of the two 4160 V engineered safeguards buses are energized from its respective diesel generator.

The design success criteria (DSC) in LAR Table E1-1 for TS LCO 3.8.1, Conditions A, B, and C appears inconsistent with the LCO by not listing minimum power source(s) of the type identified in the respective LCO condition. Clarify or explain this inconsistency.

a) Condition A – Minimum offsite power circuit(s) Startup Transformer 1 or 2 to address LCO.

b) Condition B – Minimum DG(s) to address LCO for design basis accident (DBA).

c) Condition C – Minimum DG(s) to address LCO for DBA since both offsite circuits inoperable.

<u>Entergy Response:</u>

As discussed in TS Bases 3.8.1, "Applicable Safety Analyses", the operability of the AC electrical power sources is consistent with the initial assumptions of the accident analyses and is based upon meeting the design basis of the unit. This results in maintaining at least one train of the onsite or offsite AC sources Operable during accident conditions that consider an assumed loss of all offsite power or all onsite AC power and a worst-case single failure. Therefore, as stated in the DSC in LAR Table E1-1 for TS LCO 3.8.1, only one train powered by an offsite power source, or a DG is required to meet accident analysis.

A modified, abbreviated Table E1-1 is included as Attachment 4 to this letter, which incorporates the above response and replaces the corresponding portion of the table in the original LAR.

**EEEB Question 03**

GDC 17 requires, in part, that both offsite and onsite electrical power systems be provided. This includes onsite dc electrical systems.

SAR Section 8.3.1.1.2 describes that there are two offsite sources for ANO-1, Startup Transformers 1 and 2, capable of providing a source of power for ANO-1 safe shutdown and post-shutdown conditions. For the loss of one offsite power source with the main generator unavailable, the available offsite power source is sufficient for unit safe shutdown. Upon loss of normal (main generator) and standby power sources (both offsite sources), each of the two 4160 V engineered safeguard buses are energized from its respective DG. ANO-1 SAR Section 8.3.1.1.6 states that each of the four redundant 120 V vital AC distribution panels supplies power to one of four channels of Nuclear Instrumentation and Reactor Protection Systems. Each of three channels of ESAS is supplied by one 120 V vital AC distribution panel. SAR Section 8.3.2.1 states that the 1E 125 V direct current (VDC) system consists of two 125 V batteries that provide DC power to the two 125 VDC control centers (one per train) and distribution panels. Four battery chargers are supplied, with two serving as normal supplies to the DC control centers. The second battery charger for each control center serves as a standby battery charger.

The DSC in Table E1-1 for TS LCO 3.8.9, Conditions A, B, and C appear inconsistent with the LCO by not listing SSCs (AC safety buses or DC buses or 120 VAC distribution panels) as shown in Table B 3.8.9-1 of the TS Bases for each respective LCO condition. Clarify or explain this inconsistency.

a) Condition A – Minimum AC safety buses for DBA.

b) Condition B – Minimum 120 VAC distribution panels for DBA.

c) Condition C – Minimum DC buses for DBA.

*Entergy Response:*

a. Design Success Criteria in LAR Table E1-1 for TS LCO 3.8.9, Condition A should read as follows: A minimum of one AC electrical power distribution subsystem is required to meet accident analyses assumptions. The AC subsystem consists of the following SSCs: a 4160V Engineered Safeguard Bus, a 480V Load Center, and 480V Motor Control Centers (refer to TS Bases Table B 3.8.9-1 for specific subsystem requirements).

b. Design Success Criteria in LAR Table E1-1 for TS LCO 3.8.9, Condition B should read as follows: A minimum of one 120 VAC electrical power distribution subsystem is required to meet accident analyses assumptions. The 120 VAC subsystem consists of two 120 VAC distribution panels (refer to TS Bases Table B 3.8.9-1 for specific subsystem requirements).

c. Design Success Criteria in LAR Table E1-1 for TS LCO 3.8.9, Condition C should read as follows: A minimum of one DC electrical power distribution subsystem is required to meet accident analyses assumptions. The DC subsystem consists of the following SSCs: two 125 VDC Buses and a 125 VDC Distribution Panel (refer to TS Bases Table B 3.8.9-1 for specific subsystem requirements).

A modified, abbreviated Table E1-1 is included as Attachment 4 to this letter, which incorporates the above responses and replaces the corresponding portions of the table in the original LAR.

**NRC/NRR/Technical Specifications Branch (STSB) Question 1:**

The proposed administrative controls for the RICT Program in TS 5.5.18 paragraph "e" of Attachment 2 to the LAR was based on the TS markups of TSTF-505, Revision 2.

The NRC staff recognizes that the model SE for TSTF-505, Revision 2 contains improved phrasing for the administrative controls for the RICT Program in TS 5.5.7 paragraph "e." Specifically, the phrasing "approved for use with this program" instead of "used to support this license amendment."

Discuss whether the phrases "used to support Amendment # xxx" or, as discussed in the TSTF-505 model SE, "approved for use with this program" would provide more clarity for this paragraph, in lieu of the original phrasing in TS 5.5.18 paragraph "e."

*Entergy Response:*

Att. 2 TS 5.5.18 paragraph "e" of the LAR submittal (Reference 8) states:

> *e. The risk assessment approaches and methods shall be acceptable to the NRC. The plant PRA shall be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant, as specified in Regulatory Guide 1.200, Revision 2. Methods to assess the risk from extending the Completion Times must be PRA methods <u>used to support this license amendment</u>, or other methods approved by the NRC for generic use; and any change in the PRA methods to assess risk that are outside these approval boundaries require prior NRC approval.*

The model SE for TSTF-505 Revision 2 (Reference 9), TS 5.5.18 paragraph "e" states:

> *e. The risk assessment approaches and methods shall be acceptable to the NRC. The plant PRA shall be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant, as specified in Regulatory Guide 1.200, Revision [2]. Methods to assess the risk from extending the Completion Times must be PRA methods <u>approved for use with this program</u>, or other methods approved by the NRC for generic use; and any change in the PRA methods to assess risk that are outside these approval boundaries require prior NRC approval.*

The improved phrasing as stated in the Model SE "… approved for use with this program …" provides more clarity than the original phrasing used in the ANO-1 license amendment application and TSTF-505 Revision 2 markup for TS 5.5.18 since it does not imply a connection with a particular amendment and specifically applies to the Risk Informed Completion Time Program.

ANO-1 requests to use the same phrasing as proposed in the model SE TS 5.5.18 paragraph "e".

Attachment 2 contains the Technical Specification Page Markups and Attachment 3 contains the Retyped Technical Specification Pages.

**Supplemental Request 1.a**

NRC Request: a. The NRC staff noted that there is no defense-in-depth assessment for instrumentation and controls (I&C) and the associated table. Please provide this information.

*Entergy Response:*

TSTF-505 Revision 2 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, safety injection, reactor building 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 ANO-1 instrumentation design creates defense-in-depth due to the redundancy and diversity of the channels for each function, as described in the following tables. In general, the following principles apply to each ANO-1 instrumentation system (see Tables 1, 2, 3, 4, 5, and 6 for specific details).

- Each function has multiple channels.
- A failed channel does not cause or prevent a trip/actuation.
- When applicable, if 1 channel in the function is out-of-service, then the 1 channel can be placed in trip.

1.1 Reactor Protection System (RPS) Instrumentation

The RPS Instrumentation employs diversity in the number and variety of different inputs which will result in a reactor trip. The RPS, as described in the ANO-1 Safety Analysis Report (SAR), Section 7.1.2, includes sensors, relays, bypass circuits, and switches that are necessary to cause initiation of a reactor trip. Functional diversity is provided by monitoring multiple inputs of neutron flux, reactor coolant system (RCS) pressure, RCS flow, reactor outlet temperature, RCS pump status, reactor building (RB) pressure, main feedwater (MFW) pump turbine status, and main turbine status. There are at least four redundant sensor input signals from each of these parameters. The RPS consists of four identical protection channels, each terminating in a trip relay within a reactor trip (RT) module. In the normal, untripped state, each protection channel passes current to the terminating trip relay and holds it energized as long as all inputs are in the normal energized (untripped) state. Should any one or more inputs become de-energized (tripped) the terminating relay in that protective channel de-energizes (trips). Each protection channel trip relay has four logic controlling contacts, each controlling a logic relay in one RT module. Therefore, each RT module has four logic relays controlled by the four protection channels. The four logic relays combine to form a 2-out-of-4 coincidence network in each RT module. The coincidence logics in all RT modules trip whenever any two of the four protection channels trip.

The Control Rod Drive (CRD) system contains multiple CRD trip devices, two AC trip breakers, and two DC trip breaker pairs that provide a path for power to the CRD system. In addition to the safety rods, the power for the regulating rods and APSRs may be interrupted by the electronic trip relays. The system has two separate paths (or channels), with each path having either two breakers in series or a breaker and an electronic trip relay in series. Each path provides independent power to the CRDs.

Either path can provide sufficient power to operate all CRDs. Two separate power paths to the CRDs ensure that a single failure that opens one path will not cause an unwanted reactor trip.

The RPS consists of four independent protection channels, each containing a Reactor Trip Module (RTM). Each RTM receives signals from its own measurement channels that indicate a protection channel trip is required. The RTM transmits this signal to its own two-out-of-four logic and to the two-out-of-four logic of the RTMs in the other three RPS channels. A trip in any two of the four protection channels initiates a trip of all four logic networks. Whenever any two RPS channels trip, the RTM in each channel actuates to remove 120 VAC power from its associated CRD trip breaker.

The reactor is tripped by opening circuit breakers and de-energizing electronic trip relays that interrupt the control power supply to the CRDs. Six breakers are installed to increase reliability and allow testing of the trip system. A one-out-of-two taken twice logic is used to interrupt power to the rods.

The four RPS protection channels are identical in their functions. The channels combine in the system logic to trip the reactor automatically to protect the reactor core and RCS. The RPS is designed to provide the necessary protection to ensure that the reactor core and RCS safety limits (SLs) as well as accident analysis acceptance criteria are not violated. The safety limits of importance to the RPS include RCS pressure, core outlet temperature, departure from nucleate boiling ratio (DNBR), and fuel centerline temperature.

Table 1 below presents the TS 3.3.1 logic descriptions for all the functions listed in TS Table 3.3.1-1.

### 1.1.1 Diverse Reactor Overpressure Protection System (DROPS)

In addition to the RPS, ANO employs a Diverse Reactor Overpressure Prevention System (DROPS) (described in the ANO-1 SAR Section 7.2.4). DROPS was designed to meet the intent of 10CFR50.62, known as the ATWS rule. Paragraph 50.62 gives requirements for reduction of risk from Anticipated Transients Without Scram (ATWS) events for light-water cooled nuclear power plants. DROPS is made up of two subsystems which will actuate and perform protective functions when their associated parameter(s) indicate a ATWS event. The two systems are Diverse Scram System (DSS) and ATWS Mitigation System Actuation Circuitry (AMSAC). DSS de-energizes the regulating group control rod drives when RCS pressure reaches 2430 psig. AMSAC trips the main turbine and actuates both channels of EFW if main feedwater flow indicates less than 15% of total flow and reactor power is greater than 45%.

DROPS is a two channel logic system which monitors plant process parameters and compares them to pre-selected trip values to determine if conditions exist that are indicative of an ATWS event. Each DROPS channel is a small, self-contained micro-processor based system designed specifically to actuate existing systems. The monitored parameters are diverse and independent from those which are used by the Reactor Protection System (RPS). The parameters monitored are Wide Range RCS Pressure, Linear Reactor Power (Gamma Metrics), and Main Feedwater Flow (MFW) for Loop A and Loop B.

The function of DROPS DSS subsystem is to trip the reactor and trip the main turbine on high RCS pressure. The AMSAC portion of DROPS will initiate Emergency Feedwater (EFW) and trip the main turbine when a reactor power, main feedwater flow mismatch occurs. Actuation of the DROPS system generally assumes a failure of the RPS and Control Rod Drive (CRD) system during an RCS high pressure transient.

Table 2 below presents the TS 3.3.2 RPS Manual Reactor Trip Function diversity.

**Table 1 Information to Support RPS Instrumentation Diversity**

| RPS Function | Table 3.3.1-1 Func. | Channels to Trip (1)(2)(3) | Primary Transient / Accident Protection (6)(7) | Diverse Actuation Functions* | Comments |
|---|---|---|---|---|---|
| Nuclear Overpower (High Setpoint) | 1.a | 2 out of 4 RPS Channels | **- Startup Accident**<br>**- Rod Withdrawal Accident at Rated Power**<br>**- Rod Ejection**<br>**- Steam Line Failure**<br>**- Moderator Dilution** | - RCS High Pressure<br>- RCS High Outlet Temperature<br>- DSS(8) | Each excore nuclear instrument consists of an upper and lower element which is summed for total power, and the difference taken for imbalance |
| Nuclear Overpower (Low Setpoint) | 1.b | | | | Modes 2-5 N/A for RICT |
| RCS High Outlet Temperature (4) | 2 | 2 out of 4 RPS Channels | **- Rod Withdrawal Accident at Rated Power**<br>- ATWS | - RCS High Pressure<br>- Nuclear Overpower<br>- DSS(8)<br>- AMSAC(8) | One RTD per channel / 2 channels per RCS Hot Leg |
| RCS High Pressure (5) | 3 | 2 out of 4 RPS Channels | **- Startup Accident**<br>**- Rod Withdrawal Accident at Rated Power Operation**<br>**- Moderator Dilution**<br>- **Rod Ejection**<br>- ATWS | - Nuclear Overpower (High Setpoint)<br>- RCS High Outlet Temperature<br>- Nuclear Overpower RCS Flow and Measured Axial Power Imbalance<br>- DSS(8)<br>- AMSAC(8) | |
| RCS Low Pressure (5) | 4 | 2 out of 4 RPS Channels | **- Loss of Coolant**<br>**- Rod Ejection**<br>**- SG Tube Failure**<br>**- Steam Line Failure** | - RCS Variable Low Pressure<br>- Reactor Building High Pressure | |
| RCS Variable Low Pressure (5) | 5 | 2 out of 4 RPS Channels | - Loss of Coolant<br>- SG Tube Failure<br>- Steam Line Failure | - RCS Low Pressure<br>- Reactor Building High Pressure | Temperature inputs same instruments as RCS High Outlet Temperature |
| Reactor Building High Pressure | 6 | 2 out of 4 RPS Channels | - Steam Line Failure<br>- Loss of Coolant | - RCS Low Pressure<br>- RCS Variable Low Pressure | RB High Pressure not credited in safety analysis |

| RPS Function | Table 3.3.1-1 Func. | Channels to Trip (1)(2)(3) | Primary Transient / Accident Protection (6)(7) | Diverse Actuation Functions* | Comments |
|---|---|---|---|---|---|
| Reactor Coolant Pump to Power | 7 | 2 out of 4 RPS Channels | **- Loss of Coolant Flow** | - Nuclear Overpower RCS Flow and Measured Axial Power Imbalance | |
| Nuclear Overpower RCS Flow and Measured Axial Power Imbalance | 8 | 2 out of 4 RPS Channels | **- Loss of Coolant Flow** | - Reactor Coolant Pump to Power | Reactor Power inputs same instruments as for Nuclear Overpower trip |
| Main Turbine Trip (Oil Pressure) | 9 | 2 out of 4 RPS Channels (1) | - ATWS | - RCS High Outlet Temperature<br>- RCS High Pressure<br>- DSS(8) | (Loss of Heat Sink not in Safety Analysis) |
| Loss of Main Feedwater Pumps (Control Oil Pressure) | 10 | 2 out of 4 RPS Channels (1) | - ATWS | - RCS High Outlet Temperature<br>- RCS High Pressure<br>- DSS(8)<br>- AMSAC(8) | (Loss of Heat Sink not in Safety Analysis) |
| Shutdown Bypass RCS High Pressure (5) | 11 | | | | Modes 2-5 N/A for RICT |

* ANO-1 RPS does not require concurrent parameters of the same type to result in reactor trip – just that at least two (2) RPS channels trip on any monitored parameter exceeding its setpoint. For example, one channel of RPS may trip on low RCS pressure and one channel may trip on high reactor building pressure. The result is that two (2) RPS channels have tripped which results in all four (4) channels tripping and actuating their trip devices.

(1) Each Function trips its respective RPS channel, which will cause a reactor trip with 2/4 RPS trip signals.

(2) Bypassed RPS channels reduce the number of total available channels by 1, e.g., from 2/4 to 2/3.

(3) An inoperable channel may be placed in a tripped state, reducing the redundancy from 2/4 required tripped channels to 1/3 required tripped channels.

(4) This temp also used to calculate setpoint for RCS Variable Low Pressure Trip

(5) This pressure input also used in other RPS trips.

(6) Each listed accident results in a reactor trip.

(7) BOLD signifies primary accident credited for associated RPS Trip in Safety Analysis and normal text signifies non-safety analysis credited accidents.

(8) Anticipated Transient Without SCRAM (ATWS) mitigation system

**Table 2 RPS Manual Actuation Instrument Diversity**

| Function | Safety Function | Accident or Plant Condition | Diverse Reactor Trips |
|---|---|---|---|
| Manual Reactor Trip | Reactor Trip | - Failure of RPS Automatic Trip<br>- Failure of Manual Reactor Trip Pushbutton on C03 | 1) One (1) Manual Reactor Trip pushbutton switch on Control Room panel C03<br>2) Two (2) CRD Power Supply Breaker Trip PBs on C03 (Independent of RPS Trip Circuits)<br>3) Diverse Reactor Overpressure Protection System (DROPS) Diverse SCRAM System (DSS) automatically drops regulating control rods upon high RCS pressure independently from RPS<br>4) Two (2) AC CRD Breakers may be tripped from outside the Control Room |

1.2 Engineered Safeguards Actuation System (ESAS) Instrumentation

The Engineered Safeguards Actuation System (ESAS) monitors three parameters via analog instrument channels. Each analog instrument channel provides input to the appropriate digital actuation logic channels that initiate equipment with a two-out-of-three coincidence logic on each digital channel. Each digital actuation logic channel includes bistable inputs from all three analog instrument channels of one parameter, i.e., either Low RCS Pressure, High RB Pressure, or High High RB Pressure. The digital actuation logic combines the analog instrument channel trips to actuate the individual Engineered Safeguards (ES) components needed to initiate each ES System. The ESAS is divided into four functions actuated by eight digital actuation logic channels.

The ESAS is a basic 2-out-of-3 coincidence logic system. Each input variable is measured three times and the three redundant signals terminate in bistables. The ESAS consists of 8, 2-out-of-3 coincidence logic networks for actuating the equipment in the engineered safeguards systems. The odd numbered networks are located in one digital subsystem while the even numbered networks are located in the other digital subsystem.

The coincidence logic output is normally de-energized. Trip action consists of closing the electrical path through the logic thereby energizing a trip bus. Unit Controls (UCs) are employed to couple the trip signal from the trip bus to the safeguards devices (pump, valve, etc.). There is one UC for every safeguards device or group of related devices controlled by an actuation channel. The trip signal follows a normally closed path in each UC, finally terminating in an output relay, within each UC. The output relays of an actuation channel's UCs are connected to a common trip bus.

The design of the ESAS logic can be summarized in terms of the systems operation as follows:

A. Each protective action is initiated by either of two actuation channels with 2-out-of-3 coincidence between input signals.

B. Protective action is initiated by applying power from the actuation channel coincidence logic to the individual output relays in the UC's which in turn energize the CR relays in each safeguards device controller.

C. There is a UC for every safeguards device or group of related devices (valve, pump, etc.).

A manual trip switch is provided for each ESAS channel. There are 8 manual trip pushbuttons on the control console, one for each actuation channel.

The ESAS High Pressure Injection (HPI) Function is actuated by ESAS digital actuation logic Channels 1 and 2 and includes the following system actuations: HPI, a subset of RB isolation valves, diesel generators (DGs), and ES electrical alignment. Digital actuation logic Channels 1 and 2 are actuated by two-out-of-three RCS Pressure – Low analog instrument channels, or two-out-of-three RB Pressure – High analog instrument channels.

The ESAS Low Pressure Injection (LPI) Function is actuated by ESAS digital actuation logic Channels 3 and 4 and includes the following system actuations: LPI, a subset of RB isolation valves, and emergency feedwater (EFW) through an ESAS signal provided to the Emergency Feedwater Initiation and Control (EFIC) Instrumentation System. Digital actuation logic Channels 3 and 4 are actuated by two-out-of-three RCS Pressure – Low analog instrument channels, or two-out-of-three RB Pressure – High analog instrument channels.

The ESAS RB Cooling Function is actuated by ESAS digital actuation logic Channels 5 and 6 and includes the following system actuations: RB cooling, a subset of RB isolation valves, and RB penetration room ventilation system. Digital actuation logic Channels 5 and 6 are actuated by two-out-of-three RB Pressure – High analog instrument channels.

The ESAS RB Spray Function is actuated by ESAS digital actuation logic Channels 7 and 8 and includes the following system actuations: RB spray. Digital actuation logic Channels 7 and 8 are actuated by two-out-of-three RB Pressure – High High analog instrument channels.

Table 3 presents the TS 3.3.5 ESAS logic descriptions for all the functions listed in TS Table 3.3.5-1, "ESAS Instrumentation."

Table 4 presents the TS 3.3.6 ESAS Manual Initiation Instrumentation diversity.

**Table 3 Information to Support ESAS Instrumentation Diversity**

| ESAS Parameter | Table 3.3.5-1 Parameter | Channels to Trip (Analog)(1) | Primary Transient / Accident Protection | Diverse Actuation Functions* |
|---|---|---|---|---|
| RCS Pressure – Low Setpoint | 1 | 2 of 3 | - Loss of RCS Coolant<br>- Steam Line Break<br>- Feedwater Line Break<br>- SG Tube Rupture | - Manual PBs (ESAS Digitals 1-4)<br>- Manual HPI<br>- Manual LPI |
| RB Pressure – High Setpoint | 2 | 2 of 3 | - Loss of RCS Coolant<br>- Steam Line Break<br>- Feedwater Line Break | - Manual PBs (ESAS Digitals 1-6)<br>- Manual RB Isolation<br>- Manual RB Cooling |
| RB Pressure – High High Setpoint | 3 | 2 of 3 | - Loss of RCS Coolant<br>- Steam Line Break<br>- Feedwater Line Break | - Manual PBs (ESAS Digitals 1-8)<br>- Manual RB Spray<br>- Manual RB Cooling<br>- Manual RB Isolation |

(1) An inoperable parameter's instrument channel may be placed in a tripped state, reducing the redundancy from 2 of 3 required analog instrument channels for actuation to 1 of 2 remaining analog instrument channels required for actuation.

**Table 4 ESAS Manual Initiation Instrumentation Diversity**

| Function | Safety Function | Accident or Plant Condition | Diverse Methods |
|---|---|---|---|
| High Pressure Injection (HPI) | ECCS (HPI) | - Loss of RCS Coolant<br>- Steam Line Break<br>- Feedwater Line Break<br>- SG Tube Rupture | Depress Redundant ES Digital Channel PB<br>Manual HPI |
| Low Pressure Injection (LPI) | ECCS (LPI) | - Loss of RCS Coolant<br>- Steam Line Break<br>- Feedwater Line Break<br>- SG Tube Rupture | Depress Redundant ES Digital Channel PB<br>Manual LPI<br>Manual EFW |
| Reactor Building Cooling and Isolation | RB Cooling and Isolation | - Loss of RCS Coolant<br>- Steam Line Break<br>- Feedwater Line Break | Depress Redundant ES Digital Channel PB<br>Manual RB Cooling<br>Manual RB Isolation |
| Reactor Building Spray (RBS) | RBS | - Loss of RCS Coolant<br>- Steam Line Break<br>- Feedwater Line Break | Depress Redundant ES Digital Channel PB<br>Manual RB Spray |

1.3 Emergency Feedwater Initiation and Control (EFIC) Instrumentation

The Emergency Feedwater Instrumentation and Control (EFIC) system is designed to protect against the consequences of a simultaneous blowdown of both steam generators. Upon detection of a steam line break, the EFIC system automatically initiates action to isolate each affected steam generator by closing its main steam isolation valve (MSIV) and its main feedwater isolation valve (MFIV). The Emergency Feedwater (EFW) System is actuated to protect the core during an overheating condition upon a loss of main feedwater or a loss of primary side forced circulation (loss of all four reactor coolant pumps). In addition, EFIC controls the EFW flow rate to the SG(s) to control SG level and minimize overcooling. EFIC also selects the appropriate SG(s) under conditions of steam line break or main feedwater or emergency feedwater line break downstream of the last check valve, and provides for isolation of the main steam and main feedwater lines of a depressurized steam generator.

The EFIC instrumentation contains devices and circuitry that generate the following signals when monitored variables reach levels that are indicative of conditions requiring protective actions.

a. EFW Initiation,
b. EFW Vector Valve Control, and
c. Main Steam Line Isolation.

EFW is initiated to restore a source of cooling water to the secondary system when conditions indicate that the normal source of feedwater is insufficient to continue heat removal. The two indications used for this are the loss of both MFW pumps and a low level in the steam generator (SG). Also, EFW is initiated when action is being taken to isolate the MFW from the SG during conditions of uncontrolled depressurizations. This is done by initiating EFW when steam pressure reaches the low SG pressure setpoint. Also, EFW is initiated when the primary system experiences a total loss of forced circulation. This initiation, on the loss of all reactor coolant pumps (RCPs), ensures the EFW is available to raise SG levels to promote natural circulation cooling.

The EFIC System initiates EFW when an Engineered Safeguards Actuation System (ESAS) signal is initiated on low RCS pressure or high reactor building pressure (ESAS Channels 3 and 4) in order to support heat removal following Emergency Core Cooling System (ECCS) actuation.

The EFIC System also initiates EFW on loss of main feedwater flow as part of the Diverse Reactor Overpressure Protection System (DROPS) which is the system provided for ANO-1 to comply with requirements to reduce risk from an anticipated transient without scram (ATWS). The DROPS consists of the Diverse Scram System (DSS) and the ATWS Mitigation System Actuation Circuitry (AMSAC). EFW initiation for ATWS prevention and mitigation is not required by TS 3.3.11.

The EFIC System also isolates main steam and MFW to an SG that has experienced an uncontrolled depressurization. With the uncontrolled depressurization, the heat sink temperature control is lost, and the heat removal rate cannot be controlled. The main steam and MFW are isolated to an SG when the steam pressure reaches a low setpoint below the normal operating point of the secondary system.

EFW initiation also enables EFIC vector logic which performs an EFW control function to preclude the delivery of fluid to a depressurized SG, thereby avoiding an uncontrolled cooling condition as long as the other SG remains pressurized. When both of the SGs are depressurized, the EFIC vector logic provides EFW flow to both SGs until a significant pressure difference between the two SGs is developed, thereby ensuring that core cooling is maintained.

Each EFIC train actuates on a one-out-of-two taken twice combination of trip signals from the instrumentation channels. Each EFIC channel can issue an initiate command, but an EFIC actuation will take place only if at least two channels issue initiate commands. For the EFW Initiation and Main Steam Line Isolation functions, the one-out-of-two taken twice logic combinations are transposed between trains so that failure of two channels prevents actuation of, at most, one train.

1.) EFW Initiation

The individual instrumentation channels that serve EFIC EFW Initiation Function are discussed below.

a. Loss of MFW Pumps (Control Oil Pressure)

Loss of both MFW Pumps is one of the six parameters within the EFIC System that automatically initiates EFW. The MFW Pump status instrumentation, and associated bypasses, are internal to the Reactor Protection System (RPS). For RPS, loss of MFW Pumps is detected by MFW Pump turbine control oil pressure.

Each RPS channel receives MFW Pump status information from one of four pressure switches per pump. If both switches in a single channel trip (one from each pump), the associated RPS channel trips. Each RPS channel provides a contact input into its associated EFIC channel representative of both MFW Pumps tripped. At least two EFIC channels in trip are required for EFW Initiation. This Function is automatically bypassed when THERMAL POWER is < 10% RTP and the bypass is automatically removed when THERMAL POWER is ≥ 10% RTP.

The bypass functions occur internal to the RPS, i.e., prior to input to the EFIC System. This parameter value (i.e., 10% RTP) is a nominal value consistent with the requirements of LCO 3.3.1, "RPS Instrumentation."

b. SG Level – Low

Each EFIC channel has two level transmitters for each OTSG. One is a low range instrument which monitors the OTSG with a level range of 6" to 156" H2O. One is a high range instrument which monitors the OTSG with a level range of 102" to 500" H2O. These signals are combined and used by the EFIC SG Level Controllers; however, EFIC initiation is only supplied by the low range level detectors. SG level compensation is performed by the compensation module in each channel. SG pressure is used for level compensation.

Four EFIC dedicated low range level transmitters per SG are used to generate the signals used for detection for low level conditions for EFW actuation. There is one transmitter for each of the four channels A, B, C, and D. At least two channels are required to initiate EFW.

Signals from channels A and B are also used to control SG level at approximately 31 inches when one or more RCPs are operating.

c. SG Pressure – Low

Four transmitters per SG (one transmitter per channel) provide the EFIC System with channels A through D of SG Pressure - Low. These are the same transmitters used by the Main Steam Line Isolation Function. When the SG pressure at the transmitter drops below the bistable's TS Allowable Value of 584.2 psig on a given channel, an EFW Initiation signal is sent to the automatic actuation logic. At least two channels are required to initiate EFW and main steam line isolation. The low pressure Function may be manually bypassed when either SG is less than 750 psig. If both SG pressure inputs exceed 750 psig, the EFIC channel bypass is automatically removed. The low pressure operational bypass allows for normal cooldown without EFIC actuation.

As stated above, each EFIC channel has two OTSG pressure signal inputs (one from each OTSG). Each OTSG has four pressure transmitters (one for each EFIC channel) that have their sensing taps located in the steam line upstream of the MSIV's.

d. RCP Status

A loss of power to all four RCPs is an indication of a pending loss of forced flow in the Reactor Coolant System. These signals are input into the four channels of EFIC.

When at least two channels issue initiate commands based on loss of all RCPs, the EFIC System will automatically actuate EFW and control the level at approximately 312 inches in the SG. This higher level provides a thermal center in the SG at a higher elevation than that of the reactor to enhance natural circulation of the reactor coolant. This parameter is referenced to the top of the lower tube sheet. To allow heatup and cooldown operations without actuation, a bypass permissive of 10% RTP is used. The 10% bypass permissive was chosen because it was an available, qualified Class 1E signal at the time the EFIC System was designed.

When the first RCP is started, the "loss of four RCPs" initiation signal may be manually reset. If the bypass is not manually reset, it will be automatically reset when the unit reaches 10% power. Should the channel remain bypassed when ≥ 10% RTP, the channel is considered inoperable and appropriate conditions are entered. Failure of the automatic bypass removal feature alone or the inability to bypass a channel when below 10% RTP does not constitute channel inoperability.

During cooldown, the bypass may be inserted at any time the power has been reduced below 10% RTP. However, for most operating conditions, this trip function remains active until after the Decay Heat Removal System has been initiated and the system is ready for the last RCP to be tripped. This trip function must be bypassed prior to stopping the last RCP. This parameter value (i.e., 10% RTP) is a nominal value consistent with the requirements of LCO 3.3.1, "RPS Instrumentation."

e. ESAS

The EFIC System initiates EFW when an ESAS signal is initiated on low RCS pressure or high reactor building pressure (ESAS Channels 3 and 4) in order to support heat removal following ECCS actuation. This is a digital signal provided by the ESAS Automatic Actuation Logic.

f. DROPS

The EFIC System also initiates EFW on loss of main feedwater flow as part of the DROPS which is the system provided for ANO-1 to comply with requirements to reduce risk from an ATWS. The DROPS consists of the Diverse Scram System (DSS) and the ATWS Mitigation System Actuation Circuitry (AMSAC). EFW initiation for ATWS prevention and mitigation is not required by TS 3.3.11.

2.) EFW Vector Valve Control

The function of the EFW vector logic is to determine whether EFW should not be fed to one or the other SG once enabled by the EFW Initiation Function. This is to preclude the continued addition of EFW to a depressurized SG and, thus, to minimize the overcooling effects.

Each set of vector logic receives SG pressure information from bistables located in the input logic of the same EFIC channel. The pressure information received is:

a. SG A pressure less than 584.2 psig,
b. SG B pressure less than 584.2 psig,
c. SG A pressure 100 psid greater than SG B pressure, and
d. SG B pressure 100 psid greater than SG A pressure.

The vector logic outputs are in a neutral state until enabled by the train A or B trip logics. When enabled, the vector logic can issue close commands to the EFW control valves and open or closed commands to the EFW isolation valves per the selected channel assignments. The level control module provides input to the flow controllers which control the position of the EFW control valves. Each vector logic may isolate EFW to one SG or the other, never both.

3.) Main Steam Line Isolation

Four pressure transmitters (one transmitter per channel) per SG provide EFIC with channels A through D logic of SG pressure.

Bypass

One of the four initiation channels can be put into "maintenance bypass." Bypassing one initiation channel isolates that channel's signal to the functions fed from initiation channel but does not bypass the trip logic within the actuation train. An interlock feature prevents bypassing more than one channel at a time. In addition, since the EFIC System receives signals from the RPS, the maintenance bypass from the RPS is interlocked with the EFIC System. If one channel of the RPS is in maintenance bypass, only the corresponding channel of the EFIC may be bypassed (e.g., channel A, RPS, and channel A, EFIC). This ensures that only the corresponding channels of the EFIC and RPS are placed in maintenance bypass at the same time.

EFIC channel maintenance bypass does not bypass EFW Initiation from ESAS. The EFIC EFW initiation from ESAS is, however, bypassed when its associated ESAS channel is bypassed.

The EFIC System is designed to perform its intended EFW Initiation and Main Steam Line Isolation function with one channel in maintenance bypass (in effect, inoperable) concurrent with a postulated single failure in any one of the remaining channels.

Manual Control of EFW Components

Manual override capability of EFIC control signals exists in the control room on cabinet C09 for the following valves:

A. CV-2670, CV-2627, CV-2620, CV-2626 (EFW isolation valves),
B. CV-2667, CV-2617, CV-2613, CV-2663 (EFW turbine steam valves),
C. CV-2619, CV-2676 (atmospheric dump isolation valves),
D. CV-2630, CV-2680 (main feedwater isolation valves), and
E. CV-2645, CV-2646, CV-2647, CV-2648 (EFW flow control valves).

Position of the override control in any other than the "AUTO" position is continuously annunciated in the control room for each EFW train.

The EFW motor driven pump P7B may be stopped by placing its control room handswitch on C09 to the pull-to-lock position. This is annunciated as part of EFW train B.

The EFIC manual initiation capability provides the operator with the capability to actuate EFIC Functions from the control room in the absence of any other initiation condition. Manually actuated Functions include Main Steam Line Isolation for steam generator (SG) A, Main Steam Line Isolation for SG B, and Emergency Feedwater (EFW) Actuation. These Functions are provided in the event the operator determines that an EFIC Function is needed prior to automatic actuation or in the event that EFIC does not automatically actuate when required. These are backup Functions to those performed automatically by EFIC. The manual actuation of these functions may be performed from the Remote Switch Matrix (RSM), located on the main control boards (C09), or from the manual actuation trip switches located on the EFIC control cabinets in the control room. The required manual actuation logic within each train consists of two manual switches (one for Trip Bus 1 and one for Trip Bus 2). When one manual trip switch is depressed, a half trip occurs. When both manual trip switches are depressed, a full trip of the train actuation occurs for that particular Function. The Remote Switch Matrix and the EFIC control cabinet trip switches perform parallel functions and, therefore, any combination of switches depressed within a train that energizes both Trip Bus 1 and Trip Bus 2 for a given Function will result in an actuation of that Function. The use of two manual trip switches for each train of actuation logic allows testing without actuating the end devices and also reduces the possibility of accidental manual actuations.

Two manual initiation switches per actuation train (Train A and Train B) of each Function (A and B Main Steam Line Isolation, and EFW Actuation) are required to be OPERABLE. This requirement may be satisfied by the manual trip switches located on the Remote Switch Matrix on the main control board, by the trip switches located on the EFIC control cabinets, or by any combination of switches located on the Remote Switch Matrix and the EFIC control cabinets such that Trip Bus 1 and Trip Bus 2 are available for each EFIC Function in each of the two EFIC trains.

Table 5 presents the TS 3.3.11 EFIC logic descriptions for all the functions listed in TS Table 3.3.11-1, "Emergency Feedwater Initiation and Control System Instrumentation."

Table 6 presents the TS 3.3.12 EFIC Manual Initiation Instrumentation diversity.

**Table 5 Information to Support EFIC Instrumentation Diversity**

| EFIC Function | | Channels to Trip | Primary Transient / Accident Protection | Diverse Actuation Functions | Comments |
|---|---|---|---|---|---|
| 1. EFW Initiation | a. Loss of MFW Pumps | 1 out of 2 taken twice | - Main FW Line Break<br>- EFW Line Break<br>- Loss of All AC Power to Auxiliaries<br>- Steam Line Break<br>- Loss of All RCPs | - AMSAC initiates EFIC Ch. A and D directly if Rx power >45% and Main FW Flow <15%<br>- SG Level – Low | - MFW Pump status signals originate from RPS<br>- MFW Pump status automatically bypassed in RPS |
| | b. SG Level – Low | 1 out of 2 taken twice | - Loss of Feedwater<br>- Loss of Load<br>- Loss of All AC Power to Auxiliaries<br>- Steam Line Break | - AMSAC initiates EFIC Ch. A and D directly if Rx power >45% and Main FW Flow <15%<br>- SG Pressure – Low<br>- ESAS actuates EFW on ES Ch. 3 and 4 | - Low SG Level cannot be bypassed<br>- Each EFIC Channel receives a low range SG level signal from each SG |
| | c. SG Pressure – Low | 1 out of 2 taken twice | - Loss of Feedwater<br>- Loss of Load<br>- Loss of All AC Power to Auxiliaries<br>- Steam Line Break<br>- Feedwater Line Break | - AMSAC initiates EFIC Ch. A and D directly if Rx power >45% and Main FW Flow <15%<br>- SG Level Low<br>- ESAS actuates EFW on ES Ch. 3 and 4 | - SG pressure signals used for level compensation<br>- Components closed by vector isolation may be manually overridden on C09<br>- SG Pressure Low may be bypassed during plant shutdown on initiate module<br>- Each EFIC Channel receives a SG pressure signal from each SG |
| | d. RCP Status | 1 out of 2 taken twice | - Loss of All AC Power to Auxiliaries<br>- Loss of RCS Flow<br>- Loss of Power to Auxiliaries | - SG Level – Low<br>- SG Pressure – Low<br>- ESAS actuates EFW on ES Ch. 3 and 4 | - RCP status signals originate in RPS<br>- RCP Status trip may be bypassed during plant shutdown on initiate module |

| EFIC Function | | Channels to Trip | Primary Transient / Accident Protection | Diverse Actuation Functions | Comments |
|---|---|---|---|---|---|
| 2. EFW Vector Valve Control | a. SG Pressure – Low | 1 out of 2 taken twice | - Loss of Feedwater<br>- Loss of Load<br>- Loss of All AC Power to Auxiliaries<br>- Steam Line Break<br>- Feedwater Line Break | - AMSAC initiates EFIC Ch. A and D directly if Rx power >45% and Main FW Flow <15%<br>- SG Level Low<br>- ESAS actuates EFW on ES Ch. 3 and 4 | - SG pressure signals used for level compensation<br>- Components closed by vector isolation may be manually overridden on C09<br>- Components may be manually operated to control flow to SG on C09<br>- Each EFIC Channel receives a SG pressure signal from each SG |
| | b. SG Differential Pressure - High | 1 out of 2 taken twice | - One SG affected by a:<br>- Steam Line Break<br>- Feedwater Line Break<br>- Loss of Feedwater | - AMSAC initiates EFIC Ch. A and D directly if Rx power >45% and Main FW Flow <15%<br>- SG Level Low<br>- ESAS actuates EFW on ES Ch. 3 and 4 | - Components closed by vector isolation may be manually overridden on C09<br>- Components may be manually operated to control flow to SG on C09 |
| 3. Main Steam Line Isolation | a. SG Pressure - Low | 1 out of 2 taken twice | - Steam Line Break<br>- Feedwater Line Break | - AMSAC initiates EFIC Ch. A and D directly if Rx power >45% and Main FW Flow <15%<br>- SG Level Low<br>- ESAS actuates EFW on ES Ch. 3 and 4 | - SG Pressure signals used for level compensation<br>- Each EFIC Channel receives a SG pressure signal from each SG |

**Table 6 Information to Support EFIC Manual Initiation Instrumentation Diversity**

| Function | Safety Function | Accident or Plant Condition | Diverse Methods |
|---|---|---|---|
| a. Steam generator (SG) A Main Steam Line Isolation | "A" Main Steam Line Isolation (MSLI) | Steam or Feedwater Line Break Affecting "A" SG | - Depress "A" SG MSLI switch on RSM<br>- Depress "A" SG MSLI switch on EFIC Control Cabinet<br>- Manually actuate "A" MSLI components on C09 |
| b. SG B Main Steam Line Isolation | "B" MSLI | Steam or Feedwater Line Break Affecting "B" SG | - Depress "B" SG MSLI switch on RSM<br>- Depress "B" SG MSLI switch on EFIC Control Cabinet<br>- Manually actuate "B" MSLI components on C09 |
| c. Emergency Feedwater (EFW) Initiation | Emergency Feedwater | Loss of Main Feedwater (MFW) to either SG | - Depress redundant EFW switch on RSM<br>- Depress redundant EFW switch on EFIC Control Cabinets |

**Supplemental Request 2.a**

On PDF page 35 of 323 (see also PDF page 159 & 181) of the application, LCO 3.3.12 Condition C, appears to be a loss of function. The NRC staff notes that it does not matter whether the function is credited in the accident analysis (see justification at the top of PDF page 181). Please explain.

_Entergy Response:_

TS 3.3.12, "Emergency Feedwater Initiation and Control (EFIC) Manual Initiation" states:

LCO 3.3.12 Two manual initiation switches per actuation train for each of the following EFIC Functions shall be OPERABLE:

> a. Steam generator (SG) A Main Steam Line Isolation,
> b. SG B Main Steam Line Isolation, and
> c. Emergency Feedwater (EFW) Initiation.

APPLICABILITY: When associated EFIC Function is required to be OPERABLE.

Condition C states:

> One or more EFIC Function(s) with one or both required manual initiation switches inoperable in both actuation trains.

Required Action C.1 states:

> Restore one actuation train for the associated EFIC Function(s) to OPERABLE status within 1 hour

The Background in the basis for TS 3.3.12 states the following:

> *"The manual actuation of these functions may be performed from the Remote Switch Matrix, located on the main control boards, or from the manual actuation trip switches located on the EFIC control cabinets in the control room. The required manual actuation logic within each train consists of two manual switches (one for Trip Bus 1 and one for Trip Bus 2). When one manual trip switch is depressed, a half trip occurs. When both manual trip switches are depressed, a full trip of the train actuation occurs for that particular Function. The Remote Switch Matrix and the EFIC control cabinet trip switches perform parallel functions and, therefore, any combination of switches depressed within a train that energizes both Trip Bus 1 and Trip Bus 2 for a given Function will result in an actuation of that Function."*

The Applicable Safety Analysis of the basis states:

> *"EFIC Functions credited in the safety analysis are automatic. However, the manual initiation Functions are required by design as backups to the automatic initiation Functions and allow operators to actuate EFW or Main Steam Line Isolation whenever these Functions are needed. Furthermore, the manual initiation of EFW and Main Steam Line Isolation may be specified in unit operating procedures.*

> *The EFIC manual initiation functions satisfy Criterion 4 of 10 CFR 50.36 (Ref. 2)."*

The Basis for the LCO states:

> *"Instrumentation on the main control board performing an EFIC manual initiation Function shall be OPERABLE.*
>
> *Two manual initiation switches per actuation train (Train A and Train B) of each Function (A and B Main Steam Line Isolation, and EFW Actuation) are required to be OPERABLE. This requirement may be satisfied by the manual trip switches located on the Remote Switch Matrix on the main control board, by the trip switches located on the EFIC control cabinets, or by any combination of switches located on the Remote Switch Matrix and the EFIC control cabinets such that Trip Bus 1 and Trip Bus 2 are available for each EFIC Function in each of the two EFIC trains."*

The Bases for Required Action C.1 states:

> *"With one or both required manual initiation switches of one or more EFIC Function(s) inoperable in both actuation trains, one actuation train for each Function must be restored to OPERABLE status within 1 hour. With the train restored, the second train must be placed in the appropriate condition within 72 hours per Required Action A.1 or B.1, as applicable. Compliance with these actions ensures the single-failure criterion is met. The Completion Time allotted to restore the train allows the operator to take all the appropriate actions for the failed train and still ensures that the risk involved in operating with the failed train is acceptable."*

The NUREG 1430 Rev. 5 basis for its Condition B.1 (same as ANO-1 Condition C.1) states that following:

> *"B.1*
> *With one or both manual initiation switches of one or more EFIC Function(s) inoperable in both actuation channels, one actuation channel for each Function must be restored to OPERABLE status within 1 hour [or in accordance with the Risk Informed Completion Time Program]. With the channel restored, the second channel must be placed in the tripped condition within 72 hours (Required Action A.1). With the channel in the tripped condition, the single-failure criterion is met, and the operator can still initiate one actuation channel given a single failure in the other channel. The Completion Time allotted to restore the channel allows the operator to take all the appropriate actions for the failed channel and still ensures that the risk involved in operating with the failed channel is acceptable."*

Note that the Bases in the Standard Technical Specifications (STS) does not overtly credit the manual actuation switches on the EFIC control cabinets like the ANO TS Bases. Also note that both the STS and the TSTF-505 Rev. 2 both include the option to apply RICT to this LCO. If one does not assume that more than two manual initiation switches exist for each train of EFW and MSLI, then a loss of function would exist if one switch per train of a function (or functions) were lost or if both switches of the same train were lost for a function (or functions). ANO credits the manual switches located on the EFIC control cabinets as well as the pushbutton switches on the EFIC Remote Switch Matrix (RSM). As long as one switch per train of a function exists on either or both the EFIC Control Cabinets or the RSM, then that function remains capable of being manually actuated by the operator. If the malfunction renders BOTH the same trip bus and train's switches on the EFIC Control Cabinet and the RSM inoperable, then this would be a loss of the capability to manually actuate that function for the affected train, and if this were to occur for both trains' respective function (or both trains' respective functions), then a loss of function would be the result.

As LCO 3.3.12 states:

> *Two manual initiation switches per actuation train for each of the following EFIC Functions shall be OPERABLE.*

For ANO-1, there exist four manual initiation switches per actuation train for each EFIC function – two on the RSM, and two on the EFIC Control Cabinet, and they each may be credited for satisfying this LCO.

Page 181 states the following for justification of applying RICT to LCO 3.3.12:

> *"With one or more EFIC functions with one required manual initiation switch inoperable in one actuation train, assuming no single failures are present on the redundant train, the redundant train may still be actuated via the operable manual initiation switches. Likewise, with one or more EFIC functions with both required manual initiation switches inoperable in one actuation train, the redundant train may still be actuated via the operable manual initiation switches.*
>
> *Because both trip buses must be actuated for a function in order for that function to result in train actuation, a loss of the manual initiation capability would result if the manual initiation switches on both trains were inoperable. However, this does not prevent the automatic actuation features of EFIC. Because automatic features remain available, the EFW and MSLI safety functions will continue to be met. The accident analyses assume EFIC will actuate automatically and that associated systems will respond within an assumed time period. Manual actuation is an operator aid and is not relied upon in the accident analyses. Therefore, the proposed configuration is acceptable because the RICT will consider the risk of a potential loss of automatic features before being applied."*

Entergy agrees that the model SE for TSTF-505 Revision 2 limits applicability of the TSTF to conditions that are not considered TS loss of function (LOF). In this case, Entergy wishes to add the justification above (ANO-1 has four, not just two, manual actuation switches per train per function) and retract the paragraph that the safety analysis credits automatic actuation instead of manual actuation for the justification why LCO 3.3.12 Action C.1 may have RICT applied. Entergy also would like to add a note to the condition stating that RICT may not be used if a loss of function exists (e.g. all four actuation switches for a function are inoperable, or any two of the same switches (one switch on the RSM and its corresponding switch on the EFIC Control Panel) are inoperable for each EFIC actuation train such that the operator may only be able to perform a half trip for each train without the capability to complete a full trip for either train.

TSTF-505 and Regulatory Guide 1.174 state:

> *With respect to EFW components and the EFIC system manual trip function, TS Section 3.3.12, "Emergency Feedwater Initiation and Control (EFIC) Manual Initiation," should confirm that at least one redundant or diverse means (other <u>automatic</u> features or <u>manual action</u>) <u>to accomplish the safety functions</u> (for example, reactor trip, safety injection, reactor building isolation, etc.) <u>remains available during use of the RICT</u>, consistent with the defense-in-depth philosophy as specified in RG 1.174.]*

All of the EFIC actuated components (e.g., EFW pumps, steam valves, flow control valves, isolation valves, and suction source valves) may be operated in manual mode control in the event a manual EFIC control system actuation does not or cannot occur due to malfunctions. Although these would be manually performed actions, they are procedurally driven by the Emergency Operating Procedures (EOPs) as Repetitive Tasks (RTs), and the control board operators are well trained in their use. This is consistent with the defense-in-depth philosophy as specified in RG 1.174.

The following note is to be added to the Completion Time for Condition C which modifies when the Risk Informed Completion Time may be applied:

*NOTE: Not applicable when unable to manually initiate an EFIC Function.*

The marked up TS is included in Attachment 2, the retyped TS is included in Attachment 3, and both are intended to replace the corresponding TS pages in the original LAR.

References:

1. Entergy, PSA-ANO1-01-AS-01, "ANO-1 Anticipated Transient Without SCRAM (ATWS) Analysis," Revision 1, October 2019

2. Entergy, COPD-024, "Risk Assessment Guidelines", Revision 75, March 2023

3. Entergy, PSA-ANO1-06-4B-SOU, "ANO-1 PRA – Assessment of Key Assumptions and Sources of Uncertainty for TSTF-505 (RICT) Submittal," Revision 0, February 2023

4. Twisdale, L.A., et al., "Tornado Missile Risk Analysis," NP-768, Electric Power Research Institute, Palo Alto, California, May 1978

5. Entergy, PSA-ANOC-06-4B-TORMIS, "Tornado Missile and Pressure Fragilities for Select ANO SSCs," Revision 0, October 2022

6. Letter from Entergy to NRC, "License Amendment Request to Incorporate Tornado Missile Risk Evaluator (TMRE) into the Licensing Basis" (ML19119A090) (0CAN041904) dated April 29, 2019

7. Entergy, CALC-ANOC-MS-18-00009, "ANO-1 TMRE Exposed Equipment Failure Probability (EEFP) Development Report", Revision 3, February 2019

8. Letter from Entergy to NRC, "License Amendment Request to Revise Technical Specifications to Adopt Risk-Informed Completion Times TSTF-505, Revision 2, 'Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4' " (ML22356A249) (1CAN122201) dated December 22, 2022

9. NRC, "Final Revised Model Safety Evaluation by the Office of Nuclear Reactor Regulation Technical Specifications Task Force Traveler TSTF-505, Revision 2 'Provide Risk-Informed Extended Completion Times – RITSTF Initiative 4B' " (ML18267A259) dated November 21, 2018

**Attachment 2**

**1CAN092301**

**Technical Specification Page Markups**

[3 pages]

## 3.3 INSTRUMENTATION

### 3.3.12 Emergency Feedwater Initiation and Control (EFIC) Manual Initiation

LCO 3.3.12 Two manual initiation switches per actuation train for each of the following EFIC Functions shall be OPERABLE:

a. Steam generator (SG) A Main Steam Line Isolation;

b. SG B Main Steam Line Isolation; and

c. Emergency Feedwater (EFW) Initiation.

APPLICABILITY: When associated EFIC Function is required to be OPERABLE.

ACTIONS

------------------------------------------------------NOTE------------------------------------------------------
Separate Condition entry is allowed for each Function.
------------------------------------------------------------------------------------------------------------------

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. One or more EFIC Function(s) with one required manual initiation switch inoperable in one actuation train. | A.1 Place affected trip bus in the affected train for the associated EFIC Function(s) in trip. | 72 hours<br><br>OR<br><br>In accordance with the Risk Informed Completion Time Program |
| B. One or more EFIC Function(s) with both required manual initiation switches inoperable in a single actuation train. | B.1 Restore one manual initiation switch for each of the affected EFIC Function(s) to OPERABLE status. | 72 hours<br><br>OR<br><br>In accordance with the Risk Informed Completion Time Program |
| C. One or more EFIC Function(s) with one or both required manual initiation switches | C.1 Restore one actuation train for the associated EFIC Function(s) to OPERABLE status. | 1 hour<br><br>OR |

Move to Pg 3.3.12-2

| | | |
|---|---|---|
| inoperable in both actuation trains. | | --------- NOTE ------- Not applicable when unable to manually initiate an EFIC Function. --------------------------<br><br>In accordance with the Risk Informed Completion Time Program |

## 5.0 ADMINISTRATIVE CONTROLS

### 5.5 Programs and Manuals

c. When a RICT is being used, any change to the plant configuration, as defined in NEI 06-09-A, Appendix A, must be considered for the effect on the RICT.

   1. For planned changes, the revised RICT must be determined prior to implementation of the change in configuration.

   2. For emergent conditions, the revised RICT must be determined within the time limits of the Required Action Completion Time (i.e., not the RICT) or 12 hours after the plant configuration change, whichever is less.

   3. Revising the RICT is not required If the plant configuration change would lower plant risk and would result in a longer RICT.

d. For emergent conditions, if the extent of condition evaluation for inoperable structures, systems, or components (SSCs) is not complete prior to exceeding the Completion Time, the RICT shall account for the increased possibility of common cause failure (CCF) by either:

   1. Numerically accounting for the increased possibility of CCF in the RICT calculation; or

   2. Risk Management Actions (RMAs) not already credited in the RICT calculation shall be implemented that support redundant or diverse SSCs that perform the function(s) of the inoperable SSCs, and, if practicable, reduce the frequency of initiating events that challenge the function(s) performed by the inoperable SSCs.

e. The risk assessment approaches and methods shall be acceptable to the NRC. The plant PRA shall be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant, as specified in Regulatory Guide 1.200, Revision 2. Methods to assess the risk from extending the Completion Times must be PRA methods approved for use with this program, or other methods approved by the NRC for generic use; and any change in the PRA methods to assess risk that are outside these approval boundaries require prior NRC approval.

**Attachment 3**

**1CAN092301**

**Retyped Technical Specification Pages**

[3 Pages]

## 3.3 INSTRUMENTATION

### 3.3.12 Emergency Feedwater Initiation and Control (EFIC) Manual Initiation

LCO 3.3.12 Two manual initiation switches per actuation train for each of the following EFIC Functions shall be OPERABLE:

a. Steam generator (SG) A Main Steam Line Isolation;

b. SG B Main Steam Line Isolation; and

c. Emergency Feedwater (EFW) Initiation.

APPLICABILITY: When associated EFIC Function is required to be OPERABLE.

ACTIONS

------------------------------------------------------NOTE------------------------------------------------------
Separate Condition entry is allowed for each Function.
----------------------------------------------------------------------------------------------------------------------

| CONDITION | REQUIRED ACTION | COMPLETION TIME |
|---|---|---|
| A. One or more EFIC Function(s) with one required manual initiation switch inoperable in one actuation train. | A.1 Place affected trip bus in the affected train for the associated EFIC Function(s) in trip. | 72 hours<br><br><u>OR</u><br><br>In accordance with the Risk Informed Completion Time Program |
| B. One or more EFIC Function(s) with both required manual initiation switches inoperable in a single actuation train. | B.1 Restore one manual initiation switch for each of the affected EFIC Function(s) to OPERABLE status. | 72 hours<br><br><u>OR</u><br><br>In accordance with the Risk Informed Completion Time Program |

| CONDITION | REQUIRED ACTION | | COMPLETION TIME |
|---|---|---|---|
| C. One or more EFIC Function(s) with one or both required manual initiation switches inoperable in both actuation trains. | C.1 | Restore one actuation train for the associated EFIC Function(s) to OPERABLE status. | 1 hour<br><br>OR<br><br>--------- NOTE -------<br>Not applicable when unable to manually initiate an EFIC Function.<br>--------------------------<br><br>In accordance with the Risk Informed Completion Time Program |
| D. Required Action and associated Completion Time not met for EFW Initiation Function. | D.1 | Be in MODE 3. | 6 hours |
| | AND | | |
| | D.2 | Be in MODE 4. | 12 hours |
| E. Required Action and associated Completion Time not met for Main Steam Line Isolation Function. | E.1 | Be in MODE 3. | 6 hours |
| | AND | | |
| | E.2.1 | Reduce steam generator pressure to < 750 psig. | 12 hours |
| | OR | | |
| | E.2.2 | Close and deactivate all associated valves. | 12 hours |

SURVEILLANCE REQUIREMENTS

| SURVEILLANCE | | FREQUENCY |
|---|---|---|
| SR 3.3.12.1 | Perform CHANNEL FUNCTIONAL TEST. | In accordance with the Surveillance Frequency Control Program |

5.0 ADMINISTRATIVE CONTROLS

5.5 Programs and Manuals

c. When a RICT is being used, any change to the plant configuration, as defined in NEI 06-09-A, Appendix A, must be considered for the effect on the RICT.

   1. For planned changes, the revised RICT must be determined prior to implementation of the change in configuration.

   2. For emergent conditions, the revised RICT must be determined within the time limits of the Required Action Completion Time (i.e., not the RICT) or 12 hours after the plant configuration change, whichever is less.

   3. Revising the RICT is not required If the plant configuration change would lower plant risk and would result in a longer RICT.

d. For emergent conditions, if the extent of condition evaluation for inoperable structures, systems, or components (SSCs) is not complete prior to exceeding the Completion Time, the RICT shall account for the increased possibility of common cause failure (CCF) by either:

   1. Numerically accounting for the increased possibility of CCF in the RICT calculation; or

   2. Risk Management Actions (RMAs) not already credited in the RICT calculation shall be implemented that support redundant or diverse SSCs that perform the function(s) of the inoperable SSCs, and, if practicable, reduce the frequency of initiating events that challenge the function(s) performed by the inoperable SSCs.

e. The risk assessment approaches and methods shall be acceptable to the NRC. The plant PRA shall be based on the as-built, as-operated, and maintained plant; and reflect the operating experience at the plant, as specified in Regulatory Guide 1.200, Revision 2. Methods to assess the risk from extending the Completion Times must be PRA methods approved for use with this program, or other methods approved by the NRC for generic use; and any change in the PRA methods to assess risk that are outside these approval boundaries require prior NRC approval.

**Attachment 4**

**1CAN092301**

**Modified Entries to Table E1-1,**
**"In Scope TS/LCO Conditions to Corresponding PRA Functions"**

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.3.1, Reactor Protective System (RPS) Instrumentation** | | | | | | |
| Four channels of RPS instrumentation shall be operable<br>Required Action B.1<br>With two channels inoperable, place one channel in trip within 1 hour<br>(ITS 3.3.1, Required Action B.1) | Instruments outlined in Table 3.3.1-1 | Not explicitly | Reactor trip initiation | Two-out-of-four coincidence logic required to initiate a reactor trip via input to the Reactor Trip Module (RTM) channels | Same as Design Criteria | All four trip circuits are modeled (A, B,C,D). However, only the analog pressure and temperature sensor transmitters are credited for initiating the trip signal for the PRA accident sequences. Other sensors can also generate trip signals but are not modeled in the PRA. Surrogates can be used at the RPS channel trip logic for instrumentation not in the model for generating risk estimates.<br>Therefore, SSCs can be modeled at the RPS channels to be consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of Enclosure 1. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.3.6, Engineered Safeguards Actuation System (ESAS) Manual Initiation** | | | | | | |
| Two ESAS manual initiation channels shall be operable<br>Required Action A.1<br>One or more Functions with one channel inoperable, restore channel within 72 hours<br>(ITS 3.3.6, Required Action A.1) | High Pressure Injection (HPI)<br>Low Pressure Injection (LPI)<br>Reactor Building (RB) Cooling<br>RB Spray | Not explicitly | LCO 3.3.6 covers only the system level manual initiation of the ESAS Functions | One-out-of-two manual pushbuttons required for each ESAS Function | Same as Design Criteria | The manual initiation for every ESAS function is not modeled for every PRA function. For functions where the manual initiation is modeled, no surrogate is needed. For functions where the manual initiation is not modeled the sample RICT calculations failed a train of automatic initiation using the events associated with master relays or automatic functions as surrogate modeling for calculating a conservative RICT estimate. The failure rate of the operator action to manually initiate the ESAS logic is conservative relative to the failure rates of the automatic system and its designed redundancies. As a result, failing the automatic functions is a conservative surrogate relative to the manual function. A discussion of system design is included in Section 3 of Enclosure 1. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.3.12, Emergency Feedwater Initiation and Control (EFIC) Manual Initiation** | | | | | | |
| Two manual initiation switches per actuation train for each EFIC Function shall be operable<br><br><u>Required Action A.1</u><br><br>One or more EFIC Function(s) with one required manual initiation switch inoperable in one actuation train, place affected trip bus in the affected train for the associated EFIC Function(s) in trip within 72 hours<br><br>(ITS 3.3.12, Required Action A.1) | EFW<br><br>MSLI | Not explicitly | EFW (RCS heat removal)<br><br>MSLI (RCS pressure, temperature, and inventory control) | At least one EFW train and isolation of one of the two main steam isolation valves (MSIVs) required to meet accident analyses assumptions (blowdown limited to one SG) | Same as Design Criteria | The manual initiation for every EFIC/MSLI function is not modeled for every PRA function. For functions where the manual initiation is modeled, no surrogate is needed. For functions where the manual initiation is not modeled the sample RICT calculations failed a train of automatic initiation using the events associated with master relays or automatic functions as surrogate modeling for calculating a conservative RICT estimate. The failure rate of the operator action to manually initiate the EFIC/MSLI logic is conservative relative to the failure rates of the automatic system and its designed redundancies. As a result, failing the automatic functions is a conservative surrogate relative to the manual function. Additional justification required by TSTF-505 is included in Section 2 of Enclosure 1. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| Two manual initiation switches per actuation train for each EFIC Function shall be operable<br>Required Action B.1<br>One or more EFIC Function(s) with both required manual initiation switch inoperable in a single actuation train, restore one manual initiation switch for each of the affected EFIC Function(s) within 72 hours<br>(ITS 3.3.12,<br>Required Action A.1) | EFW<br>MSLI | Not explicitly | EFW (RCS heat removal)<br>MSLI (RCS pressure, temperature, and inventory control) | At least one EFW train and isolation of one of the two main steam isolation valves (MSIVs) required to meet accident analyses assumptions (blowdown limited to one SG) | Same as Design Criteria | The manual initiation for every EFIC/MSLI function is not modeled for every PRA function. For functions where the manual initiation is modeled, no surrogate is needed. For functions where the manual initiation is not modeled the sample RICT calculations failed a train of automatic initiation using the events associated with master relays or automatic functions as surrogate modeling for calculating a conservative RICT estimate. The failure rate of the operator action to manually initiate the EFIC/MSLI logic is conservative relative to the failure rates of the automatic system and its designed redundancies. As a result, failing the automatic functions is a conservative surrogate relative to the manual function. Additional justification required by TSTF-505 is included in Section 2 of Enclosure 1. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.6.2, Reactor Building Air Locks** | | | | | | |
| Two RB air locks shall be operable<br>Required Action C.3<br>One or more reactor building air locks inoperable for reasons other than Condition A or B, restore within 24 hours<br>(ITS 3.6.2, Required Action C.3) | RB | Not explicitly | RB integrity | At least one door in each air lock closed and sealed | Same as Design Criteria | SSCs are not modeled in the PRA. A pre-existing containment failure for large leaks can be modeled as a conservative surrogate in the PRA LERF assessment. This event assumes there is a pre-existing containment flaw at the time of the accident. Therefore, the RICT calculations go straight to bypass. Additional justification required by TSTF-505 is included in Section 2 of Enclosure 1. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.6.3, Reactor Building Isolation Valves** | | | | | | |
| Each RB isolation valve shall be operable<br><br>Required Action A.1<br><br>One or more penetration flow paths with one reactor building isolation valve inoperable, isolate flow path within 48 hours<br><br>(ITS 3.6.3, Required Action A.1) | RB | Yes | RB integrity | At least one valve in each penetration is assumed to be closed upon receipt of associated ESAS signal | At least one valve in each penetration is assumed to be closed upon receipt of associated ESAS signal for penetrations with a diameter of > 2 inches | The RB isolation function is a PRA modeled function.<br><br>SSCs for penetrations that exceed the PRA success criteria for LERF (2 inches or larger) are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program.<br><br>Any RB isolation valve that is screened due to size (< 2 inches) from the PRA model, has no contribution to CDF or LERF and delta risk calculation is limited to the seismic and high winds penalty factors.<br><br>For conditions where multiple screened penetrations are open (exceeding the 2 inches or larger criteria), a representative surrogate will be selected, such as the use of a modeled containment pathway that represents the bypass of containment.<br><br>For all cases where a surrogate is used, a conservative or actual failure rate can be used in the RICT calculations to represent the available isolable penetration in the surrogate modeling. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| Each RB isolation valve shall be operable<br><u>Required Action C.1</u><br>One or more penetration flow paths with one reactor building isolation valve inoperable, restore within 72 hours<br>(ITS 3.6.3, Required Action C.1) | RB | Not explicitly | RB integrity | At least one valve in each penetration is assumed to be closed upon receipt of associated ESAS signal | Isolation failures for each penetration where the associated piping is connected directly to the RB atmosphere or the RCS and has a diameter of > 2 inches | The RB isolation function is a PRA modeled function. However, penetrations that are not directly connected to the RCS or RB atmosphere are typically screened due to low likelihood of a pipe rupture concurrent with a plant accident/transient.<br>SSCs for penetrations that are 2 inches or larger that are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program.<br>SSCs for penetrations that are 2 inches or larger that have been screened from the PRA can be evaluated using a modeled penetration as a surrogate for penetrations screened due to the low frequency of a pipe rupture.<br>Any RB isolation valve that is screened due to size (< 2 inches) from the PRA model, has no contribution to CDF or LERF. Therefore, the PRA delta risk calculation contribution will be limited to the seismic and high winds penalty factors.<br>For conditions where multiple screened penetrations are open (exceeding the 2 inches or larger criteria), a representative surrogate will be selected, such as the use of a modeled containment pathway that represents the bypass of containment.<br>For all cases where a surrogate is used, a conservative or actual failure rate can be used in the RICT calculations to represent the available isolable penetration in the surrogate modeling. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.6.5, Reactor Building Spray and Cooling Systems** | | | | | | |
| Two RB spray trains and two RB cooling trains shall be operable<br>Required Action A.1<br>One RB spray train inoperable, restore within 72 hours<br>(ITS 3.6.6, Required Action A.1) | RB Spray | Not explicitly | RB integrity | At least one RB spray and one RB cooling train required to meet accident analyses assumptions | One RB cooling train required to meet the PRA success criteria. RB spray is not modeled. | The RB sprays are not included in the PRA success criteria. Thermal hydraulic analysis concluded that that RB Cooling System is sufficient for reducing post-accident building pressure following a loss of coolant accident (LOCA). Therefore, the PRA conservatively models only the RB Cooling System's function for maintaining RB integrity and reducing the driving force of leakage of radioactive materials from the RB in the PRA. The failures of one train of reactor building coolers (units VSF-1A and VSF-1C or VSF-1B and VSF-1D) can be used as a PRA surrogate for the failure of one RB spray train. See additional justification required by TSTF-505, included in Section 2 of Enclosure 1, for details on the PRA and the modeling of the associated functions. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.8.1, AC Sources – Operating** | | | | | | |
| Two offsite circuits and two DGs shall be operable<br><u>Required Action A.3</u><br>One offsite circuit inoperable, restore within 72 hours<br>(ITS 3.8.1, Required Action A.3) | Vital AC electrical power sources | Yes | AC electrical power to associated TS-required SSCs | At least one AC electrical train, powered by either an offsite circuit or a DG, is required to meet accident analyses assumptions | Same as Design Criteria | SSCs are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of this enclosure. |
| Two offsite circuits and two DGs shall be operable<br><u>Required Action B.4</u><br>One DG inoperable, restore within 7 days<br>(ITS 3.8.1, Required Action B.4) | Vital AC electrical power sources | Yes | AC electrical power to associated TS-required SSCs | At least one AC electrical train, powered by either an offsite circuit or a DG, is required to meet accident analyses assumptions | Same as Design Criteria | SSCs are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of this enclosure. |
| Two offsite circuits and two DGs shall be operable<br><u>Required Action C.2</u><br>Two offsite circuits inoperable, restore one offsite circuit within 24 hours<br>(ITS 3.8.1, Required Action C.2) | Vital AC electrical power sources | Yes | AC electrical power to associated TS-required SSCs | At least one AC electrical train powered by a DG is required to meet accident analyses assumptions | Same as Design Criteria | SSCs are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of this enclosure. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| Two offsite circuits and two DGs shall be operable<br><u>Required Actions D.1 and D.2</u><br>One offsite circuit AND one DG inoperable, restore at least one source within 12 hours<br>(ITS 3.8.1, Required Actions D.1 and D.2) | Vital AC electrical power sources | Yes | AC electrical power to associated TS-required SSCs | At least one AC electrical train powered by either an offsite circuit or a DG is required to meet accident analyses assumptions | Same as Design Criteria | SSCs are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of this enclosure. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| **3.8.9, Distribution Systems – Operating** | | | | | | |
| Two AC, DC, and 120 VAC electrical power distribution subsystems shall be operable<br><u>Required Action A.1</u><br>One or more AC electrical power distribution subsystem(s) inoperable, restore subsystem within 8 hours<br>(ITS 3.8.9, Required Action A.1) | Associated vital buses, load centers, and motor control centers | Yes | AC electrical power to associated TS-required SSCs | At least one AC electrical power distribution subsystem is required to meet accident analyses assumptions. The AC subsystem consists of the following SSCs: a 4160V Engineered Safeguard Bus, a 480V Load Center, and 480V Motor Control Centers (reference TS Bases Table B 3.8.9-1 for specific subsystem requirements.) | Same as Design Criteria | SSCs are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of this enclosure. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| Two AC, DC, and 120 VAC electrical power distribution subsystems shall be operable<br>Required Action B.1<br>One or more 120 VAC electrical power distribution subsystem(s) (RS1, RS2, RS3, RS4) inoperable, restore subsystem within 8 hours<br>(ITS 3.8.9, Required Action B.1) | 120 VAC electrical power distribution subsystems RS1, RS2, RS3, RS4 | Yes | Supply required AC instrument power to required loads | At least one 120 VAC electrical power distribution subsystem is required to meet accident analyses assumptions. The 120 VAC subsystem consists of two 120 VAC distribution panels (reference TS Bases Table B 3.8.9-1 for specific subsystem requirements.) | Same as Design Criteria | SSCs are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of this enclosure. |

| Modified Entries to Table E1-1, In Scope TS/LCO Conditions to Corresponding PRA Functions | | | | | | |
|---|---|---|---|---|---|---|
| **TS and Condition Description** | **SSCs Covered by TS Condition** | **SSC in PRA Model** | **Functions Covered by TS Condition** | **Design Success Criteria** | **PRA Success Criteria** | **Disposition** |
| Two AC, DC, and 120 VAC electrical power distribution subsystems shall be operable<br><br>Required Action C.1<br><br>One or more DC electrical power distribution subsystem(s) inoperable, restore subsystem within 8 hours<br><br>(ITS 3.8.9, Required Action C.1) | Vital DC panels D01, D02, RA1, RA2, D11, D15, D21, D25 | Yes | DC electrical power to associated TS-required SSCs | At least one DC electrical power distribution subsystem is required to meet accident analyses assumptions. The DC subsystem consists of the following SSCs: two 125 VDC Buses and a 125 VDC Distribution Panel (reference TS Bases Table B 3.8.9-1 for specific subsystem requirements.) | Same as Design Criteria | SSCs are modeled consistent with the TS scope and can be directly included in the CRMP tool for the RICT program. A discussion of system design is included in Section 3 of this enclosure. |