

NRR-DRMAPEm Resource

From: Wengert, Thomas
Sent: Monday, October 7, 2019 7:26 AM
To: Arnold, Timothy
Cc: BICE, DAVID B (ANO); Pascarelli, Robert
Subject: ANO-1 and 2 -- Final RAI #1 RE: License Amendment Request to Incorporate Tornado Missile Risk Evaluator (TMRE) Into Licensing Basis (EPID L-2019-LLA-0093)
Attachments: ANO - Final RAI #1 for TMRE LAR.pdf

On September 20, 2019, the U.S. Nuclear Regulatory Commission (NRC) staff sent Entergy Operations, Inc. (Entergy) the draft Request for Additional Information (RAI) identified below. This RAI relates to the license amendment request (LAR) to change the license basis documents for Arkansas Nuclear One, Units 1 and 2 to use the Tornado Missile Risk Evaluator (TMRE) methodology as the licensing basis to qualify several components that have been identified as not conforming to the unit-specific current licensing basis.

Entergy subsequently informed the NRC staff that the information requested by the NRC staff was understood and that no additional clarification of the RAI was necessary. A publicly available version of this final RAI (attached with "Draft" removed) will be placed in the NRC's Agencywide Documents Access and Management System (ADAMS). As agreed, please provide a response to this RAI by December 19, 2019 (i.e., within 90 days of the date of the draft RAI).

From: Wengert, Thomas
Sent: Friday, September 20, 2019 1:26 PM
To: Arnold, Timothy
Cc: BICE, DAVID B (ANO) ; Pascarelli, Robert
Subject: ANO-1 and 2 Draft RAI RE: License Amendment Request to Incorporate Tornado Missile Risk Evaluator (TMRE) Into Licensing Basis (EPID L-2019-LLA-0093)

By letter dated April 29, 2019 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19119A090), Entergy Operations, Inc. submitted a license amendment request for Arkansas Nuclear One, Units 1 and 2 (ANO). Specifically, the proposed amendments would change the license basis documents for Arkansas Nuclear One, Units 1 and 2 to use the Tornado Missile Risk Evaluator (TMRE) methodology as the licensing basis to qualify several components that have been identified as not conforming to the unit-specific current licensing basis. The TMRE methodology was transmitted to the U.S. Nuclear Regulatory Commission (NRC) by the Nuclear Energy Institute (NEI) as NEI Technical Report 17-02, Revision 1, on September 21, 2017 (ADAMS Accession Nos. ML17268A033 and ML17268A036).

The NRC staff has determined that additional information, as described in the attached request for additional information (RAI), is required for the staff to complete its review of this application. This RAI is identified as draft at this time to confirm your understanding of the information that the NRC staff needs to complete the evaluation. If the request for information is understood, please respond to this RAI within 30 days of the date of this request.

Please contact me if you would like to set up a conference call with the NRC staff to clarify this request for information.

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REQUEST FOR ADDITIONAL INFORMATION
BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO THE APPROVAL TO UTILIZE THE TORNADO MISSILE RISK EVALUATOR
TO ANALYZE TORNADO MISSILE PROTECTION NONCONFORMANCES FOR
ENTERGY OPERATIONS, INC.,
ARKANSAS NUCLEAR ONE, UNITS 1 AND 2
DOCKET NOS. 50-313 AND 50-368

By letter dated April 29, 2019, Entergy Operations, Inc. (the licensee) submitted a license amendment request (LAR) to incorporate the Tornado Missile Risk Evaluator methodology (TMRE) in the licensing basis for Arkansas Nuclear One (ANO), Units 1 and 2 (ANO-1 and ANO-2) (Agencywide Documents Access and Management System (ADAMS) Accession No. ML19119A090). The U.S. Nuclear Regulatory Commission (NRC) staff has reviewed the licensee's submittal and determined that additional information is required to complete the review. The requested additional information is provided below.

PRA RAI 01 - ANO-1 Internal Events PRA Model Full-Scope Peer Review

Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment [PRA] Results for Risk Informed Activities," Revision 2, March 2009 (ADAMS Accession No. ML090410014) endorses American Society for Mechanical Engineers/American Nuclear Society (ASME/ANS) RA-Sa-2009, "Addenda to ASME/ANS RA-S-2008, Standard for Level 1 / Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," (the PRA Standard). According to the regulatory position in Section C.2 of RG 1.200, when the staff's regulatory positions contained in Appendices A through D are taken into account, use of a peer review can be used to demonstrate that the PRA [with regard to an at-power Level 1/LERF PRA for internal events (IEs) (excluding external hazards)] is adequate to support a risk-informed application.

Section 4.1 of Attachment 1 of the licensee amendment request states that a peer review of the ANO-1 probabilistic safety assessment (PSA) model was performed in August 2009. However, Section 4.2 of Attachment 1 of the LAR states that the latest full-scope peer review for ANO-1 was conducted in July 2009 using RG 1.200, Revision 1 (ADAMS Accession No. ML070240001). Based on the information provided in the LAR, the NRC staff could not determine which revision of RG 1.200 the licensee used to perform the peer review of the ANO-1 IE probabilistic risk assessment (PRA) model.

ENCLOSURE

Therefore, the NRC staff requests that the licensee:

- a. Clarify which revision of RG 1.200 was used to perform the peer review of the ANO-1 IEPR model that formed the basis for the ANO-1 TMRE PRA model.
- b. If the peer review was conducted against Revision 1 of RG 1.200, provide justification, such as a gap assessment, that the differences between the currently and formerly endorsed PRA standards do not impact the technical acceptability of the ANO-1 TMRE PRA.

PRA RAI 02 - ANO-1 Nonconforming SSCs Not Included in the TMRE Analysis

Section 2.3 of the enclosure to the LAR, identifies two nonconforming, safety-related structures, systems, and components (SSCs) for ANO-1 that were not incorporated into the TMRE PRA models. These SSCs are: (1) conduit EC1493, which includes the reactor head vent solenoid valve, and (2) small bore service water piping (HCD-65-2" and HCD-65-2") to VCH-4A and 4B pumps. The justification provided by the licensee for their exclusion was that they were evaluated as having a negligible impact on risk in the IE PRA and therefore not included in the TMRE PRA.

Part 2 of the 2009 ASME/ANS PRA Standard contains several supporting requirements (SRs) that allow screening of SSCs from the IEPR. However, the self-assessment of SR SY-A15 for application to the TMRE PRA in Appendix D of NEI 17-02, Revision 1B, "Tornado Missile Risk Evaluator Industry Guidance Document" (ADAMS Accession No. ML18262A328), specifically states that the "... failure of SSCs due to tornado missiles shall not use the exclusions of SY-A15." The NRC staff's comments on the self-assessment for SY-A15 provides additional clarification on not using screening for the TMRE PRA. The licensee's comment for ANO-1 for SY-A15 in Table 9 in Enclosure Attachment 1 to the LAR states, "The TMRE process was followed as described," which appears to the NRC staff to be inconsistent with the screening of the two nonconforming SSCs identified above.

Therefore, the NRC staff requests that the licensee describe how the exclusion of the two nonconformances identified above is consistent with the guidance in NEI 17-02, Revision 1B. In particular, address the statement in the self-assessment for SRs for development of the TMRE PRA that states that the failure of SSCs due to tornado missiles shall not use the exclusions of SR SY-A15. Alternately, the NRC staff requests that the licensee demonstrate that the exclusion of the two nonconformances identified above does not impact this LAR.

PRA RAI 03 - ANO Tornado Missile Walkdown Area

RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," Revision 3, (ADAMS Accession No. ML17317A256), Staff Regulatory Guidance Section C.2, states that the engineering analyses conducted to justify any proposed licensing basis change should be appropriate for the nature and scope of the proposed change.

Section 3.4.2 of NEI 17-02, Revision 1B, states that in the case of targets greater than 1500 feet from the plant reference point, a qualitative evaluation of the missile inventory within 2500 feet from the outlying target(s) should be done. The intent of this evaluation is to determine whether

the missile inventory used for the TMRE is applicable to all the targets.

Section 3.3.3 of the enclosure to the LAR states the missile walkdown was performed in accordance with Section 3.4 of NEI 17-02 and the walkdown area was defined by a 2500 feet radius from the center point between the two reactor buildings, but does not state if all targets satisfied the criteria of NEI 17-02, Revision 1B. Based on the information provided in the LAR, it is unclear to the NRC staff if the qualitative evaluation identified in NEI 17-02 was performed and whether such an evaluation resulted in changes to the missile inventory. Therefore, the NRC staff requests that the licensee:

- a. Confirm that the ANO TMRE methodology includes a qualitative evaluation of the missile inventory within 2500 feet of targets that are further than 1500 feet from the plant reference point and changes the missile inventory, if necessary.
- b. If such qualitative evaluation is not included in the ANO TMRE methodology, justify that exclusion for current and future applications of the ANO TMRE.

PRA RAI 04 - ANO Multiunit LOOP

Section C.6.3 of RG 1.174, Revision 3, states that the licensee's submittal should discuss measures used to ensure the PRA is acceptable for the application PRA, such as a report of a peer review augmented by a discussion of the appropriateness of the PRA model for supporting a risk assessment of the licensing basis change being considered.

Section 6 of NEI 17-02, Revision 1B, describes the TMRE PRA model to be used in the analyses. The appropriate event and fault trees, at a minimum, cause a reactor trip and loss of offsite power (LOOP). Section 6.2 of NEI 17-02, Revision 1B, states that for multi-unit sites, the tornado event should be assumed to result in a multi-unit LOOP event. Further, a generic list of TMRE-relevant SRs is provided in NEI 17-02, Revision 1B, Appendix D.

In Enclosure Attachments 1 and 2 of the LAR, the licensee discusses PRA technical adequacy for ANO Units 1 and 2, respectively. Section 4.2 in each attachment states that a systematic review of the SRs relative to the ANO-1 and ANO-2 TMRE model development was performed and documented in the "Additional ANO-1/ANO-2 TMRE Comments" column of Table 9. However, the NRC staff noted that two SRs related to multi-unit LOOP events (IE-A10 and IE-B5) have no entries in either table and therefore, it is not clear to the NRC staff whether the ANO TMRE methodology is consistent with the guidance in NEI 17-02.

The NRC staff requests that the licensee confirm that the ANO TMRE methodology followed the guidance in Section 6.2 of NEI 17-02, Revision 1B, by assuming that the tornado event results in a multi-unit LOOP event. If the guidance is not followed, describe the ANO methodology with detailed justification or provide an updated TMRE analysis that incorporates multi-unit LOOP initiators.

PRA RAI 05 - ANO TMRE Compliant-Case Conservatism Sensitivity

Section C.2.5.1.2 of RG 1.174, Revision 3, states that in interpreting the results of a PRA, it is important to understand the impact of a specific assumption or choice of model on the predictions of the PRA.

Section 7.2.2 of NEI 17-02, Revision 1B, states that the licensee should review cut sets in the top 90 percent of the TMRE compliant case to identify conservatism related to equipment failures only that could impact results and perform sensitivity studies to address SRs AS-A10, LE-C3 and SY-B7 in Appendix D.

Section 3.3.9 of the enclosure to the LAR states for the compliant-case sensitivity that compliant TMRE basic events were removed from both the compliant and degraded cases. This appears to the NRC staff to remove valid failures of exposed SSCs from both cases, whereas the intent of the sensitivity is to address conservatism related to failure probabilities only in the compliant case. Therefore, the NRC staff requests that the licensee:

- a. Provide justification that the approach for performing the compliant-case conservatism sensitivity study is appropriate to evaluate the compliant-case conservatisms consistent with the guidance in NEI 17-02, Revision 1B.
- b. Alternatively, provide an updated sensitivity study that only impacts an identified conservatism in the compliant-case results.

PRA RAI 06 - Table Corrections

In the enclosure to the LAR on page 34 of 37, the ANO-1 TMRE Missile Distribution Sensitivity Results table provides the core damage frequency (CDF) and large early release frequency (LERF) for the degraded and compliant plants, and the difference (delta) between the two for the missile distribution sensitivity study.

In the enclosure to the LAR on page 36 of 37, the ANO-1 Single Event Cutset Sensitivity Results table provides the CDF and LERF for the degraded and compliant plants, and the delta between the two for the single event cutset sensitivity study.

The NRC staff noted that both tables indicate that the compliant plant CDF and LERF are greater than degraded plant CDF and LERF, but no explanation is provided in the LAR. Based on the NEI 17-02 guidance for modeling non-conforming SSCs in the compliant case and the basis for the risk assessment in the TMRE methodology, it is unclear to the NRC staff how the compliant case values are higher than the degraded case. Therefore, the NRC staff requests that the licensee explain the above-cited results and/or provide corrections to the tables as applicable.

PRA RAI 07 - ANO-1 Defense-in-Depth Considerations

One of the five key principles of risk-informed decisionmaking addresses defense-in-depth (DID) considerations. Section C.2.1.1.3, "Evaluating the Impact of the Proposed Licensing Basis Change on Defense in Depth," of RG 1.174, Revision 3, provides guidance on the consideration of DID as part of risk-informed decisionmaking for licensing basis changes.

Section 3.2 of the enclosure to the LAR states that nonconforming conduits in the ANO-1 demineralizer area if impacted by a tornado-generated missile could affect both trains of service water (SW). The same section also states that both trains of emergency feedwater (EFW) may also be impacted by a tornado-generated missile in the ANO-1 demineralizer area. The LAR further indicates that the TMRE PRA analysis demonstrates that the SW and EFW systems will remain “functional.” Based on the information provided in the LAR, it appears to the NRC staff that SSC functionality from a PRA viewpoint is being used to support a DID conclusion. Further, the NRC staff notes that due to the potential for non-confirming conduits to affect both trains of SW or EFW and the lack of detailed cable tracing, a tornado-generated missile hit on the conduits would be modeled as a common-cause failure (CCF) of both trains of SW or EFW. Therefore, it is unclear to the NRC staff how PRA “functionality” is being claimed by the licensee. The guidance in Section C.2.1.1.3 of RG 1.174, Revision 3, does not support the use of PRA “functionality.” The NRC staff requests that the licensee:

- a. Clarify the statement that the TMRE PRA analysis demonstrates that the SW and EFW systems will remain “functional” following impact from a tornado-generated missile.
- b. Justify how the use of “functionality” in a PRA model is consistent with the guidance on the DID considerations described in Section C.2.1.1.3 of RG 1.174, Revision 3, to meet the second key principle of risk-informed regulation. Alternately, provide a basis that does not rely on PRA “functionality” for why DID continues to be maintained despite the apparent CCFs of the SW and EFW systems.

Section 3.3.9 of the enclosure to the LAR discusses several sensitivity studies including the “ANO-1 Single Event Cutset Sensitivity.” The LAR states that the base CDF cutset results contain several single-order cutsets (i.e., initiating event and one basic event) and identifies the most important of such basic events as tornado failures for Room 129 (Control Room), Room 98 (Corridor) and Room 97 (Cable Spreading Room). The guidance for Item 5, “Maintain multiple fission product barriers,” in Section C.2.1.1.3 of RG 1.174, Revision 3, states that the evaluation of the proposed licensing basis change should demonstrate that the change does not (1) create a significant increase in the likelihood or consequence of an event that simultaneously challenges multiple barriers or (2) introduce a new event that would simultaneously impact multiple barriers. It appears to the NRC staff, that the single order cutsets in the base TMRE PRA model challenge DID by simultaneously impacting and failing multiple barriers. Therefore, the NRC staff requests that the licensee:

- c. Describe the SSCs that are considered as being impacted by tornado-generated missiles in Room 129 (Control Room), Room 98 (Corridor) and Room 97 (Cable Spreading Room) and their modeling in the TMRE PRA (i.e., what SSCs the single basic event for the rooms represents).
- d. Justify how simultaneous challenges to multiple barriers is avoided and consequently, DID is maintained given the insights from the ANO-1 TMRE PRA model base results as well as the “ANO-1 Single Event Cutset Sensitivity.” The justification should include details about any conservatisms in modeling the impact of tornado-generated missiles as well as resulting failures of relevant SSCs in Room 129 (Control Room), Room 98 (Corridor) and Room 97 (Cable Spreading Room).

The ANO-1 TMRE “Missile Distribution Sensitivity” discussed in Section 3.3.9 of the enclosure to the LAR demonstrates a substantial increase in LERF. Section 3.3.9 of the enclosure to the LAR and the discussion for “Item 20” in Enclosure Attachment 3 of the LAR provides justification for why this result is conservative. However, the conservatisms discussed seem generally applicable to the entire TMRE model (i.e., to the total CDF and LERF), and therefore would apply to both the compliant and degraded cases. It is unclear to the NRC staff how they relate specifically to the modeling of the nonconformances that results in the calculated delta risk. For example, it is stated that a detailed evaluation of cable routing would allow fewer correlated failures and thus result in a lower risk, but these cables appear not to be related to any of the nonconformances listed in Table 1 of the LAR. As another example, the LAR states that much of the risk increase is caused by the multiplier applied to targets in the “bowling alley,” but it is later explained in Item 20.c of Attachment 3 of the enclosure that none of the “highly exposed” SSCs are considered nonconformances. It appears to the NRC staff that there is an additional failure mode introduced that impacts LERF more adversely than CDF. Therefore, the NRC staff requests that the licensee:

- e. Justify how a reasonable balance between accident mitigation and prevention is maintained as part of DID given the substantial increase in LERF for the ANO-1 TMRE “Missile Distribution Sensitivity” discussed in Section 3.3.9 of the LAR. The justification should include discussion of insights from the cited sensitivity study as well as any conservatisms in the determination of the change in risk (e.g., related to modeling the impact of tornado-generated missiles as well as resulting failures of relevant SSCs).

PRA RAI 08 - Key Assumptions and Uncertainties That Could Affect the Application

Regulatory Position C. 3.3.2, “Assessment of Assumptions and Approximations,” of RG 1.200, Revision 2, states in part:

For each application that calls upon this regulatory guide, the applicant identifies the key assumptions and approximations relevant to that application. This will be used to identify sensitivity studies as input to the decision-making associated with the application.

Key assumptions and sources of uncertainty as well as their disposition in the context of this application are important elements of the NRC staff’s review of and conclusion for this application. The licensee’s response to Item 22 in Enclosure Attachment 3 to the LAR states, “Action to identify the key assumptions and sources of uncertainty, along with any potential impact on the TMRE application in the PRA model of record, is being tracked via a Condition Report.” As a result, it appears to the NRC staff that key assumptions and sources of uncertainty for this application have neither been identified nor dispositioned.

Regulatory Position C.4.2, “Licensee Submittal Documentation,” of RG 1.200, Revision 2, states in part:

These assessments provide information to the NRC staff in their determination of whether the use of these assumptions and approximations is appropriate for the application, or whether sensitivity studies performed to support the decision are appropriate.

Regulatory Position, C.4.2, “Licensee Submittal Documentation,” of RG 1.200, Revision 2, identifies key assumptions in the PRA that impact the application as information that the licensee should submit to support the NRC staff’s conclusion that the proposed licensing basis change is consistent with the key principles of risk-informed regulation and NRC staff expectations.

Based on established guidance and precedent for decisionmaking and submittal documentation for risk-informed licensing actions, key assumptions and sources of uncertainty as well as their disposition in the context of this application need to be provided as part of the application. NRC staff cannot support its review of and conclusion for this application based on yet-to-be-determined information. Therefore, the NRC staff requests that the licensee:

- a. Describe the approach used to identify and characterize the key assumptions and key sources of uncertainty that impact this application. The description should include discussion of how the licensee’s approach is consistent with that in NUREG-1855, “Guidance on the Treatment of Uncertainties Associated with PRAs in Risk-Informed Decision Making, Revision 1 (ADAMS Accession No. ML17062A466), or RG 1.200, Revision 2.
- b. Describe how each identified key assumption and key source of uncertainty was dispositioned for this application.

PRA RAI 09 - ANO-1 and ANO-2 Aggregate Results

Section C.2.4, “Acceptance Guidelines,” of RG 1.174, Revision 3, provides acceptance guidelines for risk-informed decisionmaking.

The following PRA RAIs may result in changes to the ANO TMRE PRA models:

- PRA RAI 03—ANO Tornado Missile Walkdown Area
- PRA RAI 04—ANO Multiunit LOOP
- PRA RAI 07- ANO-1 Defense-in-Depth Considerations

The following PRA RAIs address sensitivity studies and exceedance of RG 1.174 criteria.

- PRA RAI 05—ANO TMRE Compliant-Case Conservatism Sensitivity
- PRA RAI 08 - Key Assumptions and Uncertainties That Could Affect the Application

For any changes introduced as a result of these RAIs, the NRC staff requests that the licensee:

- a. Provide updated ANO TMRE results and associated sensitivities that incorporate changes from the resolutions of these RAIs.
- b. If the guidelines from RG 1.174 applicable to TMRE PRA as discussed in NEI 17-02 are exceeded, provide justification using one of the three methods described in Section 7.3 of NEI 17-02.