From:	Wentzel, Michael
Sent:	Thursday, June 18, 2020 3:08 PM
To:	Orf, Tracy J
Subject:	Browns Ferry Nuclear Plant, Units 1, 2, and 3 Request for Additional Information Regarding Incorporation of TMRE into the Licensing Basis (EPID L-2020-LLA-0099)
Attachments:	Browns Ferry Nuclear Plant, Units 1, 2, and 3 - Request for Additional Information Regarding Incorporation of TMRE Into the Licensing Basis (L-2020-LLA-0099).pdf

Dear Mr. Orf:

By application dated May 6, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20127H904), the Tennessee Valley Authority submitted a license amendment request for Browns Ferry Nuclear Plant, Units 1, 2, and 3 (Browns Ferry). The proposed amendments would modify the licensing and design bases as described in the Updated Final Safety Analysis Report to include a new methodology based on NEI 17-02, Revision 1 (ADAMS Accession No. ML17268A023) for determining the structures, systems, and components that require protection from tornado-generated missiles.

The U.S. Nuclear Regulatory Commission's (NRC's) Probabilistic Risk Assessment Licensing Branch B (APLB) staff is reviewing the application and has identified areas where it needs additional information to support its review. The NRC staff's request for additional information (RAI) is attached . As previously discussed with you, the NRC staff requests your response to the RAI within 30 days of the date of this email.

If you have any questions, please contact me at (301) 415-6459 or michael.wentzel@nrc.gov.

Sincerely,

Michael Wentzel, Project Manager
Plant Licensing Branch II-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Hearing Identifier: NRR_DRMA
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REQUEST FOR ADDITIONAL INFORMATION

TENNESSEE VALLEY AUTHORITY

BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3

DOCKET NOS. 50-259, 50-260, AND 50-296

TORNADO MISSILE RISK EVALUATOR

By letter dated May 6, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20127H904), the Tennessee Valley Authority (TVA, the licensee) submitted a license amendment request (LAR) for Browns Ferry Nuclear Plant, Units 1, 2, and 3 (Browns Ferry). By reference, the submittal incorporated NEI 17-02, Revision 1 which contains the Tornado Missile Risk Evaluator (TMRE) methodology (ADAMS Accession No. ML17268A023). The proposed amendments would modify the licensing and design bases as described in the Updated Final Safety Analysis Report (UFSAR) to include a new methodology based on NEI 17-02, Revision 1 for determining the structures, systems, and components (SSCs) that require protection from tornado-generated missiles.

TMRE PRA Assumptions and Approximations

Regulatory Position 2.3 in RG 1.174, Revision 3, "An Approach For Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," January 2018 (ADAMS Accession No. ML17317A256), states that for a probabilistic risk assessment (PRA) to support an application, the methods used to develop the PRA should be implemented correctly and the assumptions and approximations be reasonable. The following questions are related to reasonableness of the assumptions and approximations in the TMRE PRA.

RAI 1

Section B.2, "Using EPRI NP-768 Data to Determine Missile Impact Parameter (MIP)," of Nuclear Energy Institute (NEI) 17-02, Revision 1, "Tornado Missile Risk Evaluator (TMRE) Industry Guidance Document," September 2017 (ADAMS Accession No. ML17268A036), states, in part:

> […] choosing the most conservative target [missile impact parameter (MIP)] from NP-768 (Target 4) would lead to overly conservative results for many targets at a [nuclear power plant (NPP)]. Therefore, the normalized tornado missile impact probability from "All Targets" in NP-768 (from Table 3-15) is proposed for use in the TMRE. This results in a MIP that is based on the combined hits on all modeled surfaces in NP-768, Plant A.

The derivation of the MIP includes the containment building (Target 1). As stated in NEI 17-02, Revision 1, Section B.2, in part:

> [t]he containment building is surrounded by other buildings … so only the upper part of the containment is exposed to tornado missiles.

Additionally, the elevation of the exposed upper part of the containment is different from the elevation of other targets included in the calculation of near ground missiles.

Due to the overall height and the large surface area of the containment building, many missiles may be unable to reach upper portions of the containment building, which reduces the overall density of missile strikes and could become unrepresentative of other shorter plant buildings.

Section 3.2.3.2, “Missile Impact and Damage Probability Estimates,” of the Electric Power Research Institute (EPRI) topical report NP-768, “Tornado Missile Risk Analysis,” May 1978, states, in part:

> [t]he individual target contributions to the total hit probability is generally greater for the larger targets but least for the containment structure (7.65 x 10-10, Table 3-8) which is shielded from impact for the first 60 ft above ground elevation.

Provide justification for including Target 1 (containment building) of Plant A in EPRI NP-768 in the computation of the average MIP for targets less than 30 feet (ft) above grade, given that the containment building is shielded by other buildings and is not impacted by near ground missiles. Discuss how inclusion of the Plant A containment building in the computation of the average MIP for targets less than 30 ft above grade impacts this application.

<u>RAI 2</u>

Section B.4, “MIP Values for Use in the TMRE,” of NEI 17-02, Revision 1, provides two sets of MIP values, one for elevated targets and one for near ground targets. The demarcation between near ground and elevated targets is 30 ft above the primary missile source for a target. For targets near the ground, the MIP appears to be derived using the target areas listed in Table B-2 of NEI 17-02, Revision 1, which generally excludes the area of the roof (with an exception for Target 6, which includes the area of the roof). For the elevated MIP value, the area used to derive the MIP includes all the areas listed in Table B-1 of NEI 17-02, Revision 1, which includes roof areas.

a) The EPRI topical report NP-768 Plant A targets vary in height from 20 to 230 ft. With the exception of the Target 1 (containment building), the buildings range in height from 20 to 80 ft. The weighted average (weighted by the wall area) height of all targets is 94 ft. The weighted average (weighted by the wall area) height of the targets is 56 ft if Target 1 is excluded.

   Provide the basis for the 30 ft demarcation between near ground and elevated targets, given that EPRI NP-768 Plant A buildings range in height from 20 to 230 ft.

b) The MIPs calculated for elevated targets in Section B.4 are about 54 percent of the MIPs calculated for near ground targets. This percentage seems to reflect the assumptions with respect to areas included in the calculation of MIPs for elevated and near ground targets. The difference in area appears to be the only factor that determined the difference between MIPs for elevated and near ground targets. One of the sensitivity analyses in Appendix E of NEI 17-02, Revision 1, examines the impact of target elevation on target hit probabilities. Revision 1 of NEI 17-02 states that the results of

> this sensitivity analysis show that in general as target elevation increases, hit probability decreases.
>
> Describe the relationship between the numerical results shown in Appendix E and address whether the Appendix E results are generally consistent with the ratio of elevated to near ground MIPs calculated in Appendix B, "Bases for MIP and Missile Inventories." If Appendix E numerical results are not consistent with the ratio calculated in Appendix B, provide a justification.

RAI 3

Section 5, "Evaluate Target and Missile Characteristics," of NEI 17-02, Revision 1, states, in part, that:

> [t]he <30 ft MIP value can be used in cases where it is difficult to determine if the target is >30 ft above all missile sources.

Table 5-1 in NEI 17-02, Revision 1, refers to targets that are 30 ft above or below "grade," and Note 2 to the table explains:

> [t]he term grade here is meant to refer to the elevation at which a majority of the missiles that can affect the target is located. Typically, this is plant grade, although for some targets it may be different.

The above discussions in Sections 5 and 5.1 of NEI 17-02, Revision 1, seem to provide different guidance regarding how to determine elevated targets (for which the MIP values are different). The NRC staff notes that missiles may exist at elevations above some nominal plant grade or that targets exist at elevations that are above and below the nominal plant grade.

a) Describe the process that TVA used for determining near ground and elevated targets considering various elevations of targets and missiles. The description should include how this process ensures proper consideration of missile source applicability for each target relative to the demarcation height.

The hit frequency in EPRI NP-768 is a function of the insertion height of the missiles. In EPRI NP-768, the missiles were assumed inserted from heights ranging from 5 to 50 ft, except for cars, which were assumed inserted from 5 to 10 ft.

b) Provide justification that the range of cited insertion heights would not underestimate hit probabilities.

RAI 4

NEI 17-02, Revision 1, Section 3.2.3, "SSC Failure Modes," references consequential failures and describes treatment of identified and documented cases to be addressed in Section 6, "Develop TMRE PRA Model," of NEI 17-02, Revision 1. Specifically, the first bullet in Section 3.2.3 characterizes tanks and piping as "passive" components.

Section 3.2.3 does not appear to include guidance on consideration of secondary effects. Such effects include consideration for fluid-filled tanks and pipes, combustion motor intake effects

(loss of oxygen from inert gas tank rupture or exhaust re-direction scenarios), and other potential secondary effects to SSCs' function.

Describe how secondary effects that may result from failure of non-conforming conditions were considered for identification of the initiating events and failure modes in the licensee's TMRE development.

RAI 5

Section 3.4.3 of NEI 17-02, Revision 1, states that it is not necessary to explicitly account for the additional outage-related missiles in the TMRE missile inventory. This section further states that outages are of relatively short duration compared to the operational time at a nuclear power plant. The NRC staff notes that the total duration of outages or other temporary activities that involve bringing additional equipment to the sites may be relatively long for a three-unit site. It does not appear that Browns Ferry has considered additional equipment (such as outage conditions) in estimating the number of missiles.

Clarify whether Browns Ferry outage-related missiles were considered in the total number of missiles used for Browns Ferry TMRE implementation. Provide a justification if those missiles are not considered in estimating the total number of missiles at the site.

RAI 6

Section 3.4, "Tornado Missile Identification and Classification," of NEI 17-02, Revision 1, provides guidance for verifying the number of missiles resulting from the deconstruction of various types of buildings through the TMRE walkdown.

The guidance does not appear to involve walkdowns to count the potential missiles a non-Category I building contains inside the structure or to count missiles that would be generated by the deconstruction of the structure itself. How did TVA ensure that the missile inventories from building deconstruction are not underpredicted for a specific plant.

a) For each type of building addressed in NEI 17-02, Revision 1, explain how Browns Ferry missile count considers building contents (i.e., materials that are not part of the building itself but available to become missiles if the building is hit).

b) For those types of buildings where the NEI 17-02, Revision 1, methodology was applied, verify that the overall estimate of non-structural missiles within buildings is representative or bounding.

RAI 7

Sections 5.2, "Missile Inventories," and 5.2.1, "Missile Inventory Example," of NEI 17-02, Revision 1, explain that a bounding inventory of missiles was developed from a survey of five plants along with a generic distribution of missile types. These sections explain that the missile types and target robustness categories are used to determine if a target fails. Section 5.2 explains that in using the TMRE approach, the missiles at a specific plant should be counted to ensure that the missile inventory at the plant is bounded by the inventory used in the TMRE methodology based on the survey. Finally, Section B.6, "Missiles Affecting Robust Targets," of NEI 17-01, Revision 1, states that the number of missiles used in the Exposed Equipment Failure Probability (EEFP) calculation can be adjusted to account for the population of missiles

that can damage an SSC and provides the percentage of the total missile inventory for each type of robust target. These percentages appear to depend on specific missile type counts taken from two plant missile inventories as shown in Tables B-15, B-16, and B-17.

The sections of NEI 17-02, Revision 1, cited above do not appear to provide guidance for adjusting the relative contribution of each missile type based on plant-specific information. A skewed distribution of missile types at a specific plant site could have an impact on the risk results of the TMRE PRA, because certain missiles (from certain missile robustness categories) can fail a greater number of SSCs than missiles from lesser robustness categories.

Describe how any future use of the TMRE guidance for adjusting the number of missiles for robust targets at Browns Ferry will be performed to ensure that the contribution of each missile type to the overall missile population in NEI 17-02, Revision 1, is representative of the contribution of each missile type to the overall missile population in Browns Ferry.

RAI 8

Section 5.3, “Target Exposed Area,” of NEI 17-02, Revision 1, provides the method for calculating the area of an SSC that is exposed to being struck by a tornado missile for various types of SSCs and how their target exposed area should be calculated for the EEFP. When calculating surface area, some components (e.g., tanks, ultimate heat sink fans, etc.) are susceptible to potential missiles in the vertical direction that could result in additional exposed area. As specified in RG 1.76, “Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants,” Revision 1 (ADAMS Accession No. ML070360253), the NRC considers the missiles capable of striking in all directions with horizontal velocities and vertical velocities.

Section 3.3.2, “Target Walkdowns,” of Enclosure 1 to the LAR provides the scope of TMRE walkdowns. Item 3 of Section 3.3.2 includes identifications of “directions from which tornado missiles could strike the target” in the scope of walkdowns. It does not appear to differentiate between horizontal and vertical missiles consistent with the NRC guidance.

Considering that tornado missiles could strike from all directions, describe how Item 3 in Section 3.3.2 of Enclosure 1 to the LAR was performed and how vertical missiles and directional aspects are included in the Browns Ferry TMRE.

RAI 9

Section 3.3.1 of Enclosure 1 of the LAR submittal states, in part,

> The TMRE model uses the loss of offsite power (LOOP) sequences with no offsite power recovery, therefore PRA logic and components that do not support mitigating a LOOP can be screened.

Section 6.1, “Event Tree/Fault Tree Selection,” of NEI 17-02, Revision 1, states that in addition to LOOP event trees, other internal initiating events should also be reviewed to ensure that either (1) a tornado event cannot cause another initiating event or (2) the impact of the initiating event can be represented in the logic selected to represent the tornado-initiating event.

It is not clear whether the review discussed in Section 6.1 of NEI 17-02 was performed by TVA to support this submittal.

The walkdowns also appear to have been performed with a focus on the LOOP mitigation and other initiators or support system failures do not appear to have been considered during the walkdowns.

Describe whether a review was performed to ensure that a tornado event cannot cause another initiating event or the impact of the initiating event can be represented in the logic selected to represent the tornado-initiating event. Provide the results of this review including a discussion of any potential impact on and from walkdowns.

Principles of Risk-Informed Decision-Making

RAI 10

One of the key principles in RG 1.174, Revision 3, states that the proposed change meets the current regulations unless it is explicitly related to a requested exemption.

Section 4.1, "Applicable Regulatory Requirements/Criteria," of Enclosure 1 to the LAR states that Section 3.5.1.4, "Missiles Generated by Tornadoes and Extreme Winds," of NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants" (SRP) allows for a probabilistic basis for "relaxation of deterministic criteria" for tornado missile protection of SSCs. The submittal further states that "RG 1.174 establishes criteria…to quantify the 'sufficiently small' frequency of damage" discussed in the SRP. However, the cited SRP sections discuss the probability of occurrence of events and not the change in core damage frequency (CDF) and large early release frequency (LERF). The probabilistic criteria in SRP 3.5.1.4 (i.e., the probability of damage to unprotected safety-related features) is not directly comparable to RG 1.174 acceptance guidelines.

Address how the proposed methodology will continue to provide reasonable assurance that the SSCs important to safety will continue to withstand the effects of missiles from tornados or other external events without loss of capability to perform their safety function.

RAI 11

Regulatory Position 2.1.2 in RG 1.174, Revision 2, discusses safety margin as one of the key principles of risk-informed integrated decision-making. This Regulatory Position states, in part, that with sufficient safety margin, the safety analysis acceptance criteria in the licensing basis (e.g., final safety analysis report (FSAR), supporting analyses) are met or proposed revisions provide sufficient margin to account for analysis and data uncertainty. Section 7.5, "Defense-in-Depth and Safety Margin," of NEI 17-02, Revision 1, explains that an engineering evaluation should be performed to assess whether the proposed licensing basis change maintains safety margin and identify conservatisms in the risk assessment to show that safety margin is maintained.

Section 3.2 "Traditional Engineering Considerations," of Enclosure 1 to the LAR discusses safety margin and states, in part, that "safety analysis acceptance criteria in the licensing basis are unaffected by the proposed change," but provides no basis for that statement.

Section 2.3, "Evaluate Target and Missile Characteristics," of NEI 17-02, Revision 1, states that tornado missile failures do not need to be considered for SSCs protected by 18-inch reinforced concrete walls, 12-inch reinforced concrete roofs, and/or 1-inch steel plate. The guidance requires no analysis for evaluating the risk of non-conforming conditions that are protected as

described in Section 2.3 of NEI 17-02, Revision 1, and implies that no protection against the tornado-generated missiles is needed for those SSCs. Revision 1 of NEI 17-02 provides similar guidance in Sections 5 and 6.5.

a) Describe the basis for the conclusion that the safety analysis acceptance criteria in the licensee's safety analysis are not impacted by the proposed change.

b) Discuss any non-conforming conditions that were (or if identified in the future, will be) screened from Browns Ferry TMRE analysis using the criteria in Section 2.3 of NEI 17-02, Revision 1. For those non-conforming conditions, demonstrate that the safety analysis acceptance criteria in the licensing basis are met or that proposed revisions provide sufficient margin to account for analysis and data uncertainty.

RAI 12

Regulatory Position 2.4 in RG 1.174, Revision 3, discusses the risk acceptance guidelines. Section 7.3, "Comparison to Risk Metric Thresholds," of NEI 17-02, Revision 1, indicates that the delta risk between the compliant case and the degraded case PRA results should be evaluated against the "very small" change in risk acceptance guidelines given in RG 1.174, Revision 3 (change in CDF of smaller than 10^{-6} per year and change in LERF of smaller than 10^{-7} per year), and states, in part, that:

> [i]t is possible that some licensees may exceed these thresholds, in which case, additional discussion on defense-in-depth and safety margins may be warranted in the LAR.

Section 2.5, Quantify Risk, Perform Sensitivity Analyses, and Compare to Thresholds," of NEI 17-02, Revision 1, states, in part, that:

> [i]f ΔCDF or ΔLERF are close to or exceed the thresholds of RG 1.174, refinements to the Compliant and/or Degraded Case PRAs may be appropriate.

And

> [i]f further reductions to ΔCDF and ΔLERF are not possible [by refining the analysis], the licensee will need to decide whether physical modifications should be made and to which SSCs.

Section 7.3 of NEI 17-02, Revision 1, appears to allow providing more information about defense-in-depth if the change-in-risk thresholds of RG 1.174 are exceeded, whereas Section 2.5 appears to allow analysis refinement and plant modification if the thresholds are exceeded.

Describe the licensee's approach if performance-monitoring programs indicate that the risk acceptance guidelines for "very small" change-in-risk in RG 1.174, Revision 3, are exceeded. Clarify whether any additional refinements beyond the guidance in NEI 17-02, Revision 1, will be made if acceptance guidelines are exceeded.

RAI 13

Regulatory Position 3 in RG 1.174, Revision 3, states that careful consideration should be given to implementation of the proposed change and the associated performance-monitoring

strategies. Section 8.1, “Plant Configuration Changes,” of NEI 17-02, Revision 1, states that design control programs meeting 10 CFR Part 50 Appendix B, “Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants,” will ensure subsequent plant configuration changes are evaluated for their impact on non-conforming SSC risk using TMRE. Section 8.1 also states, in part, that:

> [l]icensees should ensure that they have sufficient mechanisms to assure that any significant changes to site missile sources, such as a new building, warehouse, or laydown area are evaluated for impact to the TMRE basis, even if not in the purview of the site Design Control program.

a) Describe the mechanism(s) and approach(es) that will be followed by the licensee to determine whether a particular change to the facility is “significant” for evaluation of the impact to the TMRE basis.

b) Describe the licensee’s mechanisms that assure temporary and permanent changes to site missile sources will be evaluated.

c) Describe the process(es) that ensure changes that could affect Browns Ferry TMRE results (e.g., plant design changes, changes made to the licensee’s base internal events PRA model and new information about the tornado hazard at the plant) are considered in future implementation of the licensee’s TMRE.

d) Describe, with justification, the treatment of the currently identified non-conforming conditions in future uses of the licensee’s TMRE PRA model.

e) Describe, with justification, how the cumulative risk associated with unprotected SSCs evaluated under TMRE will be considered in future decision making (e.g., 10 CFR 50.59 criteria as well as in future risk-informed submittals).

<u>TMRE PRA Model and Results</u>

<u>RAI 14</u>

Regulatory Position 2.3.3 in RG 1.174, Revision 3, states that the level of detail required of the PRA is that which is sufficient to model the impact of the proposed change. This Regulatory Position further states that the characterization of the problem should include establishing a cause-effect relationship to identify portions of the PRA affected by the issue being evaluated.

Section 6.5, “Target Impact Probability Basic Events,” of NEI 17-02, Revision 1, states, in part, that:

> SSC failures from tornado missiles may need to be considered for failure modes not previously included in the internal events system models…

Section 6.5 then provides four relevant examples (i.e., flow diversion and/or leaks, tank vent failures, valve position transfer - spurious actuations, and ventilation damper failures). The section does not provide guidance about when and to what extent such failure modes should be considered.

Describe how the potential failure modes stated in Section 6.5 of NEI 17-02, Revision 1, were considered by the licensee during the TMRE walkdown, identified, and included in the licensee's TMRE PRA model used to support this application.

RAI 15

Section 3.3, "Ex-Control Room Action Feasibility," of NEI 17-02, Revision 1, states that no credit for operator action should be taken for actions performed within 1 hour of a tornado event outside a Category I structure (in a location for which the operator must travel outside a Category I structure), but can be considered in the PRA after 1 hour. Guidance in this section states that operator actions after 1 hour could be impacted by such environmental conditions as debris that blocks access paths and should be considered by taking into account whether equipment will be accessible and whether the time required to perform the action will be impacted.

Discuss, with justification, the assessments performed to ensure that environmental conditions will not affect operator actions that are credited after 1 hour in the licensee's TMRE PRA model used to support this application.

RAI 16

Section 4.6, "Calculate Exceedance Probabilities," of NEI 17-02, Revision 1, states that exceedance probabilities should be generated for "the upper ranges for each F′ category," F′2 through F′6, using the trendline equation. The figure provided in Section 4.6 suggests that the largest exceedance probability for each F′ category, which corresponds to the lowest tornado speed for each F′ category, is used.

Describe how the exceedance probabilities influence on the initiating event frequencies in Table 3.3.4-1 of Enclosure 1 were determined using the guidance in Section 4.6 of NEI 17-02, Revision 1 in the TMRE methodology.

Uncertainties and Sensitivity Analyses

RAI 17

Regulatory Position 2 in RG 1.174, Revision 3, states that the licensee should appropriately consider uncertainty in the analysis and interpretation of findings. Regulatory Position 3 states that decisions concerning the implementation of licensing basis changes should be made after considering the uncertainty associated with the results of the traditional and probabilistic engineering evaluations.

Regulatory Position 3 in RG 1.174, Revision 3, states that careful consideration should be given to implementation of the proposed change and the associated performance-monitoring strategies. This Regulatory Position further states that an implementation and monitoring plan should be developed to ensure that the engineering evaluation conducted to examine the impact of the proposed changes continues to reflect the actual reliability and availability of SSCs that have been evaluated. This will ensure that the conclusions that have been drawn from the evaluation remain valid.

Section 7.2, “Sensitivity Analysis,” of NEI 17-02, Revision 1, address the steps that should be taken if the change in CDF and LERF from the sensitivity analyses exceed 10^{-6} per year and 10^{-7} per year, respectively.

a) Describe the Browns Ferry process if change-in-risk estimates from sensitivity analyses exceed the RG 1.174 acceptance guidelines for “very small” change in risk in implementation of TMRE methodology.

The discussions in Section 7.2 of NEI 17-02, Revision 1, do not address whether sensitivity analyses will be aggregated in future implementations of the TMRE methodology. For example, it is unclear whether the licensee will combine the sensitivity analyses related to any future open PRA facts and observations (F&Os), sensitivities that address compliant case conservatism and TMRE sensitivity analyses.

b) Describe, with justification, whether sensitivity analyses in Section 7.2 of NEI 17-02, Revision 1, will be aggregated in future implementation of the TMRE methodology.

The discussion in Section 7.2.3, “Compliant Case Conservatisms,” and Section A.2.1.3, “Non-Category I Structures and Exposed Non-Safety Related SSCs,” of NEI 17-02, Revision 1, recognizes that the TMRE PRA could produce non-conservative change-in-risk results if conservatively assumed failures in the Compliant Case mask change-in-risk. Accordingly, Section 7.2.3 of NEI 17-02, Revision 1, states, in part, that:

> [the] licensee should review cutsets in the top 90% of the TMRE compliant case to identify conservatisms related to equipment failure (opposed to offsite power recovery or operator actions) that could impact results.

Section 7.2.3 of NEI 17-02, Revision 1, also explains that the licensee should perform sensitivity studies associated with these conservatisms as directed in Appendix D of the TMRE guideline for PRA standard supporting requirements (SRs) AS-A10, LE-C3, and SY-B7 to address equipment failures in the compliant case that may be masking change-in-risk but does not provide guidance on how such a sensitivity can be performed. There are no delta CDF or LERF criteria below which this sensitivity need not be performed in this section of the TMRE.

c) Describe any future sensitivity analysis that will be performed to assess the impact of conservatisms associated with modeling the equipment failures in the compliant case of the TMRE PRA model.

Modeling operator actions could contribute to underestimating the change-in-risk calculation associated with non-conforming SSCs. Appendix D, “Technical Basis for TMRE Methodology,” of NEI 17-02, Revision 1, does not address that the concern described above could also apply to conservative human reliability analysis modeling (e.g., SR HR-G3 and HR-G7).

d) Describe how Browns Ferry will address the potential impact of TMRE assumptions related to certain human error probabilities within 1 hour after the accident on the compliant case.

<u>RAI 18</u>

Regulatory Position 2 in RG 1.174, Revision 3, states that the licensee should appropriately consider uncertainty in the analysis and interpretation of findings. Regulatory Position 3 states

that decisions concerning the implementation of licensing basis changes should be made after considering the uncertainty associated with the results of the traditional and probabilistic engineering evaluations.

The discussion in Section A.7, “Zonal vs. Uniform (Z vs U) Sensitivity,” of Appendix A, “Technical Basis for TMRE Methodology,” to NEI 17-02, Revision 1, recognizes differences between zonal and uniform missile distributions without justification. Targets were categorized in Appendix A to separate intuitive from non-intuitive trends and an adjustment factor is proposed to account for zonal distribution of missiles.

Describe, with justification, how uncertainties associated with the impact of the missile distribution on the licensee’s target hit probability are handled in the Browns Ferry TMRE methodology.

RAI 19

Section 3.3.2, Assessment of Assumptions and Approximations,” of RG 1.200, Revision 2, “An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities,” March 2009 (ADAMS Accession No. ML090410014), states, in part, that:

> [f]or 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.

Further, Section 4.2, “Licensee Submittal Documentation,” of RG 1.200, Revision 2, states, in part, that:

> [t]hese 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.

RG 1.200, Revision 2, defines the terms “key assumption” and “key source of uncertainty” in Section 3.3.2, “Assessment of Assumptions and Approximations.”

Section 6, “Conclusions on PRA Technical Adequacy,” of Enclosure 3 to the LAR states, in part, that “…assumptions and approximations used in development of the PRA have also been reviewed and are appropriate for their application.” The submittal does not describe the key assumptions and key sources of uncertainty identified for the Browns Ferry internal events PRA model and how those assumptions and uncertainties were addressed.

a) Describe the key assumptions and key sources of uncertainties in the Browns Ferry internal events PRA that may impact this application.

b) Describe how each key assumption and key source of uncertainty was dispositioned for this application.