UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

June 18, 2018

Ms. Tanya Hamilton
Site Vice President
Duke Energy Progress, LLC
5413 Shearon Harris Rd.
M/C HNP01
New Hill, NC 27562-0165

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 – REQUEST FOR ADDITIONAL INFORMATION RE: LICENSE AMENDMENT REQUEST FOR APPROVAL TO UTILIZE THE TORNADO MISSILE RISK EVALUATOR TO ANALYZE TORNADO MISSILE PROTECTION NON-CONFORMANCES (EPID L-2017-LLA-0355)

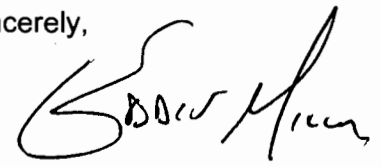
Dear Ms. Hamilton:

By letter dated October 19, 2017, as supplemented by letter dated January 11, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML17292B648 and ML18011A911, respectively), Duke Energy Progress, LLC (Duke), submitted a license amendment request regarding Shearon Harris Nuclear Power Plant, Unit 1. By reference, the submittal incorporated Nuclear Energy Institute (NEI) technical report NEI 17-02, Revision 1, "Tornado Missile Risk Evaluator (TMRE) Industry Guidance Document," September 2017, which contains the tornado missile risk evaluator methodology (ADAMS Accession No. ML17268A023). The proposed amendment would modify the licensing and design bases as described in the Updated Final Safety Analysis Report to include a new methodology for determining the structures, systems, and components that require protection from tornado-generated missiles.

The U.S. Nuclear Regulatory Commission (NRC) staff finds that additional information is needed as set forth in the Enclosure to this letter. The NRC requests a response to these questions within 30 days. The NRC staff further notes that the fee waiver approved for this activity will expire on October 19, 2018. At that point, all subsequent NRC staff efforts associated with the review will be billed at the full rate.

If you have any questions, please contact me by telephone at (301) 415-2481 or by e-mail at ed.miller@nrc.gov.

Sincerely,



G. Edward Miller, Project Manager
Special Projects and Process Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-400

Enclosure:
Request for Additional Information

cc: Listserv

REQUEST FOR ADDITIONAL INFORMATION

TORNADO MISSILE RISK EVALUATOR

METHODOLOGY LICENSE AMENDMENT REQUEST

DUKE ENERGY PROGRESS, LLC

SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1

DOCKET NO. 50-400

By letter dated October 19, 2017, as supplemented by letter dated January 11, 2018 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML17292B648 and ML18011A911, respectively), Duke Energy Progress, LLC (Duke), submitted a license amendment request (LAR) regarding Shearon Harris Nuclear Power Plant, Unit 1 (HNP). By reference, the submittal incorporated Nuclear Energy Institute (NEI) technical report NEI 17-02, Revision 1, "Tornado Missile Risk Evaluator (TMRE) Industry Guidance Document," September 2017, which contains the TMRE methodology (ADAMS Accession No. ML17268A023). The proposed amendment would modify the licensing and design bases as described in the Updated Final Safety Analysis Report (UFSAR) to include a new methodology for determining the structures, systems, and components (SSCs) that require protection from tornado-generated missiles.

The U.S. Nuclear Regulatory Commission (NRC) staff finds that additional information is needed as set forth below:

Evaluation of Target and Missile Characteristics

Regulatory Position 2.3.3 of Regulatory Guide (RG) 1.174, Revision 2, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," May 2011 (ADAMS Accession No. ML100910006), states that in the context of RG 1.174, technical adequacy will be understood as being determined by the adequacy of the actual modeling and the reasonableness of the assumptions and approximations. Regulatory Position 2.5.5 of RG 1.174, Revision 2, states that the licensee should pay particular attention to those assumptions that impact the parts of the model being exercised by the change. Finally, Regulatory Position 6.3.1 of RG 1.174, Revision 2, states that, among other items, a discussion as to why the probabilistic risk assessment (PRA) is of sufficient technical adequacy to support the application and the key modeling assumptions that are necessary to support the analysis or that impact the application should be submitted as part of an LAR. This information is intended to illustrate that the scope, level of detail, and technical acceptability of the engineering analyses conducted to justify the proposed licensing basis change are appropriate to the nature and scope of the change.

1. (DRA/DSS) Section B.2.3, "Selection of Target Missile Hit Probabilities (P) for Developing MIP" of NEI 17-02, Revision 1, states, in part:

> choosing the most conservative target MIP [missile impact parameter] from NP-768 (Target 4) would lead to overly conservative results for many targets at a NPP [nuclear power plant]. 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 Section B.2.3, 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 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) technical report EPRI NP-768, "Tornado Missile Risk Analysis," May 1978,[1] 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 (7.65×10^{-10}, Table 3-8) which is shielded from impact for the first 60 feet (ft) above ground elevation.

Justify including Target 1 (containment building) of Plant A in EPRI NP-768 in computation of the average MIP for targets less than 30 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 Plant A containment building in computation of the average MIP for targets less than 30 ft above grade impacts this application.

2. (DRA/DSS) 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 that 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. EPRI NP-768 Plant A targets vary in height from 20 to 230 ft. With the exception of Target 1 (the 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.

---

[1] Electric Power Research Institute, Inc., technical report EPRI NP-768, "Tornado Missile Risk Analysis," May 1978, Palo Alto, CA 94304 (https://www.epri.com/#/pages/product/NP-768/).

Provide the basis for the 30 feet 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 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 targets 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.

3. (DRA/DSS) 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 Duke Energy has 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.

b. 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. Justify that the range of insertion heights would not underestimate hit probabilities.

4. (DRA) Section 3.3.1, "High Winds Equipment List (HWEL)" of the enclosure to the LAR dated October 19, 2017, states, in part, that "the TMRE model uses the loss of offsite power (LOSP) sequences with no offsite power recovery, therefore PRA logic and components that do not support mitigating a LOSP can be screened." Section 6.1, "Event Tree/Fault Tree Selection," of NEI 17-02, Revision 1, states that, in addition to loss of offsite power (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 the licensee to support this submittal. For example, nuclear service cooling water tower fans do not appear to have been reviewed as initiators or as support system losses that need to be included in the sequences. 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.

   NEI 17-02, Revision 1, appears to include limited guidance on consideration of secondary effects. These effects include consideration for fluid-filled tanks and pipes and combustion motor intake effects (loss of oxygen from inert gas tank rupture or exhaust re-direction scenarios) as well as other potential secondary effects to SSC function.

   a. Clarify 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 event. Provide the results of this review including a discussion of any impact on or from walkdowns.

   b. Describe how secondary effects, including but not limited to the examples identified above, were considered in the implementation of NEI 17-02, Revision 1, for the identification of the initiating events and failure modes in the licensee's TMRE development.

5. (DRA) Section 3.4.3, "Temporary Missiles," of NEI 17-02, Revision 1, states, in part, that:

   The expected missile inventory for the post-construction site should be estimated, using walkdown results for the non-construction areas, information in Sections 3.4.2 and 3.4.4, along with design and construction information. The basis and assumptions used for the estimated number of post-construction missiles will shall be documented.

   Section 3.4.3 of NEI 17-02, Revision 1, states, in part, that "the total missile count for the sensitivity analysis should include the non-construction-related missile inventory determined in accordance with Sections 3.4.2 and 3.4.4, and a conservative estimate of the number of all construction-related missiles." The NEI guidance further states that the basis and assumptions used to determine the conservative construction missile estimate should be documented. The guidance does not appear to describe the criteria for considering missiles as temporary.

   a. Describe the approach that will be used in future implementation of the HNP TMRE methodology to classify the construction-related missiles as temporary missiles.

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. The guidance further states that outages are of relatively short duration compared to the operational time at a nuclear power plant. The NRC staff notes that duration of outages or other temporary activities that involve bringing additional equipment to the sites may be not be relatively short, specifically for multi-unit site. It is not clear whether HNP has adequately considered additional equipment in estimating the number of missiles.

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

c. Section 3.4 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 contents inside the structure or to count missiles that would be generated by the deconstruction of the structure itself. Address how the approach described in the guidance ensures that the missile inventories from building deconstruction are not underpredicted for a specific plant.

   i. For each type of building addressed in NEI 17-02, Revision 1, explain how HNP 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).

   ii. 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.

6. (DRA) Table 3.3.5 in Attachment 1 to the LAR indicates that robustness of targets with respect to certain missile types is considered in HNP TMRE development and quantification. The LAR indicates that this methodology is intended to be applied to future discoveries of as-built non-conforming conditions but does not describe how this provision will be applied.

   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 method 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 of NEI 17-01, Revision 1.

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 the HNP any future use of the TMRE guidance for adjusting the number of missiles for robust targets at HNP will be performed to ensure the evaluation will 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 HNP

7. (DRA) In a January 11, 2018, supplement to the LAR, Duke Energy withdrew those aspects of the request related to de minimis screening of vulnerabilities. A markup of the TMRE Industry Guidance Document was provided, showing those aspects of the current revision that would no longer be applied at HNP. It is unclear how the supplement affects the Enclosure and the Attachments to the LAR, that refer to this aspect of the guidance, for example, in Enclosure Sections 3.3.6, "Model Development," and 3.3.9, "Sensitivities," and Attachment Table 3.3.7-2, "PRA Results for Non-Conformance."

   Clarify how the supplement to the LAR affects the assessments in the original LAR related to de minimis screening (e.g., PRA modeling notes in Table 3.3.7-2).

8. (DRA/DSS) Section 5.3, "Target Exposed Area" of NEI 17-02, Revision 1, provides the method for calculating the Target Exposed Area. It is the area of an SSC that is exposed to being struck by a tornado missile that can result in the failure of the SSC. This section provides details on 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," March 2007 (ADAMS Accession No. ML070360253), the NRC considers the missiles capable of striking in all directions with horizontal velocities and vertical velocities. HNP licensing basis defines parameters for missile velocities in all directions in HNP UFSAR, Table 3.5.1-3, "Characteristics of Tornado-Generated Missile Spectrum."

   Section 3.3.2, "Target Walkdowns," of the enclosure to the LAR provides the scope of TMRE walkdowns. Item 3 of in that section of the LAR 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 HNP licensing basis.

   Considering that tornado missiles could strike in all directions, describe how Item 3 in Section 3.3.2 of the enclosure to the submittal was performed and how directional aspects are included in the HNP TMRE.

Principles of Risk-Informed Decision-Making

9. (DRA) One of the key principles in RG 1.174, Revision 2, states that the proposed change meets the current regulations unless it is explicitly related to a requested exemption.

Section 2.2 of the enclosure to the submittal states that HNP was designed to meet General Design Criteria (GDC) 2, "Design bases for protection against natural phenomena," and GDC 4, "Environmental and dynamic effects design bases," in Appendix A to Part 50, "General Design Criteria for Nuclear Power Plants," of Title 10 of the *Code of Federal Regulations* (10 CFR), are applicable to HNP. GDC 2 states that SSCs important to safety be designed to withstand the effects of natural phenomena such as tornadoes without loss of capability to perform their safety functions. GDC 4 states that SSCs important to safety be designed to accommodate the effects of missiles that may result from events and conditions outside the nuclear power unit, which includes tornadoes.

Section 4.1, "Applicable Regulatory Requirements/Criteria," of the enclosure 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 "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) are 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.

10. (DRA) 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, 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, calls for a discussion of defense-in-depth reflecting the actual design, construction, and operational practices of the plant. It explains that 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 the enclosure to the LAR discusses defense in depth and safety margin and states "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 as well.

a. Describe the basis for the conclusion that the safety analysis acceptance criteria in the licensee's safety analysis are unaffected by the proposed change.

b. Discuss any non-conforming conditions that were (or if identified in the future, will be) screened from HNP 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.

11. (DRA) Regulatory Position 2.4 in RG 1.174, Revision 2, discusses the risk acceptance guidelines. Section 7.3, "Comparison of 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 2 (change in CDF of smaller than 10^{-6} per year and change in LERF of smaller than 10^{-7} per year), and states:

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

Section 2.5 of NEI 17-02, Revision 1, states:

> [if] 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

> [if] 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 HNP's approach if performance-monitoring programs indicate that the risk acceptance guidelines for "very small" change-in-risk in RG 1.174, Revision 2, are exceeded. Clarify whether any additional refinements beyond the guidance in NEI 17-02, Revision 1, will be made if acceptance guidelines are exceeded.

12. (DRA) Regulatory Position 3 in RG 1.174, Revision 2, 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 of 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.

Section 4.1, "Applicable Regulatory Requirements/Criteria," of the enclosure to the LAR states that "changes, whether permanent or temporary due to construction, that increase the site missile burden within the 2500' missile radius above the 240,000 missiles assumed in the methodology will be evaluated for impact on the TMRE analysis."

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

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

c. Describe the processes that ensure changes that could affect HNP 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 HNP TMRE PRA model.

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

TMRE PRA Model and Results

13. (DRA) Regulatory Position 2.3.2 in RG 1.174, Revision 2, 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 appear to 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.

14. (DRA) 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 after the 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 HNP TMRE PRA model used to support this application.

15. (DRA/DSS) 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. In LAR Section 3.3.4, "Tornado Hazard Frequency," the tornado hazard curve is developed from data in NUREG/CR-4461.

    Describe how the exceedance probabilities influence on the initiating event frequencies in Table 3.3.4 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

16. (DRA) Regulatory Position 2 in RG 1.174, Revision 2, 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 2, 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, addresses 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 HNP process if change-in-risk estimates from sensitivity analyses exceed the RG 1.174 acceptance guidelines for "very small" change in risk in response to other parts of this request or in future implementation of TMRE methodology.

b. For future applications of the methodology, address how construction-related missiles would be considered in the analyses in Section 3.3.9, "Sensitivities."

c. For any TMRE sensitivity analyses used to address the representation of construction-related missiles, describe how the importance measures are determined from the TMRE PRA model in the context of the 'binning' approach for the tornado categories employed in the model. Describe whether and how the same basic events, which were discretized by binning during the development of the TMRE PRA model, are combined to develop representative importance measures. For the same basic events that are not combined, provide a justification that includes discussion of any impact on the results.

d. Identify the non-conforming conditions and vulnerabilities that met all the characteristics of a "highly exposed" SSC per Section 7.2.1 of NEI 17-02, Revision 1.

The discussions in Section 7.2 of NEI 17-02, Revision 1, do not appear to address whether sensitivity analyses will be aggregated in future implementations of the TMRE methodology. For example, it is not clear 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.

e. 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.

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, 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.

Section 3.3.9.1, "Conservative Risk Treatments Masking Sensitivity," of the enclosure to the LAR describes a sensitivity assessment performed to ensure conservative modeling treatments in the compliant case do not affect the risk assessment conclusions.

f. 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. For example, if manual actuation of a non-conforming SSC is an important risk reduction action and the corresponding human error probability (HEP) is conservatively determined (for example conservatively set to a failure probability of 1.0), then this can mask the full risk associated with the SSC's non-conformance. Appendix D does address whether the concern described above could also apply to conservative human reliability analysis modeling (e.g., SR HR-G3 and HR-G7).

g. Describe how HNP will address the potential impact of TMRE assumptions related to certain HEPs within 1 hour after the accident on the compliant case.

17. (DRA) Regulatory Position 2 in RG 1.174, Revision 2, 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 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 HNP TMRE methodology.

SUBJECT: SHEARON HARRIS NUCLEAR POWER PLANT, UNIT 1 – REQUEST FOR ADDITIONAL INFORMATION RE: LICENSE AMENDMENT REQUEST FOR APPROVAL TO UTILIZE THE TORNADO MISSILE RISK EVALUATOR TO ANALYZE TORNADO MISSILE PROTECTION NON-CONFORMANCES (EPID L-2017-LLA-0355) DATED JUNE 18, 2018

DISTRIBUTION:
PUBLIC
PM File Copy
RidsACRS_MailCTR Resource
RidsNrrDorlLpl2-2 Resource
RidsNrrDorlLspb Resource
RidsNrrDraAplb Resource
RidsNrrDssScpb Resource
RidsNrrLAJBurkhardt Resource
RidsNrrLABClayton Resource
RidsNrrPMVogtle Resource
RidsRgn2MailCenter Resource
GCurran, NRR
KNageswara, NRR
CFong, NRR
MReisi-Fard, NRR
SVasavada, NRR
EBrown, NRR
RKuntz, NRR

ADAMS Accession No. ML18145A181 *Via E-mail

OFFICE	NRR/DORL/LSPB/PM	NRR/DORL/LSPB/LA	NRR/DRA/APLB/BC
NAME	GEMiller	JBurkhardt	GCasto
DATE	6/8/18	6/8/18	6/8/18
OFFICE	NRR/DSS/SCPB/BC	NRR/DORL/LSPB/BC	NRR/DORL/LSPB/PM
NAME	SAnderson	DBroaddus	GEMiller
DATE	6/8/18	6/15/18	6/18/18

OFFICIAL RECORD COPY