NRR-PMDAPEm Resource

From: Uribe, Juan
Sent: Wednesday, April 29, 2015 8:42 AM
To: phil.barrett@duke-energy.com; Hubbard, Dean M (Dean.Hubbard@duke-energy.com)
Cc: Shams, Mohamed; Kuntz, Robert; Miller, Ed
Subject: Catawba Nuclear Station-Fukushima 2.1 Flooding-FHRR Review RAIs
Attachments: Catawba-FHRR RAIs-final.docx

Mr. Barret

By letter dated March 12, 2014, Duke Energy submitted its flood hazard reevaluation report (FHRR) for the Catawba Nuclear Station, Units 1 and 2 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML14077A054). During its review, the NRC staff determined that additional information is necessary to complete its assessment of the licensee's FHRR. As discussed in our clarification call, the NRC staff requests that Duke provide a response within **90** days of this email.

The attached document contains the NRC staff's Request for Additional Information (RAI) letter. Should you have any questions, please do not hesitate to contact me.

Thanks

JUAN F. URIBE PROJECT MANAGER
NRR/JLD/JHMB 301-415-3809 | O-13F10 | Juan.Uribe@nrc.gov
U.S. Nuclear Regulatory Commission

Hearing Identifier: NRR_PMDA
Email Number: 2027

Mail Envelope Properties (Juan.Uribe@nrc.gov20150429084200)

Subject: Catawba Nuclear Station-Fukushima 2.1 Flooding-FHRR Review RAIs
Sent Date: 4/29/2015 8:42:20 AM
Received Date: 4/29/2015 8:42:00 AM
From: Uribe, Juan

Created By: Juan.Uribe@nrc.gov

Recipients:
"Shams, Mohamed" <Mohamed.Shams@nrc.gov>
Tracking Status: None
"Kuntz, Robert" <Robert.Kuntz@nrc.gov>
Tracking Status: None
"Miller, Ed" <Ed.Miller@nrc.gov>
Tracking Status: None
"phil.barrett@duke-energy.com" <phil.barrett@duke-energy.com>
Tracking Status: None
"Hubbard, Dean M (Dean.Hubbard@duke-energy.com)" <Dean.Hubbard@duke-energy.com>
Tracking Status: None

Post Office:

Files	**Size**	**Date & Time**
MESSAGE	864	4/29/2015 8:42:00 AM
Catawba-FHRR RAIs-final.docx	34185	

Options
Priority: Standard
Return Notification: No
Reply Requested: No
Sensitivity: Normal
Expiration Date:
Recipients Received:

Request for Additional Information related to the Fukushima Lessons Learned Flood Hazard Reevaluation Report for the Catawba Nuclear Station, Units 1 and 2 (TAC Nos. MF3625 and MF3626)

By letter dated March 12, 2013, Duke Energy (Duke or the licensee) submitted its flood hazard reevaluation report (FHRR) for the Catawba Nuclear Station, Units 1 and 2 (Agencywide Documents Access and Management System (ADAMS) Accession Number ML14077A054). During its review, the NRC staff determined that additional information was necessary to complete its assessment of the licensee's FHRR. The following Request for Additional Information (RAI) letter documents the NRC staff's request.

RAI 1: General

As documented throughout the 50.54(f) letter (ADAMS ML12053A340), depending on whether a particular site's reevaluated flood hazard exceeds (or not) the design basis, addressees are requested to perform a series of subsequent actions.During the review, the NRC staff noted that the design basis flood elevations reported in FHRR (esp. Table 3-1) are different from those described in the latest version of UFSAR (Rev. 16, 2012). For instance for LIP flooding, the FHRR reports elevations of 594.90 ft (NGVD29) and 595.90 ft (NGVD29) for Units 1 and 2, respectively, while the Section 2.4.2.3.6 of UFSAR reports an elevation of 594.74 ft (NGVD29) for the whole site.

Please clarify the current design basis flood elevations for local intense precipitation (LIP), rivers and streams flooding, and dam failure flooding, as well as their plausible combined and associated events. If necessary, submit a revised hazard comparison consistent with the instructions provided in the 50.54(f) letter.

RAI 2: Local Intense Precipitation(LIP)

Attachment 1 of Enclosure 2 of the 10 CFR 50.54(f) lists LIP as a flood causing mechanism that should be addressed in the FHRR and provides additional information on the request. During the review, the NRC staff noted that the LIP flood reevaluation provided in the FHRRused a 1-hour, front-loaded probable maximum precipitation (PMP) event using Hydrometeorological Report Nos. 51 and 52.

Please provide a sensitivity analysis for a LIP event duration up to 72 hours in duration (e.g., 6-, 12-, 24-, 48-, 72-hour PMPs) which consider localized (one square mile) PMP events and various rainfall distributions (e.g., center-loaded and others in addition to a front-loaded distribution). The evaluations should identify potentially bounding scenarios with respect to flood height, event duration, and associated effects.

RAI 3: LIP

To understand how the extent and boundaries of the contributing drainage area were determined for the purpose of the combined 1-D and 2-D Integrated Catchment Model (ICM), please provide the following information:

a) FHRR (esp. Section 2.1.2 and Figures 2.1.2-1 and 2.1.2-2) does not clearly describe how the model boundary was determined. Provide a legible current topographic map or a GIS-viewable digital terrain model (in a format that can be viewed outside of the hydrologic modeling software) that depicts the topography of the site and the entire contributing

drainage area for LIP modeling and extends beyond the natural watershed divides that bound the contributing drainage area.

b) Identify the size of the total area that is modeled (including regions modeled in 1-D and 2-D) in the analysis of LIP flooding and discuss how the model boundaries were determined, including whether the boundaries correspond to features such as drainage divides and the justification for not including areas east and south of the site that appear to be at higher elevation than the site.

c) Discuss how the boundary conditions assigned in the ICM model control the flux of water across the boundaries of the 2-D model region, and how the treatment of boundaries affects the analysis of the effects of LIP in the plant yard and Standby Nuclear Service Water Pond.

RAI 4: LIP

Calculation CNS-194292-009 noted that "scupper sill elevations were not available: therefore scupper sills were assumed to be 6 inches above the roof elevation."

Please provide additional information that justifies the basis for the assumption of using the 6-inch sills which could impede complete roof runoff from reaching the ground. The response should include discussion on how this assumption affects the accuracy of the analysis of the effects of LIP in the plant yard.

RAI 5: Streams and Rivers

During the review of the HEC-1 watershed modeling, the NRC staff noted that the licensee adopted the Soil Conservation Service (SCS) unit hydrograph method which abstracts basin runoff from the given rainfall event based on the Antecedent Moisture Conditions (AMC), and selected AMC 2 moisture conditions.

Provide additional information that justifies the choice of AMC 2 conditions as appropriately conservative instead of the more conservative AMC 3.

RAI 6: Streams and Rivers

Appendix C in the Calculation CNS-1942920-010, "External Flooding and Dam Failure" indicates that Oxford, Cowans Ford, and Wylie Dams were modeled during the 1916 hurricane and 1940 storm even though these developments did not exist at the time. The model utilized an operation methodology to enforce that flow is equivalent to outflow.However, the staff noted that these dam(s)did not exist during the verification events.

Please provide additional information and relevant calculations pertaining to the conservatism associated with choosing to model an unregulated flow in the manner described in FHRR, compared with calculating this flow (natural flow past the dam site) based on the sum of an operationally determined outflow at the dam and its respective storage change.

RAI 7: Streams and Rivers

Calculation package CNS-194292-010 notes that the unsteady simulation for the PMF event using the Catawba River Model produced runtime warning errors related to cross-section end points and conveyance ratios. However, it does not appear that the model was subsequently adjusted.

Please discuss if the model was adjusted to address the warning errors. If the model was not adjusted, please provide a discussion that documents and justifies why an adjustment was not

necessary and how the lack of an adjustment does not affect the model's accuracy in predicting river flooding at the site.

RAI 8: Streams and Rivers

During its review of Figure 26 in CNS-194292-010 and the Catawba River Model input files, the staff noted that the cross sections at the plant site did not appear to cover the actual plant yard and Standby Nuclear Service Water Pond Dam.

Please provide additional information that confirms that the model includes sufficiently complete cross sectional coverage adjacent to the plant site to appropriately model reservoir PMF flooding at the site.

RAI 9: Dam Breaches and Failures

Attachment 1 of Enclosure 2 of the 10 CFR 50.54(f) lists Dam Breaches and failures as a flood causing mechanism that should be addressed in the FHRR and provides additional information on the request. During the review, the NRC staff noted thatthe FHRR analyzed the potential for a rapid drawdown of Lake Wylie to threaten the stability of the Standby Nuclear Service Water Pond Dam.

Please discuss the rationale for the assumption that the rapid drawdown of Lake Wylie following the overtopping of the Standby Nuclear Service Water Pond Dam would lower the reservoir only to its full pond elevation of 569.4 ft mean sea level, and not to a lower elevation associated with failure of Wylie Dam.

RAI 10: Dam Breaches and Failures

According to the Calculation CNS-194292-010, "External Flooding and Dam Failure," 11 combined dam failure scenarios were analyzed under the hierarchical framework, and thenscenario "8j4"was selected as a bounding scenario. The selected scenario is based on a combination of the Cowans Ford Dam PMF, cascading failures of five major dams (both upstream and downstream dams), and wind effects on Wylie Dam flooding. For the selected scenario, the licensee estimated dam breach parameters using the Froehlich's best-fit (median) regression equations, and used a 5 percent debris spillway capacity reduction factor.

In relation to simulating the scenario "8j4", please:

a) Provide justification for not simulating the selected scenario using the normal maximum pool level in each reservoir (instead of using less-conservative "FERC target reservoir setting") which is recommended in JLD-ISG-2013-01 (p. 4-4).
b) Provide a justification or sources of information for the statement that "[s]eismic induced dam failures required by ANS 2.8 Section 9.2.1.2 (Ref. 3) use piping failure mode breach parameters to simulate the failure of dam" (p. 50 of Calculation CNS-194292-010).
c) Provide justification why the following conservative conditions were not considered in determining a bounding dam failure flood scenario:
    - The debris spillway reduction factor up to 10 percent asrecommended in JLD-ISG-2013-01 (p. 4-7)
    - Hydropower turbine discharges during dam failure, especially from the Cowans Ford Dam
    - Bounding breach parameter values instead of best-fit ones, especially a bounding breach time for the Cowans Ford earth embankments.
    - No Wylie dam failure.

If new simulations are performed as a result of this RAI, please provide the relevant input/output files relevant to any new simulations.

RAI 11: Tsunami

Attachment 1 of Enclosure 2 of the 10 CFR 50.54(f) lists Tsunami and Combined Effect Floods as flood causing mechanisms that should be addressed in the FHRR and provides additional information on the request. During the review, the NRC staff noted that the FHRR did not provide sufficient detail or justificationfor not considering a potential landslide tsunami flooding with its associated effects (e.g., wind waves, sediment) on the Wylie Reservoir.

Please provide additional information that adequate justifies why a potential landslide tsunami flooding analysis(with its associated effects (e.g., wind waves, sediment) on the Wylie Reservoir) using available geomorphologic information and historical landslide data was not considered.

RAI 12: Hazard Input for the Integrated Assessment Report

The NRC developed JLD-ISG-2012-05 "Guidance for Performing the Integrated Assessment for External Flooding" (ADAMS Accession No. ML 2311A214)which describes to licensees methods acceptableto the NRC for performing the integratedassessment for external flooding as described in the 50.54(f) letter. Section 5.1 of this document states that: "*The hazard reevaluations performed under Recommendation 2.1 identify the external flood mechanisms applicable to a site. Before the licensee performs the integrated assessment, it should collect or review the flood height and associated effects for all applicable flood mechanisms from the hazard review for use in the integrated assessment.*

With respect to the input that will be used to develop the integrated assessment, please provide the following:

a) Clarify which flood hazard mechanisms, and their combined and associated events if applicable, will be included in the Integrated Assessment.
b) Provide the applicable flood event duration parameters (see definition and Figure 6 of JLD-ISG-2012-05, associated with mechanisms that trigger an integrated assessment using the results of the flood hazard reevaluation. This includes (as applicable) the warning time the site will have to prepare for the event (e.g., the time between notification of an impending flood event and arrival of floodwaters on site) and the period of time the site is inundated for the mechanisms that are not bounded by the current design basis.
c) Provide the basis or source of information for the flood event duration, which may include a description of relevant forecasting methods (e.g., products from local, regional, or national weather forecasting centers) and/or timing information derived from the hazard analysis.

RAI 13: Hazard Input for the Integrated Assessment Report

Please provide the flood height and associated effects (as defined in Section 9 of JLD-ISG-2012-05) that are not described in the flood hazard reevaluation report for mechanisms that trigger an integrated assessment. This includes the following quantified information for each mechanism (as applicable):

- Hydrodynamic loading, including debris;
- Effects caused by sediment deposition and erosion (e.g., flow velocities, scour);
- Concurrent site conditions, including adverse weather; and
- Groundwater ingress.