NRR-PMDAPEm Resource

From: Hall, Victor
Sent: Monday, May 04, 2015 3:10 PM
To: Carl.corbin@luminant.com
Cc: Singal, Balwant; Shams, Mohamed
Subject: Request for Additional Information: Comanche Peak Flooding Hazard Reevaluation Report (TAC Nos. MF1099 and MF1100)
Attachments: Comanche Peak Flooding RAIs - Final - May 2015.docx

Mr. Corbin,

By letter dated March 12, 2013, Luminant Generation Company (the licensee) submitted its flood hazard reevaluation report (FHRR) for Comanche Peak Nuclear Power Plant Units 1 and 2 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13074A058). By letter dated March 7, 2014, the U.S. Nuclear Regulatory Commission (NRC) staff provided a request for additional information (RAI) regarding the above referenced FHRR (ADAMS Accession No. ML14059A188). The licensee responded to this RAI by letter dated April 4, 2014 (ADAMS Accession No. ML14100A049). By letter dated August 14, 2014, the licensee supplemented its FHRR to address a calculation error (ADAMS Accession No. ML14245A136).

The staff determined that the attached RAI is necessary to complete its assessment of the licensee's FHRR. On April 14, 2015, the staff held a clarification call to discuss these questions with the licensee. The NRC requests that the licensee provide a response within 46 days of this e-mail (June 19, 2015). The NRC staff has determined that no security-related or proprietary information is contained herein.

Thank you,
-Vic

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Request for Additional Information
Fukushima Lessons Learned Flood Hazard Reevaluation Report
Comanche Peak Nuclear Power Plant Units 1 and 2 (TAC Nos. MF1099 and MF1100)

By letter dated March 12, 2013, Luminant Generation Company (the licensee) submitted its flood hazard reevaluation report (FHRR) for Comanche Peak Nuclear Power Plant Units 1 and 2 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13074A058). By letter dated March 7, 2014, the U.S. Nuclear Regulatory Commission (NRC) staff provided a request for additional information (RAI) regarding the above referenced FHRR (ADAMS Accession No. ML14059A188). The licensee responded to this RAI by letter dated April 4, 2014 (ADAMS Accession No. ML14100A049). By letter dated August 14, 2014, the licensee supplemented its FHRR to address a calculation error (ADAMS Accession No. ML14245A136). The staff determined that additional information, as requested below, is necessary to complete its assessment of the licensee's FHRR.

RAI 2-1: Local Intense Precipitation (LIP) - Choice of Methods and Technical Rationale

Background:The response to the previously issuedRAI6included input and output files for the Hydrologic Engineering Center River Analysis System (HEC-RAS) model used for modeling the local intense precipitation (LIP) event.

The discretization in the model appears insufficient toadequately predict flow depth and direction in critical areas around safety structures. This is evident in the elevations of the storage areas, and the routing of the flow:

Regarding elevations, the off-channel storage area capability within HEC-RAS estimates water surface elevation for each catchment based on a stage-volume curve. The model computes water surface elevation for each catchment and time-step, and it is noted that a single water surface elevation is computed for each catchment and time-step.However, the ground surface within an individual catchment contains variable elevations. The lack of resolution in the model limits themodel'scapability to predict flow depth and direction in critical areas around site structures important to safety.

Regarding the routing of the flow, water accumulates in areas of lowest topographic profile before exiting the catchment at the lowest elevation along the circumscribing cross sections. As such, the LIP model predicts flooding only within the lowest-profile sections of a catchment. Thus, the model does not adequately represent flooding and routing across the entire catchment, especially in areas of higher elevation. As a result, the model could not accurately predict the depth of flow and direction of flood routing since the flooding and point of discharge are located only in zones of low topographic profile.

For example, Figure 7-1 from Calculation F-03 shows a peak water surface elevation of 807.24 ft NAVD88 in the largest catchment located to the southwest. Flooding within this catchment is limited to the lowest elevation portion along the lower-right corner of the catchment. However, water could potentially pond in the upland area of this large catchment, some of which is at a ground elevation of over 850 ft. Precipitation falling onto this high elevation area has the potential to flow east to the powerblock area due to localized topographic channeling and gradient. As a result, the model may not adequately simulate temporal and spatial flood routing characteristics within and between the catchments, which could impact plant safety features.

<u>Request:</u>Providean updated modeling evaluation of the LIP flood event that includes improved discretization of the plant area that is capable of better simulating temporal and spatial flow effects across the site and in the vicinity of safety structures. Provide electronic versions of any associated modeling input and output files.

Evaluate LIP flood-water inundation into the Unit 2 TB sump and condenser pit, per the previous RAI 9, based on the results from the revised model.Evaluate a variety of different LIP storm durations and distributions (see RAI 2-2). Provide a quantitative analysis of any flooding that occurs within the Electrical and Control Building due to water conveyance via the Unit 2 TB equipment ramp.

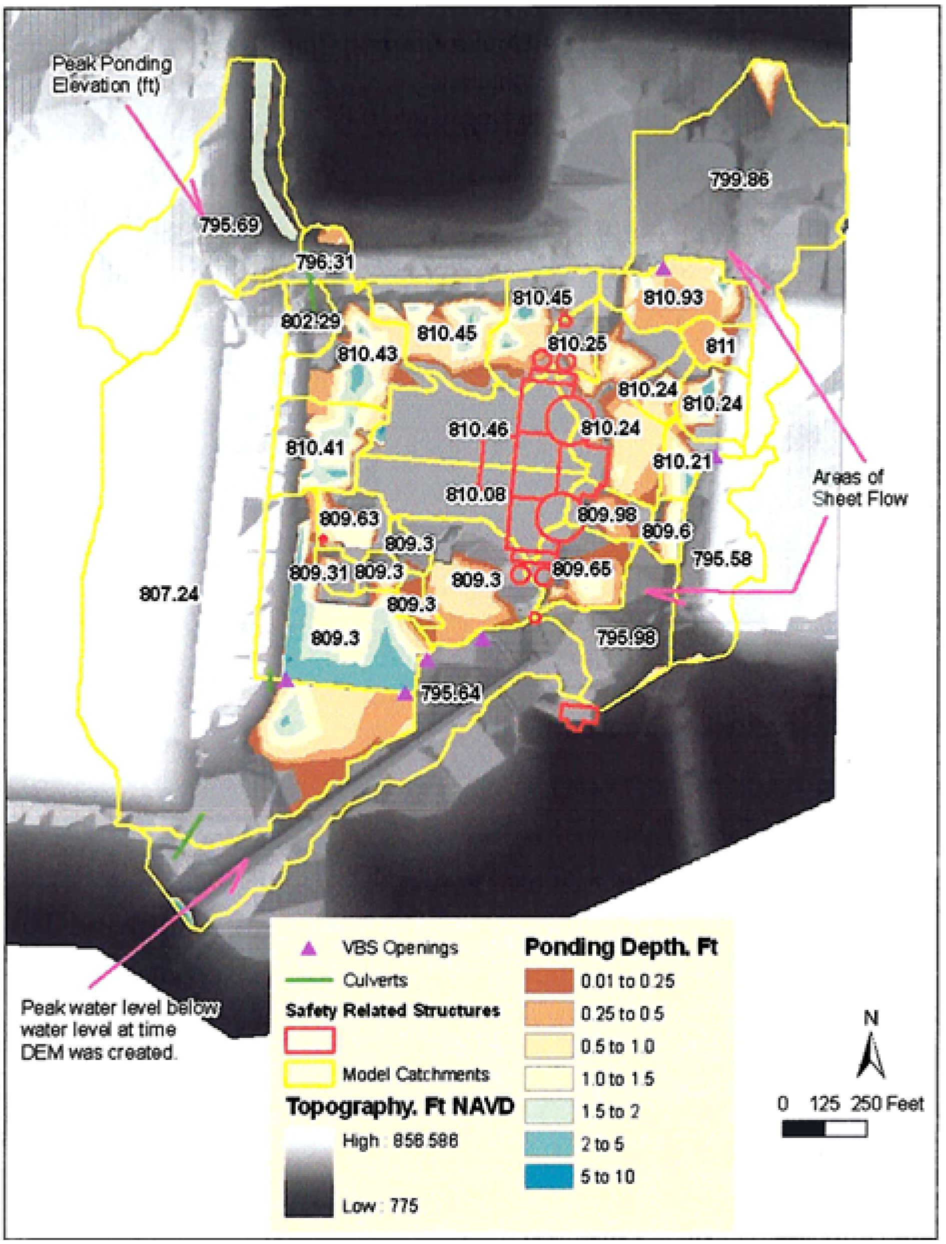

Figure 7-1 from Calculation F-03 - LIP flood modeling results

RAI 2-2: LIP- Event Duration and Distribution

Background: The LIP analysis methodology included a 6-hour duration event, beginning with the 1-hour, 1-mi^2 PMP arranged in a front-loaded (or descending) distribution. This approach may not capture the potentially most conservative and bounding flood condition resulting from precipitation events of different magnitude, duration, and timing.

Request:Provide justification that the LIP analysis presented in the FHRR is bounding in terms of warning time, flood depth, and flood duration. This justification can include sensitivity analysis of LIP event duration to consider localized (1-mi^2) PMP events up to 72 hours in duration (e.g., 1-, 6-, 12-, 24-, 48-, 72-hour PMPs) and various rainfall distributions (e.g., center-loaded and others in addition to a front-loaded distribution). The evaluations could identify potentially bounding scenarios with respect to flood height, event duration, and associated effects. Provide electronic versions of any associated modeling input and output files for the sensitivity runs.

RAI 2-3: Stream and River Flooding - Model Documentation, Choice of Methods, and Technical Rationale

Background: The response to the previously issued RAI 11 stated: "Calibration to a single return period was considered sufficient for the purposes of modeling flow in the streams upstream and downstream of the SCR, because the modeling of the PMF flood stage of importance is dominated by storage and outflow effects rather than flow in the upstream and downstream channels."However there was no technical justification to support the conclusion.

After reviewing the results it is apparent that, the SCR water level is highly sensitive to upstream modeling assumptions, even when fully crediting the SCR Dam discharge structures.

Considering the fact that the effects of upstream and downstream flows influence storage and outflow during a flood event, calibration of the hydrological modelis essential to providing appropriate predictions of water surface elevations during flooding events. In this respect, it is necessary to ensure the model performs well under various hydrologic flow/flooding conditions, and, as such, multiple observations should be used to determine model calibration accuracy when available.

Due to unavailability of flow data for the calibration of Squaw Creek flow predictions, model calibration relied on regression equations developed by the Texas Department of Transportation (TxDOT, 2011). Calibration of the HEC-HMS hydrological model included adjustment of the channel Manning's roughness coefficient and Snyder's peaking and basin coefficients to match the regression equation results for a 100-year return period flood.The source documentation includes a regression equation for a 500-year return period flood. However this equation was not used as a part of the calibration.Using the 500-year return period precipitation could result in lower peak flow compared with the 500-year regression equation, especially under more extreme flooding conditions

The HEC-HMS model includes site-specific inputs and is based on hydrologic processes while the empirical equation (TxDOT, 2011) includes only a few site-specific parameters (annual precipitation, stream slope, and watershed area, and a regression coefficient). In addition, the results indicate that the calculated peak flow from the regression equation is sensitive to the three calibration parameters.

Request: Justify the use of empirically derived regression equation results for a 100-year return period flood for calibration without having considered potential uncertainty and sensitivity in the empirical equation or calibration to or extrapolation beyond the 100-year return period event.Perform additional calibration and validation to verify the hydrological model against higher return period floods (including calibrating to the regression equation for the 500-year return period; or beyond using extrapolation) to ensure the model conservatively estimates discharge across variable precipitation and higher flow conditions. In addition, consider calibrating the HEC-HMS model using other watersheds in the area that are hydrologically comparable to the SCR watershed.Provide electronic versions of any associated modeling input and output files for the revised calculations.

RAI 2-4: Stream and River Flooding - Model Documentation, Choice of Methods, and Technical Rationale

Background: Supplement 1 to the FHRR provided updates to the river modeling, including corrections to the original hydrologic model calibration, as well as refined hydraulic model configurations to better simulate the system. The changes resulted in an overall increase in the stillwater elevation for the PMF and combined events scenarios, which in turn increased the fetch length at critical CPNPP locations (for example, the fetch length on the cooling water intake structure side increased to 18,386 ft from a previous value of 15,113 ft) used in the wave runup calculations. As a result, the wave runup and wind setup associated effects could be impacted.

Although the fetch lengths (Section 3.2.2.2.4) and stillwater elevations (Table 3-3) reported in the FHRR Supplement 1 are higher than the reported values in the original FHRR, the combined events flooding elevations (including wave run-up) reported in Table 3-3 are lower than the previously reported values at each critical location, except the service water intake structure vertical face.

Request: Provide technical justification to describewhy the combined events elevations with runup are lower despite increases in flood stillwater elevation and fetch length. Provide a description of associated effects such as wave runup and wind setup that supports the combined events resultsin order to confirm the results provided in the FHRR Supplement 1 in Table 3-3. Provide updated calculation packages, similar to the documentation and Excel file originally accompanying the F-13 material.

RAI 2-5: Stream and River Flooding - Model Documentation, Choice of Methods, and Technical Rationale

Background: Supplement 1 to the FHRR provides a description of the methodology used to evaluate stream and river and combined events flooding and outlines the major results. However, the supplement does not provide specific details on how the calculations were revised, and does not provide calibration results. Supplement 1 also does not contain updated calculations packages or input and output files.

Request: Clarifywhat changes were made in Supplement 1,including whether the calculations are based on a revised set of assumptions. If different assumptions were used, provide those assumptions and the updated calculation packages that describe the stream and river flooding and combined events flooding analyses.

RAI 2-6: Hazard Input for the Integrated Assessment - Flood Event Duration Parameters, Flood Height and Associated Effects

Background: Enclosure 2 of the 50.54(f) letter requests the licensee to perform an integrated assessment of the plant's response to the reevaluated hazard if the reevaluated flood hazard is not bounded by the current design basis. The FHRR should include all of the flood hazard information needed to understand the flood hazard and associated effects that will be an input to the integrated assessment; including the flood duration parameters for LIP (see definition and Figure 6 of the NRC interim staff guidance document JLD-ISG-2012-05, "Guidance for Performing an Integrated Assessment," dated November 2012 (ADAMS Accession No. ML12311A214).

Request:Provide the applicable flood event duration parameters associated with LIP using the results of the flood hazard reevaluation. This includes 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. Provide the basis 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 timing information derived from the hazard analysis.

Provide the flood height and associated effects that are not described in the FHRR for mechanisms that trigger an integrated assessment. This includes the following quantified information for each mechanism, as applicable:

- wind waves and run-up effects
- hydrodynamic loading, including debris
- effects caused by sediment deposition and erosion
- concurrent site conditions, including adverse weather conditions
- groundwater ingress
- other pertinent factors

RAI 2-7: Hazard Input for the Integrated Assessment - Comparison of Reevaluated Flood Hazard with Current Design Basis

Background: The FHRR provides a comparison of the reevaluated flood hazards with the current licensing basis (CLB) instead of the current design basis as required in the 50.54(f) letter. Table 3-3 of the FHRR has a tabulated summary of this comparison.

Request:Clarify the comparison of the reevaluated flood hazard to the current design bases.