



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

March 23, 2015

Mr. Adam C. Heflin
President, Chief Executive Officer,
and Chief Nuclear Officer
Wolf Creek Nuclear Operating Corporation
Post Office Box 411
Burlington, KS 66839

SUBJECT: WOLF CREEK GENERATING STATION – REQUEST FOR ADDITIONAL
INFORMATION REGARDING FLOOD HAZARD REEVALUATION REPORT
(TAC NO. MF3648)

Dear Mr. Heflin:

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident." By letter dated March 10, 2014 (ADAMS Accession No. ML14077A280), Wolf Creek Nuclear Operating Corporation submitted the Flood Hazard Reevaluation Report for Wolf Creek Generating Station in response to Recommendation 2.1.

The NRC staff has determined that the additional information, as requested in the enclosure, is needed to complete its review of the report. The questions were provided to S. Wideman of your staff on March 11, 2015. Please provide a response within 60 days of the date of this letter. If you have any questions, please contact me at 301-415-2296 or via e-mail at fred.lyon@nrc.gov.

Sincerely,

A handwritten signature in black ink that reads "CF Lyon".

Carl F. Lyon, Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-482

Enclosure
Request for Additional Information

cc w/encl: Distribution via Listserv



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REQUEST FOR ADDITIONAL INFORMATION

FLOOD HAZARD REEVALUATION REPORT

WOLF CREEK NUCLEAR OPERATING CORPORATION

WOLF CREEK GENERATING STATION

DOCKET NO. 50-482

By letter dated March 12, 2012 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML12053A340), the U.S. Nuclear Regulatory Commission (NRC) issued a "Request for Information Pursuant to Title 10 of the *Code of Federal Regulations* 50.54(f) Regarding Recommendations 2.1, 2.3, and 9.3 of the Near-Term Task Force Review of Insights from the Fukushima Dai-ichi Accident." By letter dated March 10, 2014 (ADAMS Accession No. ML14077A280), Wolf Creek Nuclear Operating Corporation (the licensee) submitted the Flood Hazard Reevaluation Report (FHRR) for Wolf Creek Generating Station (WCGS) in response to Recommendation 2.1.

The NRC staff has determined that the additional information, as requested below, is needed to complete its review of the report.

1. **RAI 1:** Local Intense Precipitation

Background: The FHRR local intense precipitation (LIP) analysis used the modeling software FLO-2D to model flooding. The FHRR does not provide any information on the WCGS site elevation dataset and how it was processed to generate the FLO-2D model grid. The process of transforming suitable terrain information into a model representation is a critical step in the process of developing an appropriate numerical model. Insufficient resolution in spatial information used to construct the Digital Terrain Model (DTM) may obscure features (e.g., a cinder block wall) that might obstruct flow. Even if these features are identified in the DTM, they may be obscured in the process of remapping the DTM to the FLO-2D grid (e.g., potential flow paths or connections and obstruction to these flowpaths smaller than the FLO-2D grid cell size can be misrepresented). Where overhangs exist, the elevations in spatial data may reflect the elevation of the overhang and not the ground.

Request: Please provide a description of the process used to develop and validate the FLO-2D grid. The description should include sufficient detailed discussion of (1) any flowpaths and obstructions in the validation process that are not represented in the FLO-2D grid, and (2) all available data that were used to identify and implement critical flowpaths in the FLO-2D model.

Enclosure

model. The choice of representation of features in the model setup can significantly affect the magnitude and direction of precipitation that runs off the building roofs. Technical discussion and documentation of the model representation and setup is required to complete the review.

Request: Please provide clarification on how buildings and other permanent structures are accounted for in the DTM dataset and how their elevations are assigned in the FLO-2D model.

3. **RAI 3:** Local Intense Precipitation

Background: The WCGS FHRR used a 6-hour LIP event, estimated using Hydrometeorological Report Numbers (HMRs) 51 and 52, to simulate the LIP flood. The FHRR used a front-loaded within-storm temporal distribution. The WCGS FHRR does not describe if alternative durations for the LIP event and alternative temporal distributions (e.g., center-loaded and end-loaded) were considered. Duration and temporal distribution of an LIP event can affect the intensity of rainfall and the shape of the flood hydrograph. Therefore, these two LIP properties have an effect on the available plant response time, the maximum flood water surface elevation, and the duration of inundation.

Request: Please provide a description of alternative durations and temporal distributions that were considered in the LIP flood reevaluation including event durations to consider localized (1 square mile) probable maximum precipitation (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 should identify potentially bounding scenarios with respect to flood height, event duration, and associated effects at locations that are of safety significance.

4. **RAI 4:** Local Intense Precipitation

Background: The WCGS FHRR does not provide a clear indication of whether the 6-h LIP depth corresponds to a 1-mi² or a 10-mi² area. Also, the FHRR does not include the precipitation depth-duration curve for the LIP event.

Request: Please provide clarification on how the 6-hour, 1-mi² PMP depth was estimated and provide the precipitation depth-duration curve used for the LIP flood analysis.

5. **RAI 5:** Local Intense Precipitation

Background: The WCGS FHRR states that the vehicle barrier system (VBS) used in the reevaluation analysis used the configuration from February 2013 and that changes to site layout have occurred since. Changes in configuration of the VBS could affect the flood analysis.

Request: Please describe any changes to the VBS since February 2013. Also, provide a technical description of the process followed to incorporate these changes in the LIP

flood analysis. *Caution:* treat appropriately any security-related information in your response.

6. **RAI 6:** Local Intense Precipitation

Background: The WCGS FHRR does not describe how precipitation runoff from building roofs was configured in the FLO-2D model. The NRC staff's review of the licensee's calculation packages in the NRC Library provided some FLO-2D model implementation details. The staff confirmed that the licensee's FLO-2D model files are consistent with the description in the calculation packages. The staff noted that American National Standards Institute/American Nuclear Society (ANSI/ANS)-2.8-1992, Section 11.4 recommends that building runoff used in the LIP flood assessment allow evaluation of worst case roof drainage. This evaluation includes analysis of alternative points of roof drainage to maximize flood elevation adjacent to points of access and egress at safety-related structures, systems and components.

Request: Please describe how drainage from facility roofs as represented in FLO-2D analyses is consistent with the recommendations of ANSI/ANS-2.8-1992, Section 11.4.

7. **RAI 7:** Local Intense Precipitation

Background: The values of Manning's roughness coefficients chosen to represent surface characteristics can significantly affect flow depths. The licensee used the lower end of the range of Manning's roughness coefficient values in the FLO-2D analyses.

Request: Please provide justification for choosing Manning's roughness coefficient values at the lower end of the range which can result in lower flood water surface elevations.

8. **RAI 8:** Local Intense Precipitation

Background: The infiltration rates used during a precipitation event can significantly reduce the amount of runoff and therefore result in reduced flow depths. The FHRR used the Soil Conservation Service (SCS) Curve Number method to estimate infiltration losses for the FLO-2D analyses.

Request: Please provide a justification for accounting for infiltration losses during a high-intensity, extreme storm.

9. **RAI 9:** Local Intense Precipitation

Background: The WCGS FHRR does not provide the locations of openings and penetrations for safety-related buildings and other plant components listed in FHRR Tables 3-1, 3-2, and 3-3. Because flow depths during the LIP event vary across the site, this information is needed to determine whether the reevaluated flood is bounded by the current design basis (CDB) at these locations.

Request: Please provide FLO-2D model grid cell identifications from which the model results were extracted and processed to produce Tables 3-1, 3-2, and 3-3 in the FHRR.

10. **RAI 10:** Hazard Input for the Integrated Assessment - Flood Event Duration Parameters

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 CDB. The FHRR does not clearly describe effects of the selected flood scenarios that are proposed to be considered in the integrated assessment.

Request: Please provide the applicable flood event duration parameters (see definition and Figure 6 of the NRC interim staff guidance document JLD-ISG-2012-05, "Guidance for Performing an Integrated Assessment," November 2012 (ADAMS Accession No. ML12311A214), 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 CDB. Also, please 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.

11. **RAI 11:** Hazard Input for the Integrated Assessment - 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 flood hazard is not bounded by the CDB. The FHRR does not clearly describe effects of the selected flood scenarios that are proposed to be considered in the integrated assessment.

Request: Please provide the flood height and associated effects (as defined in Section 9 of JLD-ISG-2012-05) 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

12. **RAI 12:** Hazard Input for the Integrated Assessment - Comparison of Reevaluated Flood Hazard with Current Design Basis

Background: The request for information pursuant to the 50.54(f) letter dated March 12, 2012, provides guidance on the contents of the FHRR. Table 4-3 of the FHRR for WCGS provides a comparison of the reevaluated flood hazards with the current licensing basis (CLB) instead of the CDB.

Request: Please provide clarification for the inconsistencies identified in the FHRR with regard to the comparison of the reevaluated flood hazard to the CDB and submit a revised hazard comparison consistent with the instructions provided in the 50.54(f) letter. Provide an update to FHRR Table 4-3 that references the CDB and its comparison to the reevaluated flood hazard; provide updated FHRR information that is consistent with the updated table.

March 23, 2015

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Carl F. Lyon, Project Manager
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