UNITED STATES
NUCLEAR REGULATORY COMMISSION
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June 9 , 2014

LICENSEES: Omaha Public Power District
Nebraska Public Power District

FACILITIES: Fort Calhoun Station, Unit 1
Cooper Nuclear Station

SUBJECT: SUMMARY OF MAY 13, 2014 MEETING BETWEEN REPRESENTATIVES OF THE ARMY CORPS OF ENGINEERS, NUCLEAR REGULATORY COMMISSION, OMAHA PUBLIC POWER DISTRICT, AND NEBRASKA PUBLIC POWER DISTRICT TO DISCUSS FLOODING ANALYSIS ASSOCIATED WITH FORT CALHOUN STATION, UNIT 1, AND COOPER NUCLEAR STATION (TAC NOS. MF3035 AND MF3036)

On May 13, 2014, the U.S. Nuclear Regulatory Commission (NRC) staff had a closed meeting with the U.S. Army Corps of Engineers (USACE), Omaha Public Power District (OPPD), and Nebraska Public Power District (NPPD) to discuss flooding hazard reevaluations (FHRs) for Fort Calhoun Station, Unit 1 (FCS), and Cooper Nuclear Station (CNS). The meeting was held at USACE's offices in Omaha, Nebraska. The closed meeting notice can be found in the Agencywide Documents Access and Management System (ADAMS) at Accession No. ML14129A445. The participants in the meeting included the following individuals:

- NRC – Andrea Kock, Christopher Cook, Ken See, and Joe Sebrosky
- USACE – Roger Kay, Teresa Reinig, John Remus, Dick Taylor, and John Bertino
- OPPD – Joe Gasper
- NPPD – Matt Nienaber
- OPPD and NPPD contractors – Larry Cieslik, Pat Englebert, Karin Hollister, and Mark Hammons

The purpose of the meeting was to discuss the USACE FHRs for FCS and CNS that was provided to OPPD and NPPD, via letters dated April 4, 2014 (ADAMS Accession Nos. ML14091A345 and ML14091A383, respectively). The agenda for the May 13, 2014, meeting can be found in Enclosure 1. Questions that OPPD and NPPD had regarding the USACE FHR can be found in Enclosure 2. Enclosure 2 contains 14 questions that apply to both FCS and CNS and one specific question that applies to CNS. The answer to the questions provided at the meeting can be found in Enclosure 2.

The USACE was provided an opportunity to comment on this summary prior to its issuance and their comments were addressed in the final version of this summary.

Please direct any inquiries to me at 301-415-1132 or at Joseph.Sebrosky@nrc.gov.

Peter Bamford for

Joseph M. Sebrosky, Senior Project Manager
Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-285 and 50-298

Enclosures:
1. Agenda
2. OPPD and NPPD Questions and Answers

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U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

USACE Ft. Calhoun and Cooper Flood Hazard Reevaluation Report

May 13, 2014, 9 am – noon

Zorinsky Federal Building, Room 854
1616 Capitol Avenue
Omaha, NE 68102

Attendees:

NRC:	Chris Cook, Joe Sebrosky, Ken See, Andrea Kock
USACE:	Roger Kay, Teresa Reinig, John Remus, Dick Taylor, John Bertino
NPPD:	Matt Nienaber
OPPD:	Joe Gasper
Contractors:	Larry Cieslik (HDR), Pat Englebert (HDR), Karin Hollister (Sargent & Lundy), Mark Hammons (FTN Associates)

----- Agenda Topics -----

TUESDAY MAY 13, 2014

Arrival for security screening. Check in at Federal Protection Service desk; POC is Ms. Teresa Reinig,	08:45 – 09:00
Introductions and identification of key personnel	09:00 – 09:15
Discussion on NPPD and OPPD Comments, Questions, and Requests on April 4, 2014 Transmittal of USACE FHR Information (attached)	09:15 – 10:30
BREAK	10:30 – 11:00
Continued Discussions on NPPD and OPPD Comments, Questions, and Requests	11:00 – 11:30
Wrap-up Questions and Answers	11:30 – 12:00

Questions From Omaha Public Power District and Nebraska Public Power District Associated with the U.S. Army Corps of Engineers Flood Hazard Reevaluation for Fort Calhoun Station and Cooper Nuclear Station

1. As documented in the summary of the December 17, 2013 meeting (ML14031A162) the licensees requested data from 5 scenarios. This request was based on information the USACE provided that they were developing data for the following five scenarios:

   Hydrologic:
   1) Dam failure due to piping during the Spillway Design Flood with reservoir pool at the maximum pool level (top of surcharge).
   2) Spillway Design Flood event without dam failure.

   Seismic:
   3) Dam failure with reservoir pool at the 500 year level.

   Sunny Day:
   4) Dam failure due to piping with reservoir pool level at the top of active storage (top of exclusive flood control).
   5) Dam failure due to piping with reservoir pool level at the 90% exceedance level.

   Results for Scenario 3 were not provided. The USACE indicated at the meeting that they judged Scenario 3 would be to be equivalent to Scenario 4 (sunny day dam failure due to piping with the reservoir pool level at the top of active storage, or top of exclusive flood control). We assume that this is why the seismic failure results were not provided. Please confirm our assumption, or provide the Scenario 3 results.

   We assume that the results labeled "Sunny Day Failure" are the results for Scenario 4. Results for Scenario 5 were not provided (sunny day dam failure due to piping with the reservoir pool level at the 90% exceedance level). The Dam Failure ISG permits lower starting pool elevations with appropriate justification. Please provide the results for Scenario 5.

   Answer

   Per the NRC interim staff guidance JLD-ISG-2013-01, "Guidance for Assessment of Flooding Hazards Due to Dam Failure," (ADAMS Accession No. ML13151A153), the potential for seismic failure was considered for each dam upstream of sites. However, based on the NRC guidance and USACE knowledge of the system, the sites do not need to evaluate flood protection for these scenarios.

   Scenario 4 pool elevations are closer in elevation to average pool levels than the Scenario 5 pool elevations, and thus are more appropriate for the "Sunny Day Failure" in accordance with the NRC ISG. Therefore, results for scenario 5 will not be provided to the licensees. The only mainstem dam failure scenarios that Cooper and Fort Calhoun Station need to consider are those provided in the April submittal.

2. As documented in the summary of the December 17, 2013 meeting (ML14031A162) the licensees stated they were building two-dimensional (2D) hydraulic models and requested "Flow distribution (left overbank flow, channel flow, and right bank flow) over the time period of the hydrographs" to provide boundary condition data for these models.

The transmittal of April 4, 2014 provided velocity distributions (left overbank, channel, and right overbank) which are not sufficient to provide boundary conditions for the 2D models. Please provide the flow distribution in the left overbank, main river channel, and right overbank at all requested locations in ML14031A162. These could be expressed as percentages of the total flow or directly in flow units (cfs).

Answer

Simulation results were developed using the one-dimensional model HEC-RAS. As such, flow distributions were not computed and cannot be provided. Based on comments by the licensees, and as discussed at the December 17 meeting, total river discharge and velocity distributions were provided at the tailrace of Gavins Point Dam (RM 811).

3. Please provide clarification of the assumed initial (starting) pool elevations at the time of the initial dam failure for each case, including all (starting) pool elevations downstream reservoirs subject to potential cascading failure. Please confirm the failure of downstream dams occurred at the time the dam embankment is overtopped by more than one foot.

Answer

The USACE analysis followed NRC JLD-ISG-2013-01 regarding the initial (starting) pool elevation. Downstream pools were assumed based on most likely pool based on historical data.

4. Please provide the assumed time of initiation of breach for the dam failures. Please confirm the "breach times" listed in the spreadsheets is the time at which the breach was initiated in the model for each case.

Answer

The USACE analysis followed NRC JLD-ISG-2013-01 regarding breach formulation and development. The breach times shown in the spreadsheets represent the initiation of breach in the HEC-RAS model.

5. Our notes from the December 17, 2013 meeting indicate that the USACE had not decided upon the breach parameters. Please provide a description of the breach parameters used in the scenarios and method(s) used to develop the parameters. Please describe how the parameters were adjusted to account for the system dams being generally larger than those included in the regression equation datasets.

Answer

The USACE analysis followed NRC JLD-ISG-2013-01 regarding breach formulation and development. The USACE analysis primarily utilized Froehlich (1995 & 2008), Von Thun & Gillette, and MacDonald & Langridge-Monopolis regression equations to estimate average breach size and development time. Professional judgment was used

in determining the appropriate parameters for all assumed breaches in the HEC-RAS models, and analyses were performed to determine the sensitivity of the final selected parameters.

6. Please confirm that the description of the HEC-RAS model used to generate these results is consistent with the model described in the Proceedings of the 31st Annual USSD Conference (2011) or provide a discussion of changes that were made to that HEC-RAS model to develop the dam failure results provided to the licensees.

Answer

The model described in Proceedings of the 31st Annual USSD Conference (2011) is consistent with the model used to generate these results with the exception of additional model geometry downstream of the Missouri River and minor geometry edits to improve model stability.

7. Please describe the location, method, and assumptions associated with the downstream boundary condition in the HEC-RAS unsteady-flow model.

Answer

Downstream boundary conditions in the HEC-RAS unsteady-flow model were specified by use of normal depth at a point more than 500 miles downstream of either nuclear power plant site.

8. Please describe how overbank areas are being modeled in HEC-RAS, particularly if cross-sections are being vertically extended and how much of the overbank areas are considered ineffective.

Answer

The model was previously calibrated to several observed storms and validated against data collected during the 2011 flood event. All cross-sections extended across the full width of the floodplain and were considered effective in conveying flows, except where ineffective flow was deemed appropriate based on standard hydraulic modeling practice and engineering judgment.

During this discussion a follow-on question was asked regarding how tributary inflows were assumed. USACE indicated that for sunny day dam failures average inflows from the tributaries were assumed. For hydrologic failures tributary flows higher than average were assumed. For the hydrologic failure scenario the tributary flows were consistent with those flows associated with the mainstem Missouri River being at or near flood stage as defined by the National Weather Service.

9. Please provide a summary of Manning's n-values used in the HEC-RAS unsteady-flow model for the channel and overbank areas, a description of how the values were developed, and if the values were adjusted to account for high flood depths.

Answer

Manning's n values varied thought the main channel and overbank. The model was calibrated to several observed storms and validated against data collected during the 2011 flood event.

Manning's n-values in the riverine reaches below Gavins Point Dam generally ranged from 0.02 to 0.03, while overbank n-values generally ranged from 0.05 to 0.07 in rural areas and 0.07 to 0.15 in urban areas. The n-values were generally held constant with the exception of areas behind levees.

10. Please provide the HEC-RAS model computational time step used for each case modeled.

Answer

Computation intervals ranged from 20 to 60 seconds on the Hydrologic Failure scenarios, 60 seconds for Sunny Day Failure scenarios, and 20 seconds to 3 minutes for the Operational Release scenarios.

11. Please clarify if storage area provided by tributary mouths or any other areas outside of the river cross sections were used in the HEC-RAS model.

Answer

Storage areas were used in the HEC-RAS model to represent major tributaries with significant inundation extending beyond the bluff line in order to account for the volume of water that would flow up these tributaries.

Major tributary inflows were modeled as lateral inflows at the cross-section immediately downstream of each tributary, rather than into the storage areas.

12. Please provide the resulting breach outflow hydrograph at each dam for each dam failure scenario.

Answer

Hydrographs at locations upstream of the Gavins Point tailrace will not be provided.

13. It is our understanding that cascading dam failures are triggered when a downstream dam embankment overtops by 1 foot. For scenarios where failure is initiated at a dam upstream of Gavins Point, please describe which downstream dams fail from the

cascading effect and assumptions regarding gate operations. Our notes from the December 17, 2013 meeting indicate two options would be considered: (1) open gates on downstream dams to delay onset of overtopping (limiting warning and evacuation time) or (2) hold releases to maximize warning and evacuation times.

Answer

The USACE analysis followed NRC JLD-ISG-2013-01 regarding breach formulation and development and professional judgment in determining when an overtopping breach failure may occur. The two options shown in the above question represent the extremes of gate operation during an extreme flow event; modeling for these scenarios followed existing emergency operating rules to the greatest extent possible and Missouri River Basin Water Management personnel were consulted in deriving the operational scenarios for all reservoirs as a system in response to a large reservoir release.

14. The licensees have developed Appendix B HEC-RAS models below Gavins Point Dam, which will be used to route a combination of the USACE dam failure hydrographs and hydrographs resulting from the failure of the non-critical dams in the drainages above the respective plant sites, as required by the ISG. We are currently in the process of routing the hydrographs from the USACE results at the Gavins Point Dam (X-Sec 811.06) through our models. To assist us in understanding the USACE results downstream of Gavins Point please provide:

    The HEC-RAS model geometry file(s) for the Missouri River reach downstream of Gavins Point Dam. To prevent the release of any security-sensitive information, the HEC-RAS flow data files and unsteady-flow plan files used in the analysis need not be provided.

Answer

It should be noted that channel bathymetry below Gavins Point Dam equivalent to that used in the USACE analysis can be obtained from existing Missouri River HEC-RAS models used for floodplain evaluations (Missouri River Floodway Study). These models can be obtained through the appropriate State floodplain regulator or through FEMA.

Cooper Specific

15. Please explain the cause of the oscillation on the Fort Peck Sunny day Failure on page C-3 and why the CNS hydrographs are not smooth.

Answer

The cause of the "oscillation" on page C-3 is due to the manner in which the Missouri River Federal levees were modeled with the levee option in HEC-RAS. During the scenario mentioned above, the left bank levees upstream and downstream of CNS are overtopped by a minor amount at one or several cross-sections, which causes flow to oscillate between being confined between levees and being conveyed across the entire

floodplain. However, careful review of all models shows this to be a phenomenon that occurs with only minor overtopping of the left bank levees, and only at elevations below the site grade of CNS. Since all oscillations occur at elevations lower than the CNS site grade, it was deemed inappropriate to expend additional time and resources on achieving a "smoother" hydrograph when the computed water surface would not exceed the CNS site grade elevation.

Please direct any inquiries to me at 301-415-1132 or at Joseph.Sebrosky@nrc.gov.

/RA by PBamford for/

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Plant Licensing Branch IV-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-285 and 50-298

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ADAMS Accession Nos.: Meeting Notice ML; Meeting Summary ML14147A359 *via email

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