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

August 23, 2016

LICENSEE: Energy Northwest

FACILITY: Columbia Generating Station

SUBJECT: SUMMARY OF JUNE 9, 2016, CLOSED MEETING BETWEEN REPRESENTATIVES OF THE U.S. ARMY CORPS OF ENGINEERS, BUREAU OF RECLAMATION, U.S. NUCLEAR REGULATORY COMMISSION, AND ENERGY NORTHWEST TO DISCUSS THE FLOOD ANALYSIS ASSOCIATED WITH COLUMBIA GENERATING STATION (CAC NO. MF3039)

On June 9, 2016, the U.S. Nuclear Regulatory Commission (NRC) staff held a closed meeting with the U.S. Army Corps of Engineers (USACE), Bureau of Reclamation, and Energy Northwest (EN, the licensee) to discuss the flood hazard reevaluation (FHR) for the Columbia Generating Station (Columbia). The meeting was held at USACE's offices in Seattle, Washington. The closed meeting notice dated May 16, 2016, can be found in the Agencywide Documents Access and Management System (ADAMS) at Accession No. ML16132A512. The list of attendees can be found as Enclosure 1 to this summary. The licensee provided a list of questions associated with the USACE FHR for the Columbia site. These questions were addressed leading up to the meeting and discussed in part during the meeting. The questions and answers can be found in Enclosure 2 to this summary.

The purpose of the meeting was to discuss the portion of the FHR the USACE is performing under contract to the NRC for Columbia. By letter dated October 4, 2013, EN requested NRC assistance in having the USACE perform a dam failure analysis for the Columbia River watershed for Columbia (ADAMS Accession No. ML13284A075). The licensee requested the NRC's assistance to support development of a flood hazard reevaluation report (FHRR) for Columbia in response to the March 12, 2012, request for information issued under Title 10 of the *Code of Federal Regulations* Part 50, Section 50.54(f) (ADAMS Accession No. ML12073A348).

The USACE and NRC provided EN with a summary of the results of the USACE dam failure analysis. The NRC stated that the next action to be completed in the process is the transmittal of the final results to EN. The NRC also stated that EN could request another meeting with the NRC after receiving the results. The licensee committed to submitting the final FHRR within 60 days of receipt of the final results.

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

If you have any questions, please contact me at (301) 415-1056 or e-mail at Lauren.Gibson@nrc.gov.

Sincerely,

Lauren Kate Gibson

Lauren K. Gibson, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

Docket No. 50-397

Enclosures:
1. List of Attendees
2. Entergy Questions and Answers

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US Army Corps of Engineers

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

NRC/USACE Intermediate Technical Review (ITR) Meeting

Columbia Generating Station

June 9, 2016

USACE, Seattle District Headquarters
The Oxbow Building
4735 East Marginal Way South
Seattle, WA 98134

LIST OF ATTENDEES:

NRC:	Andy Campbell, Chris Cook, Anthony Minarik, Brad Harvey, Ken See
USACE Omaha:	Chris Fassero, Curtis Miller
USACE Seattle:	Harry Ehlers, Travis Ball
Bur. of Reclamation:	Joe Wright, Frank Dworak
Energy Northwest:	Don Gregoire, Shannon Kinnunen, Andy Langdon, Dan Moon, Richard Rogalski
Enercon (EN):	Kurt Roblyer, Suraj Balan

Energy Northwest Columbia Generating Station –
Questions Regarding USNRC and USACE Dam Failure Analysis

Energy Northwest had originally provided questions regarding the Probable Maximum Precipitation Event and Probable Maximum Flood Hydrology.

Probable Maximum Precipitation: The USACE did not perform an analysis of the probable maximum precipitation event.

Probable Maximum Flood Hydrology To perform this screening analysis, the original Chief Joseph Dam spillway design flood was scaled up and applied to the CGS Basin-Wide PMF based on increase in drainage area. An additional 25% was added to the scaled PMF discharge to account for uncertainty in the drainage area method and the original Chief Joseph Dam flood calculations. The USACE performed a screening level analysis and confirmed the Basin-Wide PMF scenario cannot flood the CGS site, and therefore is not a critical or impactful scenario.

Probable Maximum Flood Hydraulics

1) **What hydraulic methods are utilized (e.g., steady state, unsteady state, one-dimensional, two-dimensional, etc.)?**

   NRC/USACE Response:

   HEC-RAS [Hydrologic Engineering Center River Analysis System] - 5.0, 1-dimensional flow using unsteady state conditions.

2) **What are the extents of the hydraulic modeling?**

   NRC/USACE Response:

   Kinbasket Lake (reservoir above Mica Dam located in British Columbia, Canada) is the upstream end of the modeling domain. The Pacific Ocean (tidal gage at the Columbia River mouth) is the downstream boundary of the model.

3) **What topographical inputs were utilized to develop the model?**

   NRC/USACE Response:

   RAS geometry file is a combination of various sources based on the most recently collected terrain and channel surveys available to the USACE. This data ranges in age from several decades ago (some Canadian cross sections) to a couple of years ago (most of the US portion of the Columbia system due to the Columbia River Treaty studies).

4) How are any dams and bridges incorporated into the modeling?

NRC/USACE Response:

Dams are simulated as inline structures with a number of different operating approaches – some are modeled as navigation dams, some elevation-controlled, and others with time series gate openings, depending on the complexity and operations of the dam. Bridges were excluded from the model, with the exception of three highway bridges in the upper Columbia.

5) What boundary conditions are used?

NRC/USACE Response:

Tributaries are modeled with storage areas and lateral inflow hydrographs in most cases. Separate reaches have been developed for some major tributaries and local distributed inflows. Upstream and downstream boundaries are Kinbasket Lake (reservoir upstream of Mica Dam, British Columbia) and Pacific Ocean, tidal gage at the mouth of the Columbia River, respectively.

6) How many calibration and verification storms were utilized?

NRC/USACE Response:

This model was originally set-up as a joint-effort dam break model with Canada. Reaches of the model have been calibrated independently with three of each reaches' largest recent storms. No observed events have taken place that would aid in calibration of system-wide dam break-type scenarios.

7) How were Manning's roughness coefficients determined and what range of values are used for the stream and floodplain areas?

NRC/USACE Response:

The hydraulic model used for this study is a conglomerate of smaller reach models that had recently been developed for Columbia River Treaty studies; Mapping, Modeling, and Consequences dam failure studies; and BC Hydro dam failure studies. Each of the smaller models were calibrated using the best available hydrology data. The calibration process included development of Manning's n values using historical channel data, land use coverage, aerial imagery investigation, and available research. The roughness coefficients used in the calibration process remained unchanged during this study. Typical channel roughness is .03 to .05, with isolated reaches as low and high as .022 and .07, respectively. All overbank roughness is between .07 and .1

Dam Failure

8) How were the methods of JLD-ISG-2013-01 considered (e.g., consideration for all dams in the watershed, simplified approaches, hypothetical dams representing clusters of dams, etc.)?

NRC/USACE Response:

A total of 206 dams were considered, 203 dams were screened out using NRC-provided methodologies (Japan Lessons-Learned Project Directorate, Interim Staff Guidance JLD-ISG-2013-01, "Guidance for Assessment of Flooding Hazards Due to Dam Failure," ADAMS Accession No. ML13151A153) and Corps technical team evaluation. Following this process, three dams (Mica, Revelstoke, and Grand Coulee) were identified as potentially-critical and requiring additional analysis.

9) Which dam failure scenarios were considered (e.g., hydrologic, seismic, sunny-day)?

NRC/USACE Response:

All three scenarios (hydrologic, seismic, and sunny day) were considered for each dam.

10) If seismic or sunny-day failures were considered, was coincident flooding also considered?

NRC/USACE Response:

Yes, per NRC/ISG (JLD-ISG-2013-01) guidance.

11) Which dams were identified as potentially-critical?

NRC/USACE Response:

Mica, Revelstoke, Grand Coulee.

12) Were seasonal reservoir water levels considered in the dam failure analysis?

NRC/USACE Response:

Yes.

13) Are any dams overtopped and not considered to fail? What methods were used to conclude overtopped dams would not fail?

NRC/USACE Response:

No, all dams that were overtopped were assumed to fail.

14) If the results of the dam failure analysis show that water levels exceed the 441' elevation, please provide the following:

NRC/USACE Response:

The Water level does not exceed 441 ft. (444.5 NAVD88) at the CGS site for any scenario.

15) What are the limitations and caveats of using these calculations to estimate downstream and/or off-site impacts related to flooding?

NRC/USACE Response:

The focus of the study was primarily the immediate upstream and downstream area of cross section 352.8 (adjacent to the CGS site), but the model set-up and analysis did include the entire "Hanford" reach from Priest Rapids Dam down to McNary Dam. As the model is set-up currently, it does not include levees, bridges, or full overbank terrain coverage downstream of the CGS site.

If you have any questions, please contact me at (301) 415-1056 or e-mail at Lauren.Gibson@nrc.gov.

Sincerely,

/RA/

Lauren K. Gibson, Project Manager
Hazards Management Branch
Japan Lessons-Learned Division
Office of Nuclear Reactor Regulation

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