NRC Staff Comments to Duke Energy Request for Information Response

Comment Number	Duke Letter Reference	Duke Letter Response	NRC Response
1	Attachment 1 p.4	In addition, overtopping of the main dam and abutments from excessive pump back from Lake Keowee to Lake Jocassee is considered not credible due to the redundant monitoring capabilities provided from the Jocassee main control room and Hydro Central in Charlotte.	The NRC staff strongly feels that Duke cannot discount these types of failures. There have been such overtopping control system failures as seen with the Taum Sauk Dam rupture in Missouri.
2	Attachment 1 p.6	The two failure modes noted as Category II regarded the possible seepage at the east and west abutments to the main dam that could result in piping/landslides and possibly a breach. For the east abutment, the failure mode was classified as Category II because high seepage could result in rock slope instability, resulting in damage to the switch yard and possibly personnel, if the slide were extensive. The classification was also made to point out the importance of continued monitoring and treatment if seepage were to increase significantly. For the west abutment, the failure mode was classified as Category II because high seepage could result in slope instability, possibly piping and breach in the soils above the bedrock.	Was soil liquefaction during a seismic event considered for this failure mode?

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3	Attachment 1 p.6	3) Overtopping Causes Breach of Embankment or Reservoir Rim (noted as PFM 6 in the study): The study evaluated the possibility of overtopping the main dam and embankments from pump-back operations and flooding. It noted the existence of redundant monitoring capabilities to detect the forebay elevation and alert personnel to potential overtopping events. It also noted that it would take a long time (60 hours) to overtop the main dam and embankments from pump-back operations, neglecting the fact that the spillway gates would actually be overtopped first, and the resulting discharge would slow the reservoir rise.	Duke cannot neglect the probability of overtopping.

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4	Attachment 1 p.6	3) Overtopping Causes Breach of Embankment or Reservoir Rim (noted as PFM 6 in the study): The study evaluated the possibility of overtopping the main dam and embankments from pump-back operations and flooding. It noted the existence of redundant monitoring capabilities to detect the forebay elevation and alert personnel to potential overtopping events. It also noted that it would take a long time (60 hours) to overtop the main dam and embankments from pump-back operations, neglecting the fact that the spillway gates would actually be overtopped first, and the resulting discharge would slow the reservoir rise. The other possibility evaluated was the failure of the spillway gates to operate during a PMF scenario. The study noted that the gates are maintained, inspected, and tested under FERC regulations, and therefore are in good operating condition. The study further noted that there are redundant means to raise the gates. Thus the PFM was classified as Category IV.	In order to operate the spillway effectively, the gates must be fully open AND three-of-four turbines must be operable. The gates are tested every five years and have never been fully opened under load since stop logs are used. Referencing the FERC Dam Safety Performance Monitoring Program Chapter 14 potential failure mode categories do not directly relate to risk.

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5	Attachment 1 p.8	In December, 2004, an independent engineering company (Findlay Engineering) completed a FERC-requested potential failure modes analysis (PFMA) for the Jocassee project. The PFMA concluded that there are no Category I (scale of 1 to 4, with 1 being the most significant) failure mechanisms applicable to the Jocassee project. Further, the PFMA recommended actions (which were adopted by Duke) for continued performance monitoring of Jocassee dam commensurate with identified potential failure modes.	A PFMA study is not a PRA study. The categories presented appear to be used for inspection resource allocation and are not probability frequencies. Due to the scarcity of failure data, NRC staff feels that use of this study to parse (subdivide) data is inappropriate since it will introduce too high an uncertainty.
6	Attachment 2 p.2	In addition, UFSAR [Updated Final Safety Analysis Report] Chapter 2.4.4 indicates that Jocassee was designed to the same seismic input conditions as ONS. Therefore, seismic failures of the Jocassee project are not considered credible.	The Review Level Earthquake (RLE) for the Oconee site is 0.3g. Duke needs to provide the basis for stating that Jocassee Dam has same seismic protection as the Oconee site.

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7	Attachment 2 p.3	In 1992, in response to a FERC request, the Duke Hydro Department initiated a second flooding study that assumed a complete failure of the main dam at Jocassee, in accordance with FERC guidelines. This study used the DAMBRK program, Rev. 4, and evaluated two conditions: (1) a 'sunny day' break in the main dam at normal pond conditions, and (2) a break in the dam during PMF conditions. The purpose of the study was to determine the worst possible case flooding in downstream reservoirs for inclusion in the Emergency Action Plans (EAP) for these hydro-electric facilities. The resulting inundation provided the extent to which evacuation plans were developed. The purpose of this study was not to assess credible flood heights for ONS.	Duke stated that the 1992 calculation was done to satisfy a regulatory requirement for the EAP and that NRC staff should ignore its results since it was not performed for nuclear regulation. However, in addressing Oconee site flooding, Duke based most of their assumptions on the FERC Potential Failure Modes Analysis (PFMA) in Attachment 1 as a basis that Jocassee was not susceptible to various random dam failure mechanisms which satisfied another regulatory requirement outside of nuclear. This is an inconsistent argument.

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8	Attachment 2 p.3	Duke considers a random 'sunny day' failure of the Jocassee dam not credible because of the nature of its design, its construction, the inspections conducted during its construction, and those periodic inspections that have occurred, and continue to occur, since its construction. Jocassee was designed using the current state of practice technology, employing conservative assumptions and margin. The design was created with two distinct oversight organizations, FERC and an Independent Board of Consultants. The construction of the dam utilized a standardized quality control process. The dam is subject to a comprehensive monitoring program and an extensive inspection program. Its performance history is well documented through periodic inspection reports as required by the FERC.	This argument is specious from a PRA standpoint. Duke is inconsistent in their response citing that Jocassee Dam cannot experience any failures based solely on its design margins, construction, inspections, and operation. The NRC staff has no evidence that Jocassee Dam is unique compared to other dams. NRC considered other dams, some of which with the same FERC inspection protocols, in development of the random failure frequency.

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9	Attachment 2 p. 5	Duke understands that the NRC included the Frenchman and Skagway failures, based on limited operating experience of rock-fill dams, when determining the credibility of a Jocassee dam failure. However, Duke maintains inclusion of these two dam failures in assessing the likelihood of a Jocassee dam failure is inappropriate since it compares a set of externally initiated failures against the operating years of experience for rock-fill dams. As an example, the occurrence of a dam failure due to an earthquake in California does not predict the likelihood of an earthquake in western SC exceeding the seismic capacity of the Jocassee dam. Similarly, flooding events in Montana and Colorado in 1952 and 1965, respectively, do not predict the likelihood of an inflow flood in excess of the capacity of Jocassee to successfully pass.	California seismic frequencies were not used in any computation. In considering PMP, Colorado and Montana do get less rainfall than South Carolina thus making Jocassee more susceptible than Frenchman and Skagway.

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10	Attachment 2 p.6	In previous discussions, the NRC staff has stated that it had identified 35 potentially relevant earthen dam failures. Significant differences in the assessment of operating experience could be the result of differing interpretation of important qualitative factors such as those described above, and may have counted flooding (PMF) events as discussed earlier. These differences may reduce the population of relevant dam failures that should be considered. Duke noted that many of the NPDP records were incomplete and required additional information from other sources to determine whether these failures are applicable to Jocassee. This was a common problem for many small dams. Also, Duke believes failures involving embankment slides should be excluded based on the characteristics of the rock-fill shells and the favorable results of slope stability analysis conducted for Jocassee.	NRC staff only considered dams of height greater than 50 feet. The statement that failures involving embankment slides should be excluded does not agree with the data from the FERC PMFA which shows an increase of embankment seepage and settling of the dam. Although not likely, these failure modes are still credible for Jocassee.