

Why did the Oconee flood issue take many years to address?

In 1977, the NRC initiated the Systematic Evaluation Program (SEP) to review the designs of 51 older, operating nuclear power plants. The staff compared the design of 10 of 51 older plants to the Standard Review Plan issued in 1975. The staff's review identified 27 issues, including dam integrity and site flooding that required some improvements at one or more of the 10 plants that were reviewed. These issues were captured under NRC's Generic Safety Issue - 156, SEP, which describes how the NRC resolved the 27 SEP issues for the remaining 41 plants including Oconee. Generic Safety Issue 156.1.2, Dam Integrity and Site Flooding, credited the agency's Individual Plant Examination of External Events (IPEEE) program to close the items because licensees were expected to address upstream dam failures if it could cause significant site flooding. In the NRC's 1991 Generic Letter 88-20, Supplement 4, 'IPEEE for Severe Accident Vulnerabilities', NRC requested that licensees assess their facilities for potential severe accident vulnerabilities (i.e., beyond design basis events) and consider potential enhancements.

During a 1994 NRC service water team inspection at Oconee, inspectors identified that the 1992 Duke Hydro Inundation Study predicted flood waters well in excess of the 5 ft walls that protect the SSF. The staff's inspection report shows the licensee argued that the Jocassee Dam failure was a beyond design basis event for the plant. The licensee committed to address the issue in the Oconee IPEEE, and on this basis, the staff closed the inspection issue in 1994. By NRC memorandum dated October 6, 1994, Region II staff met with NRR staff on September 1, 1994 regarding several design-related safety issues for Oconee including the Jocassee-dam flood issue. The meeting summary memo shows that NRR staff had not informed RES of the issue, and NRR staff stated that the external event hazards preliminary review of Oconee would take several months. The memo stated that NRR staff considered the issue of minimal importance. The memo does not provide explanation of the basis of NRR staff views. Region II staff informed NRR of recent high water levels at the Jocassee and Keowee dams. In 2008 discussions with the memo's author, it appears that NRR staff did not fully recognize the potential consequences and was focused on the other Oconee issues regarding the performance of safety-related equipment (e.g., ECCS) under design-basis conditions.

Duke submitted its IPEEE in 1995 which included an assessment of the Jocassee Dam flood hazard. The staff's evaluation of the IPEEE did not take issue with the derivation of the dam break frequency or take issue with other reduction factors that Duke used to reduce their risk estimates of external flood events to justify no plant protection for floods in excess of 5ft at the SSF grade level. Duke did not note in the submittal or subsequent updates that there existed a recent inundation study that was the subject of an NRC inspection issue. In 2000, the staff's IPEEE closeout letter to the licensee stated that based on the review of the information contained in the submittal, the staff considered Duke's process capable of identifying potential vulnerabilities associated with these issues at Oconee. The NRC further noted that "on the basis that no vulnerabilities associated with the external events aspects of these issues were identified, the staff considers external event issues resolved." The closeout letter cites a dominant contributor to residual risk involved Jocassee dam failures and flood heights exceeding the 5-foot high SSF flood barrier, thus rendering the SSF inoperable.

In 2008 discussions with RES staff involved in the IPEEE reviews, the staff was unaware of the Duke Hydro/FERC 1992 inundation study and the related service water inspection finding in 1994. From the staff's review of IPEEE-related correspondence and available contractor assessments, there is no documented evidence that the staff questioned the dam-break

frequency estimate or Duke's use of a reduction factor to lower the risk estimate of a potential Jocassee dam break. The reduction factor was an assumption that only 20 percent of Jocassee dam breaks result in flooding at the Oconee site greater than the 5 foot walls protecting the SSF entrances.

The issue reappeared in April of 2006 when the NRC concluded that the licensee failed to effectively control maintenance activities associated with removing a fire suppression refill access cover (a passive NRC committed flood protection barrier) in the SSF south wall to facilitate installation of temporary electrical power cables. The staff identified the issue during a periodic risk-informed flood inspection under the NRC's Reactor Oversight Process (ROP). Using the ROP Significance Determination Process, the staff discovered that the licensee may not have adequately addressed the potential consequences of flood heights predicted at the Oconee site based on the 1992 Duke Hydro/FERC Inundation Study. In 2007, the staff conducted an independent review of the Jocassee Dam failure frequency that Duke had used in the Oconee Probabilistic Risk Assessment (PRA). From that review, the staff concluded that a higher frequency estimate of Jocassee Dam failure was more appropriate and that the licensee's estimate was not adequately supported by operating experience and actual performance data of similar rock-filled dam structures. The staff also concluded that Duke had an inadequate basis for applying a reduction factor to further lower the risk estimate (i.e., the assumption that only 20 percent of floods would exceed the existing 5 foot walls).

In December of 2007, the staff initiated a design adequacy review and developed an action plan to assess the Oconee facility's ability to withstand severe flood events from a postulated Jocassee Dam break. Staff assessed the design basis, researched prior licensing actions related to flood protection, and reviewed other information to determine if the current plant design meets NRC regulatory expectations. The staff used a collaborative, consensus-building approach among 4 NRR Divisions and OGC to ensure appropriate regulatory practices were followed (e.g., backfit analysis). Based upon the draft backfit analysis, NRC concluded that an adequate protection backfit may be appropriate and further determined that additional information from the licensee was required before additional regulatory action is taken. The staff is reviewing the licensee's September 26, 2008 response letter to NRC's 50.54(f) letter.

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