Questions and Answers Related to Oconee Flood Barrier

1. How much confidence does NRR has about the fact the licensee's estimate of the Flood Frequency in its IPEEE is one order of lower based on operating experience?

We have very high confidence in our calculation. Attached is a spreadsheet comparing our experience data with the Oconee PRA and IPEEE calculations. Their error is the counting of only 2 failures of rockfill dams and then applying them to the population of both rockfill and earthen dams. During the same period (1940 to 2000) earthen dams had 32 failures. Had these 32 failures been properly included, the failure frequency would have been 2E-4 failure per dam year. If rockfill dams had been used alone, they would have gotten about the same result. There is no dam or mixture of dam populations that would get a result less than 1E-4 failure per dam year. Their result of 1.3E-5 is clearly in error.

References:

- National Inventory of Dams http://crunch.tec.army.mil/nid/webpages/nid.cfm
- National Performance of Dams Program http://npdp.stanford.edu/index.html
- Oconee IPEEE Rev 2 Section B.4.3, "Frequency of Dam failure"

2. Are there other IPEEEs which postulate external floods induced by dam failures? If there are, what are the frequencies, which those licensees used to assess risk?

NUREG-1742 identified only two IPEEEs that addressed dam failure floods quantitatively – Ft Calhoun and Diablo Canyon. Everyone else only addressed probable maximum precipitation and screened out dam failure as low probability. Unfortunately, there were few dam failure data sources around back then, so many plants used the estimate published in NUREG/CR-5042. The data source for the estimate in NUREG/CR-5042 was the Oconee PRA - NSAC/60. The calculation in NSAC/60 was done in error and it propagated throughout the industry.

References:

- NUREG/CR-5042, "Evaluation of External Hazards to Nuclear Power Plants in the United States.
- NUREG-1742, "Perspectives Gained From the Individual Plant Examination of External Events (IPEEE) Program
- NSAC/60, "Oconee PRA"

3. How much confidence do we have on licensee's predicted flood height (1980s study) that estimate the flood height at 4.71'? level?

The licensee indicated that their calculations to support the 1983 study were not retrievable and personnel who performed the work were not available. The staff has attempted to reconstruct what may be the logic for the original 4.71 foot flood level estimate as follows:

The benchmark nearest to the SSF shown on the Oconee site plan from the FSAR is at 796.63' elevation. Lake Keowee is maintained at 800' elevation. The difference is 3.37'. In the absence of any documented analysis, the basis for 4.71' is a mystery. Both the Oconee PRA and the IPEEE are silent on the 4.71' height and only mention the 5' height and even that is without explanation. However the plant does claim a probable maximum precipitation of 1.33' which when added to 3.37' would come out to 4.70' but that is speculation. Oconee never claimed it.

The plant is protected from lake Keowee by a 20' or so dike that surrounds the intake area and a similar dike that forms an extension of the Keowee dam. The east side of the site slopes down into the river valley. If the waters of lake Keowee find a path into the west yard, the east side slope may not drain them away fast enough to maintain less than 5 feet of water in the west yard. If the Keowee dam fails, the valley to the east would quickly fill and put about 3.37 feet of water into the west yard. The 1992 FERC flood model of Jocassee dam failure put 12.5 to 16.8 feet of water on site following failure of the Keowee dam. The now unavailable 1983 Duke study indicated the Keowee dam would survive and a 5 foot barrier in the yard was adequate. Duke has not presented the 1992 FERC flood model as a design basis.

D7