Oconee Nuclear Station External Flood Protection Concern

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Background of Issue

- NRC initiated the Systematic Evaluation Program (SEP) in 1977 to review the design of older, operating nuclear power plants with the current Standard Review Plan (SRP).
  - Opened Generic Safety Issue GSI-156.1.2, "Dam Integrity and Site Flooding".
  - Oconee Nuclear Station (ONS) was identified as one such plant with flooding vulnerability.
  - GSI-156 scheduled to be closed out by licensees in the Generic Letter 88-20, Supplement 4, the Individual Plant Examination of External Events (IPEEE) program.

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Oconee Nuclear Station

- Three-unit site with unique flooding vulnerability.
  - On Lake Keowee near Seneca, SC
  - No emergency diesel generators
  - Reliance of 2-unit Keowee Dam as sole source emergency ac power
  - Site is downstream of Jocassee Dam
    - A 385-ft high pumped storage hydro-station holding back Lake Jocassee
  - Licensee constructed the Standby Shutdown Facility (SSF) on site to address several issues including flooding
    - Houses equipment to safely shut down all 3 units in the event of catastrophic flood to Mode 3
    - Licensee constructed 5-ft walls around entrances to address external flooding vulnerability.
    - Licensees extended these walls to 7.5-ft in February 2009.

Flooding

- Licensee performed an ONS inundation study in 1992
  - Required by Federal Energy Regulatory Commission (FERC) Emergency Action Plan (EAP) on Jocassee license to Duke Hydro
  - Only reproducible calculation on record.
- Inundation levels calculated ranged from 12.5 to 16.8 feet
- NRC service water inspection in 1994 identified potential deficiency in the 5-ft entrance wall height to that of the inundation study.

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Licensee Disposition

- Licensee argued that Jocassee Dam floods are outside of licensing basis for ONS.
- Licensee committed to disposition of this deficiency as part of their IPEEE submittal in 1995
- An assessment of the Jocassee Dam flood hazard was included in the IPEEE without mention of the inspection issue.
- The staff's evaluation did not take issue with:
  - The derivation of the dam break frequency
  - Other factors that the licensee used to reduce their risk estimates of external flood events
  - The lack of arguments to justify plant protection for floods in excess of the height of the protective walls at the SSF grade level.
- The licensee failed to note in the submittal or subsequent updates that there existed a recent inundation study that was the subject of an NRC inspection issue.

NRC Staff Review of IPEEE Submittals

- Review of submittals for NRR was managed by RES
- RES contracted national laboratories to conduct reviews
- Region II staff met with NRR staff on September 1, 1994 which was documented in a memo
  - The Jocassee Dam rupture flood issue was discussed
  - 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 without any bases for these views
  - In light of this, RES staff was not informed of this issue

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NRC Staff Disposition of the Oconee IPEEE Submittal

- Given the submittal information, the staff's closeout letter in 2000 stated
  - Duke's process is capable of identifying potential vulnerabilities associated with these issues at Oconee
  - Considered 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.

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Re-emergence of Issue

- The Reactor Oversight Program (ROP) identified a performance deficiency against the licensee by their making and keeping an opening in the side of the SSF below the 5-ft level for 2 years without an adequate evaluation.
- The flood height calculation resurfaced during evaluation of the performance deficiency using the Significance Determination Process (SDP) in 2006
- NRC staff reviewed the dam failure probability frequency and discovered a major flaw in the licensee's calculation in 2007.

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Actions Taken by NRC Staff

- The NRC staff took the following actions to assess the Oconee facility's ability to withstand severe flood events from a postulated Jocassee Dam break :
  - Initiated a design adequacy review
  - Developed an action plan
  - Staff assessed the design basis
  - Researched prior licensing actions related to flood protection
- 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).
- A draft backfit analysis was prepared

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Results of Actions Taken by NRC Staff

- NRC concluded that an adequate protection backfit exception may be the appropriate approach.
- Further determined that additional information from the licensee was required before additional regulatory action is to be taken.
  - A 10 CFR 50.54(f) request for information letter was sent to licensee on August 15, 2008.
  - Licensee responded to the letter on September 26, 2008
  - The NRC staff has reviewed licensee's response letter to the 50.54(f) letter and is issuing a formal response.

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Generic Implications

- NRC staff has identified six (6) sites which may have a similar flood vulnerability
- NRC staff planning on reviewing closeout of GSI-156.1.2
- A proposed B.5.b review of possible strategies to mitigate core damage
- A generic communication via an Information Notice has been drafted and is in the process of concurrence.

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