Oconee Nuclear Station External Flood Protection Issue

Presentation to the Lessons Learned Oversight Board
May 5, 2009

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Background of Issue

Oconee Nuclear Station

- Three-unit site with potentially unique flooding vulnerability:
  - On Lake Keowee near Seneca, SC.
  - Reliance of 2-unit Keowee Dam as the sole source emergency ac power.
  - Site is 11 miles 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 internal flooding:
    - Houses equipment to safely shut down all 3 units (to Mode 3) in the event of catastrophic flood.
    - Licensee constructed 5-ft walls around entrances to address external flooding vulnerability from a Jocassee Dam rupture.
    - Licensee extended these walls to 7.5-ft in February 2009.

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Site Inundation Study

- Licensee performed a Jocassee Dam rupture inundation study in 1992.
  - Required by Federal Energy Regulatory Commission (FERC) Emergency Action Plan (EAP) on Jocassee license to Duke Hydro.
- Calculated inundation levels at ONS ranged from 12.5 to 16.8 feet above SSF grade and clearly above flood protection walls.
- NRC Service Water System Operational Performance Inspection (SWSOPI) in 1994 identified potential deficiency in that the 5-ft entrance wall height was significantly less than that predicted by the inundation study.

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Licensee Disposition

- Licensee stated that Jocassee Dam rupture floods are outside of licensing basis for ONS.
- Licensee committed to addressing this apparent lack of flood protection in its IPEEE submittal in 1995.
- An assessment of the Jocassee Dam flood hazard was included in the IPEEE without disposition of the inspection issue.

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NRC Disposition

- Review of IPEEE submittals to NRR was managed by RES.
- Region II service water inspection staff met with NRR staff on September 1, 1994 to discuss several issues arising from the inspection:
  - NRR staff considered the SSF flood protection issue of minimal importance and did not provide any bases for these views.
  - RES staff was not informed of the lack of resolution of the Jocassee Dam rupture SSF flood inundation issue.
- NRC staff issued standard close-out letter to the licensee which resolved most IPEEE issues identified in NUREG-1407.

Re-emergence of Issue

- The Reactor Oversight Process (ROP) evaluated a licensee performance deficiency arising from an opening made in the side of the SSF below the 5-ft flood protection level for 2 years without an adequate evaluation.
- Concerns over adequacy of the SSF wall and the 1992 flood height calculation results 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 flaw in the licensee's calculation in 2007.
- Final determination of finding was found to be of WHITE significance.

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Actions Taken by NRC Staff

- NRR concluded that the protection of the Oconee site from external flooding was an adequate protection issue with the following actions taken:
  - Issued a 10 CFR 50.54(f) letter requesting information on consequences and how the licensee addresses adequate protection of the site against external floods.
  - Determined basis for allowing short-term continued operation of the facility.
  - Now interacting with the licensee.
- Evaluation of potential generic flooding issues at other sites.

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Conclusions

Several opportunities were missed:

- In 1994, NRC reported that the licensee removed external flood protection of the SSF from the Oconee UFSAR and downgraded it to a "PRA issue".
  - NRC accepted this and did not question the licensee's rationale used for removal of Jocassee Dam rupture and SSF flood protection.
  - NRC did not address the licensing basis impact beyond that of PRA.
- The SWSOPI team members met with NRR in September 1994:
  - No written basis was given for the decision by NRR not to consider the importance of high dam rupture frequency and consequence when passing the IPEEE submittal to RES for review.
  - No tracking of this issue was made when the review was returned to NRR for issue of the closeout letter.