



EXECUTIVE TEAM BRIEFING
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- **Purpose**
 To inform NRR Senior Management about a draft Information Notice (IN) being prepared by NRR/DRA to alert addressees of a potentially nonconservative screening value for dam failure frequency.
- **Expected Outcome**
 An understanding of the background, basis, and intent of the IN
- **Process**
 Background - How issue originated and its generic implications
 Discussion - NRC evaluation and findings
 Current status of IN - concurrence process
 Conclusions and recommendations

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Background

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- White Finding at Oconee (2006) related to a performance deficiency due to maintenance at a flood barrier protection
- Best estimate flood was found to be nonconservative
- Catastrophic dam failure identified as flood risk contributor
- Analysis supporting dam failure rate estimates in Nuclear Safety Analysis Center (NSAC) report NSAC-60, "A Probabilistic Risk Assessment of Oconee Unit 3," issued June 1984

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NSAC60 Analysis

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- Estimated the failure frequency for Jocassee Dam by screening the available US historical data at the time of the analysis (1981)
 - Data based on: height, composition, construction period, failure date, and failure modes
- Acknowledge challenge in collecting representative data
- Considered failure modes separately
 - Seismic, overtopping (via Probable Maximum Precipitation estimate), and "random" failure
- Used Bayesian updating analysis to estimate "random" failure
 - In the range of 1.4 to 2.3×10^{-5} /year

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NRC Staff Actions

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- Revisited assumptions and analysis in NSAC-60
- Assessed currently available databases for U.S. dams, in order to determine generic dam failure frequencies based on:
 - historical failures of dams (Stanford University)
 - years of operation for dams (Army Corps of Engineers)
- Evaluated dam failure rate estimation in the available literature, including state-of-art dam risk assessment methods
- Developed internal assessments of dam failure rates using current information in cooperation with RES
 - Paper presented at ANS PSA 2011 International Topical Meeting on Probabilistic Safety Assessment and Analysis
- NRR/DE and NRR/DRA submitted a request to the Generic Issue Program (GIP) for further evaluation of generic implications

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NRC Staff Findings

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- Assumptions in the dam failure rate estimation approach are strongly dependent on the data completeness, accuracy
- Current databases still include a significant amount of completeness and accuracy issues
- Flooding hazard was not considered in an integrated manner (certain hazard categories excluded from further consideration)
- Use of worst-case deterministic scenarios to exclude hydrologic failures may underestimate the risk contribution from combinations of less severe but more frequent events
- Combination of generic and site-specific information may not be applicable for screening sites with different characteristics (i.e., hydrologic, geologic, operational)
- Most dam failure rate estimates are an order of magnitude higher

Applications of NSAC60



- After NSAC-60 issuance, dam failure rates were revisited in NUREG/CR-5042 "Evaluation of External Hazards to Nuclear Power Plants in the United States" (1987), which states that bounding values for dam failure rate ...
"...are quoted as being in the range of 10⁻⁶/year or even smaller, especially for modern well-engineered dams [Ref. 5.7 Oconee PRA, 1984]".
- NSAC-60 estimate was used as a reference (directly or indirectly) by other licensees as part of their Individual Plant Examination of External Events (IPEEE) submittal
- NSAC-60 and NUREG/CR-5042 may have percolated further as a screening value through the industry (most IPEEEs screened out dam failures)

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- An order of magnitude lower estimates may not be justified by historical data alone
- Applying the NSAC-60 estimate to other dams with different characteristics may be inappropriate
- Using a nonconservative screening dam failure frequency to evaluate the need for additional detailed analysis may result in underestimating the risks to the plant associated with external flooding or loss of heat sink from the failure of upstream and downstream dams or levees.
- Staff will evaluate if NUREG/CR-5042 needs to be revisited.

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- IN Status
 - Currently in concurrence
- Conclusions and Recommendations
 - Events in Japan have increased general interest on external flooding risk. However, the focus of the IN was not impacted by the accident.
 - GIP screening assessment reviews support the risk significance of the dam failure issue.
 - Staff recommends issuing the IN.
 - Follow-up generic implications expected to be addressed through the GIP

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