NRC Public Meeting

DG-1290, "Design Basis Floods for Nuclear Power Plants," and

DG-1417, “Guidance for Assessment of Flooding Hazards Due to Water Control Structure Failures and Incidents”

September 9, 2024

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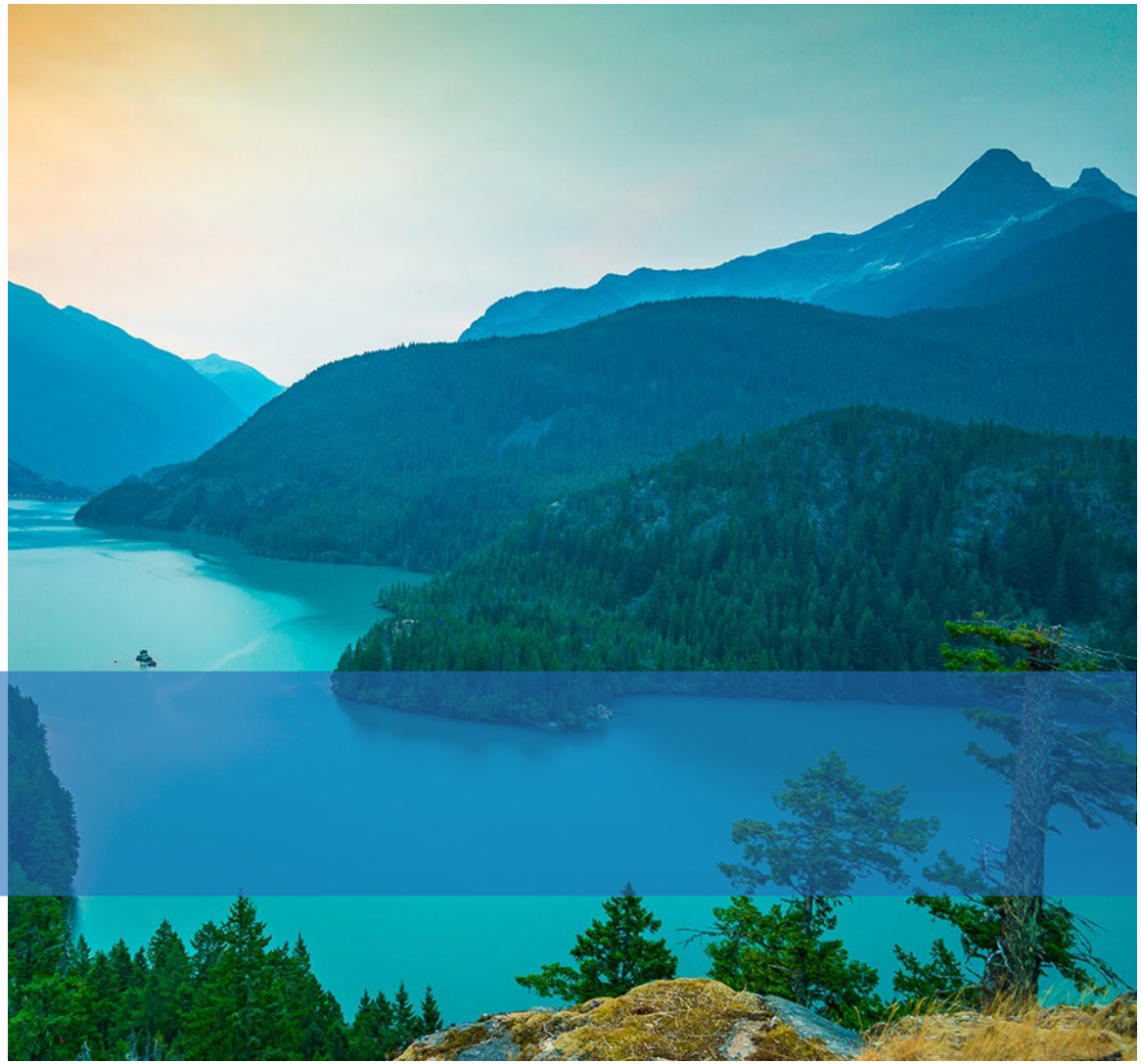
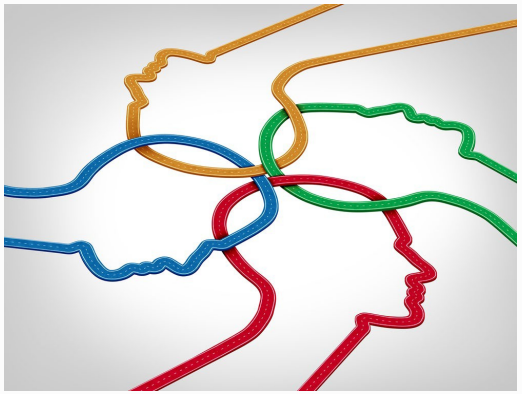


Industry Review

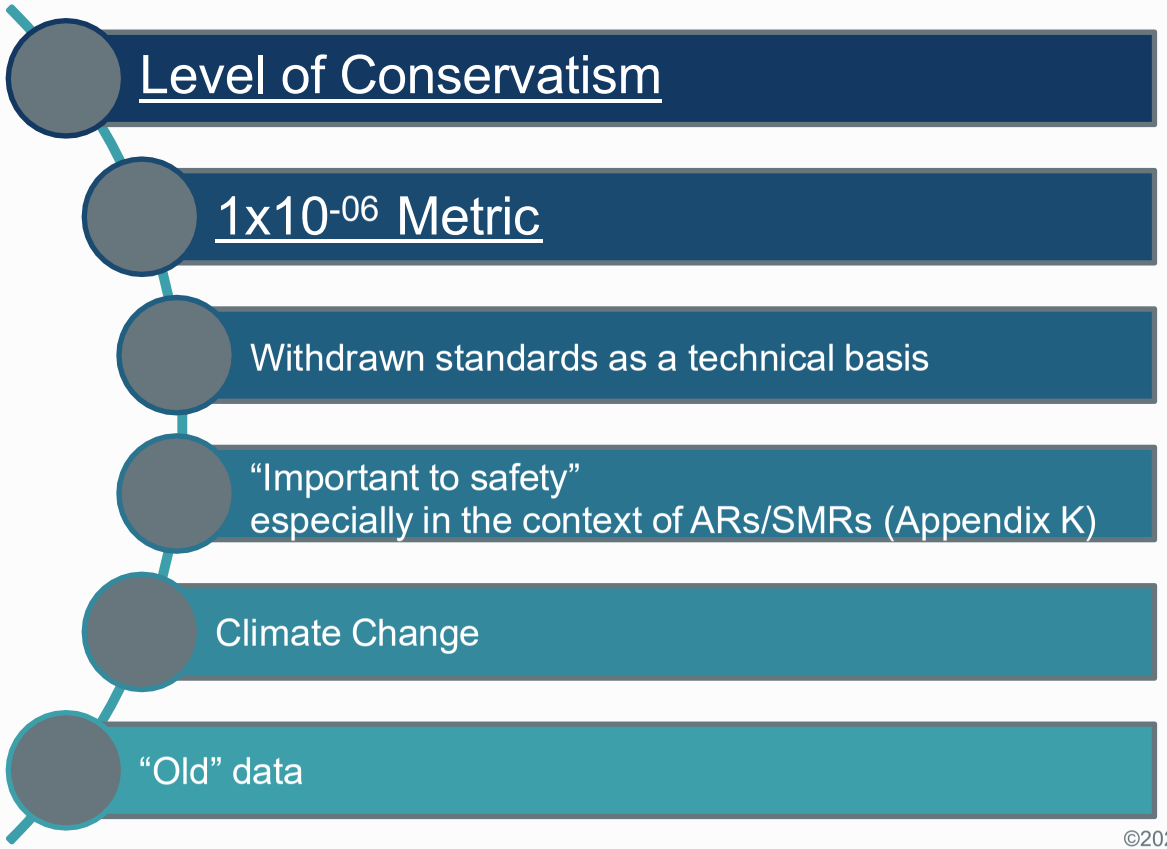
- DG-1290 "*Design Basis Floods for Nuclear Power Plants*“ (Proposed RG 1.59, Revision 3)
- DG-1417, “*Guidance for Assessment of Flooding Hazards Due to Water Control Structure Failures and Incidents*” (Proposed new RG 1.256)
- Cross-functional and diverse review
  - Flooding analysis, flood protections/design, external hazards, post-Fukushima response, licensing and regulatory affairs
  - Utility, NSSS vendors, engineering services companies, research organizations, etc.
- Feedback to be submitted
  - Detailed written comments on both documents
  - Will use this public meeting to discuss higher-priority issues which may benefit from discussion in helping to understand the concerns and shape resolution



DG-1290 "*Design Basis Floods for Nuclear Power Plants*"

(PROPOSED RG 1.59, REVISION 3)

DG-1290 Key Issues



Level of Conservatism

- *"**all** methods and assumptions should be clearly conservative…"*
  - Requiring that ALL inputs/methods/assumptions be conservative goes beyond what should be needed to provide reasonable assurance of adequate protection and results in compounded conservatism
- Proposed approach

  "the overall methods and assumptions should provide a '***demonstrably conservative***' result…"
  - With added definition of "*demonstrably conservative:*"

    demonstrably conservative - A flood hazard evaluation (deterministic or probabilistic) that is supported by observed data and/or sensitivity studies showing the adopted results are on the conservative side of realistic results. The emphasis for demonstrating conservatism is placed on the flood hazard evaluation results, not on the inputs...

$1x10^{-06}$ *Questions*

- How will $1x10^{-06}$ be used by the staff?
  - Screening for which combined flooding hazards need to be considered?
  - Setting the level of design basis flood when a probabilistic approach is proposed?
  - "As a reasonable criterion to apply to design basis flood estimates"?
- To better understand, the following would be helpful
  - Reference and technical basis for "$1x10^{-06}$ as a target …consistent with established NRC guidance"
  - Examples of how the staff would use $1x10^{-06}$ during review

$1x10^{-06}$ *Practical Implementation Challenges*

- Limited availability of data for flooding hazard:
  - Historical (≈ $1x10^{-02}$)
  - Extension of historical data (≈ $1x10^{-03}$)
  - Use of paleo flood data (≈ $1x10^{-04}$)
    - Data may not be available at all sites
    - Data is not complete
    - Data may no longer apply to current geography
  - Stochastic simulations of weather and flooding phenomena (calibrated to the existing data)

Extrapolation of at least 2-4 orders of magnitude
Uncertainty may be significant

$1x10^{-06}$ *Path Forward Discussion*

- *Practical Approaches*
  - $1x10^{-06}$ mean value, even with large uncertainty;

    or
  - If $1x10^{-06}$ cannot be achieved, then Annual Exceedance Probability (AEP) in the range of $1x10^{-04}$, with descriptions of the site's defined mitigation strategies (FLEX, SAFER, etc.) to respond to a more severe flood (e.g., $1x10^{-06}$)

- External Floods have differences from other hazards
  - May have warning time (hours to days) to prepare
  - Only SSCs below the level of the flood are exposed
  - Strategies exist to mitigate and recover from flooding (barriers, portable pumps, etc.)

DG-1290 – Key Issues Overview

Topic	Comment
Level of conservatism	In several places the documents state that "all" inputs and assumptions must be conservative. Recommend revising to state that the overall analysis must be shown to be "demonstrably conservative" as opposed to every individual input and assumption.
$1x10^{-06}$ as a "metric"	The technical basis and use of 1x10-06 is unclear and as is NRC's intended use of this value as a metric. Given the limited information available to inform a flooding hazard, implementation will be challenging.
Reference to withdrawn/unused standards	DG-1290 refers to withdrawn standards including ANSI/ANS-2.12-1978, "Guidelines for Combining Natural and External Man-Made Hazards at Power Reactor Sites," and ANSI/ANS-58.21-2007, "External Events in PRA Methodology." It is not recommended to reference withdrawn standards that were largely not used and are not reviewed or maintained. It is also noted that parts of these standards are not consistent with other guidance in this document.
"Important to safety" especially in the context of ARs/SMRs (Appendix K)	To avoid future confusion for advance reactors (ARs), Small Modular Reactors (SMRs) (as has existed in the current fleet re: *GL 84-01*) the term "important to safety" should be removed from Appendix K. Recommend use of the terms "safety-related," "non-safety-related with special treatment," and/or "non-safety-related with no special treatment" as endorsed in NEI 18-04.
Climate change	Although perhaps the simplest to project, sea level rise (SLR) is not the only variable potentially impacted by climate change. Recommend acknowledgement of NRC and industry processes which can assure that new climate data and better projections in the future are considered for impact to plant safety.
"Old" data sets	In several locations, the document presents that many data sets available for use in developing the flood hazard are several decades old and have not been updated. In order to, prevent the unfamiliar reader from having the impression that only old and out of date data is being used, consider updating this text to acknowledge NRC (e.g., POAHNI) and industry processes continuously monitor for new information (data, methods, science) to assess and respond to impacts to plant safety.

DG-1417, "*Guidance for Assessment of Flooding Hazards Due to Water Control Structure Failures and Incidents*"

(PROPOSED NEW RG 1.256)

Regulatory Guide vs. NUREG-KM

- *The Challenge - The work and analysis described in this DG are governed by federal and state dam safety regulators and performed/controlled by the dam owners*
  - Licensees do not have the information, methods, or controls to implement this DG*
  - NPPs cannot impose these requirements on dam and levee owners
- *The Question - Is a Regulatory Guide the best document choice to capture the gaps that motivated the issuance of the ISG and the lessons learned in the post-Fukushima flooding reevaluations?*
  - Instead, NUREG-KM's have recently been used to capture post-Fukushima lessons learned for both flooding and seismic issues
  - If needed, a DG should specifically focus on requirements that a licensee should implement (as opposed to items that are to the responsibility of dam regulators or dam owners)

* Unless utility is also the dam owner

Regulatory Guide vs. NUREG-KM

- NUREG-KM-0015, "*Considerations for Estimating Site-Specific Probable Maximum Precipitation at Nuclear Power Plants in the United States of America*,''
  - Captured the lessons-learned concerning the staff's 50.54(f) review experience and application of a SSPMP in anticipation of its continued use
  - Describes the technical theory, data sources, and analysis methodology that could be used to derive a SSPMP estimate
- NUREG-KM-0017, "*Seismic Hazard Evaluations for U.S. Nuclear Power Plants: Near-Term Task Force Recommendation 2.1 Results*,"
  - Presents a seismic hazard characterization for each NPP and compares the licensee's hazard characterization and the staff's confirmatory analyses
  - Provides a comprehensive description of the probabilistic methods used by licensees and the staff

Access to Detailed Dam Information

- DG-1417 describes the diverse ownership and regulatory structures associated with dams and acknowledges that gaining access to the detailed information may be a challenge
- *Practical implementation*
  - Security concerns are associated this information being public
  - Unless the dam is owned by the utility, access to detailed information needed to address DG-1417 may not be possible
  - Intervention by the NRC to facilitate access to this information or assessment insights will likely be necessary -
    provisions for NRC assistance were not retained from ISG
  - Re-evaluation of spillway releases for existing dams for existing sites may conflict with methods required by other dam regulating authorities for assessing these releases
  - Perception of conflicting conclusions on acceptability of dams could be a challenge

Seismic Failure of Dams - Example

- Consistency and clarity of expectations for evaluating “Seismic Failure”
  - Figure 10 - Seismic Dam Failure Analysis Options
  - C1.4.3 – Seismic Failure
  - C4.4 – Ground Shaking
  - C4.6 – Modeling Consequences of Seismic Dam Failure

- When is dam failure assumed?
  What is sufficient documented margin or factor of safety?
- What concurrent assumptions are required?
  Are those assumptions at the dam site or the NPP site?
  How is this analysis performed?
- Other concurrent assumptions that are expected?
  (e.g., 2-year windspeed)

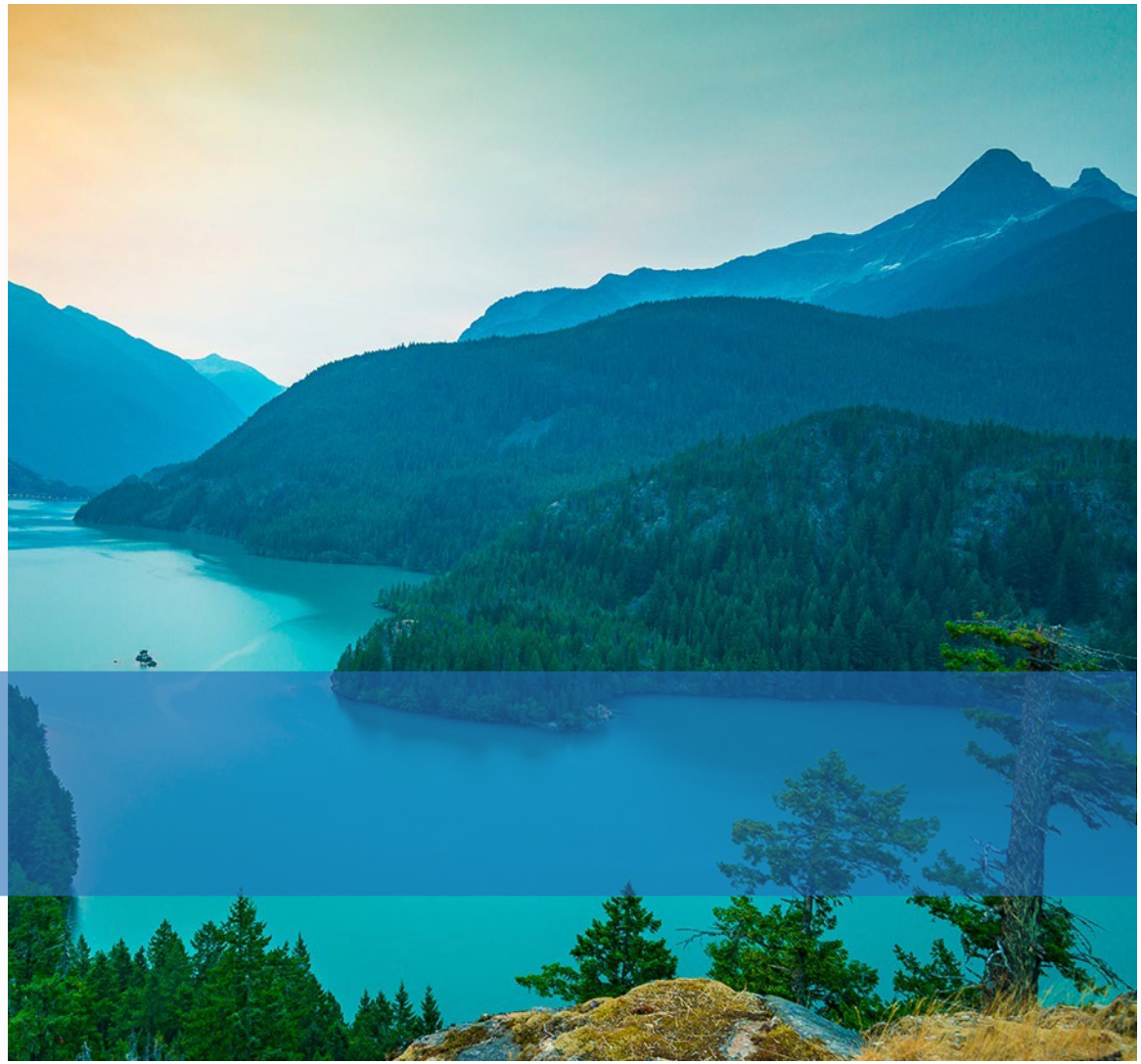
Please provide consistent examples to show how all requirements align.
How would a licensee be able to perform these evaluations?

Practical Implementation Challenges

- DG-1417 states that either methods or data needed to perform some of the analysis identified in the DG-1417 are not available
- DG-1417 provides a wealth of relevant information, however
  - Technical basis for expecting assessment of dam failure probabilities with AEPs of $1x10^{-06}$ to $1x10^{-07}$ is not clear
  - Unclear how the information can be used to achieve the stated level of precision
- Therefore, the only viable pathways for implementation are:
  - Successfully screen out the dams; *or*
  - NRC communicates that dams are "acceptable" (i.e., can be assumed not to fail); *or*
  - Assume total dam failure with concurrent assumptions and deterministically compare with DB flood for NPP, which goes well beyond what is needed for reasonable assurance of adequate protection

Ability of applicants to assess dam failure

Thank you



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