ANSI/ANS-2.8 WG Status "Determining External Flood Hazards for Nuclear Facilities"

Federal Agencies PFHA Workshop
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Topics

- Background
- Objective/Scope
- Probabilistic Approach
- Present Status
- Q & A

Background

- Historical - ANSI/ANS-2.8 (1992) "Determining design basis flooding at Nuclear Power sites" – administratively withdrawn
  - Scope considered flooding caused by
    - Precipitation, snowmelt and any resulting dam failures
    - Seismically-induced and "sunny day" dam failures
    - Surge and seiche and attendant wind generation
    - Local intense precipitation (pluvial flooding)
    - Ice effects, and
    - A reasonable combination of these events.
  - Intent to establish a methodology for a design basis flood hazard with "virtually no risk of exceedance" (i.e. Probable Maximum Floods (PMFs), Probable Maximum Hurricanes (PMH), etc.) deterministically defined bounding values with anticipated mean as low as < 10-6/yr mean probability of exceedence
  - Excluded consideration of tsunamis
  - Appendix B (not formally part of standard) estimated expected frequencies of recommended combinations
  - Withdrawn in 2002 by ANSI rules and not subsequently updated

Background - continued

- ANSI/ANS-2.8-201X being developed to fill an important nuclear standards gap
  - Reflect nuclear site flooding events since 1992
    - Insights from Hurricane Katrina surges
    - Record Mississippi and Red River floods
    - Combined flooding events at a European coastal site
  - Include surge effects of tsunamis
  - Integrate consideration of "climate change" effects
  - Reflect state-of-the-art enhancements in technology, computation methods and capabilities in fluid dynamics and hydrology
  - Extend application from power reactors to all nuclear facilities which required design basis flood estimation as a function of return periods
  - Rationalize treatment of "probable maximum"

Objective

- Develop ANSI/ANS voluntary consensus standard for determining a full range of external flood hazards
- Serve as a reference for siting nuclear facilities, SSC design, and evaluation of flood protection features
  - Deterministic methods screening process
  - Deterministic methods focus on bounding flood hazards (when possible and desirable)
  - Probabilistic risk informed methods for treating frequency-based hazard requirements and understanding hazard uncertainties
- Identify "best practices" and technologies for performing the above assessments using new flood data and technical knowledge gained over past 20 years

Scope

- Riverine flooding
  - Rainfall, snowmelt
  - Controlled and uncontrolled releases from upstream dams
- Upstream dam failure
  - Hydrologic
  - Non-hydrologic (seismic, intrinsic, other)
- Hurricane-induced storm surge
- Wind- and earthquake-generated seiche
- Tsunami
  - Seismically-initiated
  - Landslide-initiated

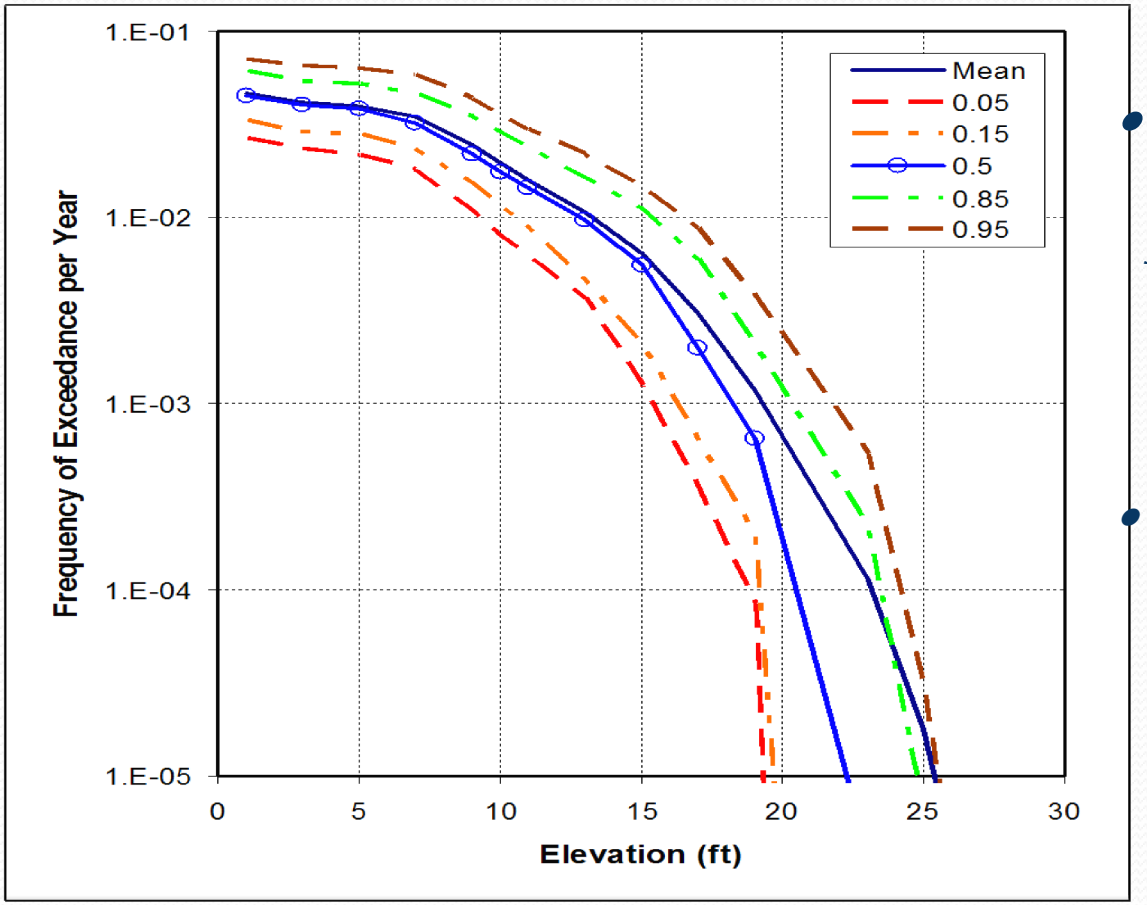
Outside of Scope

- Low water
- Dispersion, dilution and travel time of accident release of effluents
- Local intense precipitation (ANS-2.31 under development)
- Groundwater (Addressed in ANSI/ANS-2.17)
- Internal or external flooding from failure of pipes or tanks
- Standard does not specify:
  - Requirements regarding acceptability of any particular hazard frequency or hazard profile
  - Guidance on appropriateness of facility flood protection or mitigation systems

Probabilistic Approach - example

- Riverine Flood
  - √ Riverine Probabilistic Flood Hazard Analysis (PFHA)
  - √ Probabilistic Aleatory Modeling
  - √ Probabilistic Epistemic Uncertainty Modeling

Typical Results of Probabilistic Approach



- *Example external flood hazard curve*
- *Combined events consideration*

Present Status – 21-Member WG

- Y. Gao (Chair), *Westinghouse Electric Company*
- R. Schneider, *Westinghouse Electric Company*
- M. McCann, *Jack Benjamin & Associates, Inc*
- J. Kanney, *U.S. Nuclear Regulatory Commission*
- C. Mazzola, *Shaw Environmental Inc.*
- J. Stevenson, *J.D. Stevenson Associates*
- K. Bryson, *Chair, ANS-25 Subcommittee*
- K. Ng, *Bechtel Power Corp*.
- J. Hunt, *B&W technical Services Y-12*
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- Q. Hossain, *Lawrence Livermore National Laboratory*
- V. Anderson, *Nuclear Energy Institute*
- J. Stedinger, *Cornell University*
- R. Rishel, *Duke Energy*
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- G. Love, *BWSC Co.*
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- G. Meyers, *Department of Energy HS-32*
- P. Watts, *Applied Fluids Co.*
- V. Titov, *NOAA/Pacific National Environmental Laboratory*
- G. Gaillot, *Shaw Environmental Inc.*

Present Status – continued

- Working draft actively being generated
- Methods and approaches reflect current industry practice and capabilities
- This PFHA Workshop will provide extremely important insights into method selection and application
- Compilation of WG member inputs in process
- Completion target – later this year

Questions??