

Beyond Design Basis Seismic Events

Reasons For The Study

- Significant reduction in seismic hazard perception between 1989 and 1993
- Differences in seismic capacity due to spent fuel pool location and other details
- Loss of pool integrity is determined by the failure mode that has the least seismic capacity; large variations in seismic capacity can exist from one plant to another
- Plant specific hazard and seismic capacity combination can raise a risk concern
- Opportunity to address this issue in a risk informed manner

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Objective

- Examine risk informed methods of assessing plant vulnerability to this issue
- Identify conditions necessary to screen out plants with appropriate seismic demand and capacity combination

Assumptions

- Seismic fragility evaluations indicate a capacity of about 3 times the seismic design basis level unless there is any specific plant related weakness
- Seismic hazard curves from NRC and independent industry studies yield very similar values as demonstrated in the Duke Engineering report

Beyond Design Basis Seismic Events What Was Done?

- Used the basic plant grouping from NUREG 1407, “Procedural and Submittal Guidance for the Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities” published, June 1991
- Obtained annual probability of exceedance for peak ground acceleration at 3 times and 3.5 times the design level earthquake values for each plant from NUREG 1488, “Revised Livermore seismic Hazard Estimates for 69 Nuclear power plant Sites East of the Rocky Mountains” published, October 1993
- Except for a few sites, 3 times the design level earthquake has an annual probability of exceedance of about 2×10^{-5}

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- With a seismic capacity of 3 times the design level earthquake, there is high confidence that the conditional failure probability is about 0.05
- The product of hazard and failure probability (high confidence) is about 1×10^{-6} per reactor year. This is the probability of unrecoverable loss of spent fuel pool integrity and it is about half of the total probability of fuel being uncovered
- Report also presents discussions about various failure modes of the spent fuel pool structure and potential changes in structural response at high level earthquake ground motion
- A simple check list can be developed to screen out plants with no structural vulnerability or identify simple compensatory measures