



Seismic Results of Comprehensive Risk Assessments: What Are We Doing Here?

Jake Dafni, Ph.D., P.E., Matt Farren, and Heidi Pence, P.E., GEI Consultants, Inc.

Dams are typically designed for earthquake return periods ranging from 2,475 to 10,000 years. The recently imposed Federal Energy Regulatory Commission (FERC) comprehensive assessment (CA) guidelines require assessing the risk impacts of up to 1,000,000-year earthquake events. Given the lack of defined faults and source zones in the northeastern United States, we often rely on the United States Geological Survey (USGS) hazard tools to develop seismic hazard curves for the risk assessment portion of dam CAs. The USGS National Seismic Hazard Model (NSHM) used to develop the seismic hazard curves only recommends use of accelerations for earthquake return periods between 475 years and 10,000 years and relies on gridded background seismicity and extrapolation for earthquake return periods beyond 10,000 years. The non-linear seismic hazard curves predict peak ground accelerations (PGAs) significantly greater than the 10,000-year event, often more than 10 times greater than PGAs historically recorded at the dam sites. The predicted PGAs have also increased with release of the 2023 NSHM. This confluence of factors results in seismic risk driver potential failure modes for dams in the northeast, an area with low seismicity, and leaves consultants and owners unsure of what action, if any, to take. This paper shows the semi-quantitative relative risk results from more than ten CAs in the northeast, compares the risk results to areas with greater seismicity in the United States, and discusses these results within the context of case studies of seismic dam failures. We find that there are a disproportionate number of seismic risk drivers (higher likelihood of failure and consequences) for dams in the northeast despite the lack of historical seismic dam failures and recommend that the discrepancy between seismic design and the FERC CA process be reconciled.