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Lake Elmer Thomas Dam is a 421-foot long roller-compacted concrete (RCC) gravity dam on Little Medicine Creek in Comanche County, Oklahoma. The dam is only 0.5 miles upstream of the town of Medicine Park and impounds a reservoir with a maximum storage capacity of 11,800 acre-feet. With a maximum height of approximately 113 feet, Lake Elmer Thomas Dam is classified as a high hazard dam. The RCC dam is founded on massive Mount Scott Granite, approximately 3.7 miles (6 km) from the Meers fault at its closest mapped trace.

A site-specific seismic hazard assessment, completed in 2015, indicated that the recommended Safety Evaluation Earthquake (SEE), with a return period of 10,000 years, and the deterministic Maximum Credible Earthquake (MCE) would result in peak ground accelerations (PGAs) at the site of 1.22 g and 2.08 g, respectively. Both of these ground motions have PGAs that are significantly greater than 0.8 g used in the pseudo-static analysis of the dam during original design and subsequent stability evaluations.

To address concerns regarding the stability of the dam for the larger ground motions, an updated seismic stability evaluation and quantitative risk analysis of the Lake Elmer Thomas Dam were performed. The seismic stability evaluation was performed using a two-dimensional pseudo-dynamic analysis of the dam for the SEE and MCE, and updated RCC and foundation strength parameters based on a statistical analysis of data from the original design and construction. Due to the large estimated loss of life, the risk analysis used the results from the seismic stability evaluation and additional sensitivity studies to extrapolate the response of the dam to even larger ground motions. The results of the risk analysis indicated that the mean estimate for the annualized loss of life related to the potential failure of Lake Elmer Thomas Dam falls below the Bureau of Reclamation's guideline for increasing justification for risk reduction actions, and no further work or studies were recommended. Plans for careful visual inspection of the dam and review of monitoring data following ground motions felt in the area were developed.