



US Army Corps  
of Engineers  
Kansas City District

## TUTTLE CREEK DAM

# FACT SHEET

## EARTHQUAKE EFFECTS ON THE DAM

April 2001

The most recent site earthquake study (1999) for Tuttle Creek Dam identified two earthquakes to be considered for the analysis of the dam as the maximum credible events:

- An earthquake with magnitude of 6.6 occurring 12 miles from the dam (at the Humboldt Fault "Hot Spot") and a depth of 6 miles
- An earthquake with magnitude of 5.6 occurring practically under the dam (less than one mile from the dam at a depth of 6 miles). The type of fault that could generate this earthquake is not considered a threat to the dam since the duration of such an event would be around 2 seconds which is too short to affect the dam.

There are no available records of strong earthquakes in the midwest United States. Therefore, the design earthquake motions necessary for the analysis of the dam were based on the record obtained during the San Fernando, California earthquake. This earthquake occurred in 1971 and had a magnitude 6.5. This is the earthquake that severely damaged the Lower San Fernando dam. However, the motions from this earthquake were increased about 11% for use at Tuttle Creek.

The analyses of Tuttle Creek Dam showed that magnitude 6.6 earthquake would cause the natural sands under the slopes of the dam to liquefy (literally become quick sand) and lose their ability to support the dam. The calculations show that if the sands beneath the dam liquefy, the dam would spread out, the top of the dam would drop, and it is likely that cracking and horizontal movement of the dam would significantly reduce the ability of the dam to hold back water. Although the top of the dam would not be expected to drop below the lake level, it is possible that the cracking and deformation could allow water to start seeping through the dam that could cause internal erosion of the dam and eventually uncontrolled release of the lake.

The 6.6 magnitude design earthquake has a very low probability of occurrence, on the order of once in 10,000 years or so. However, calculations were done to determine what size earthquake could shake the dam enough to cause significant damage. It was found that a magnitude 5.7 earthquake 12 miles from the dam is the smallest earthquake that could potentially cause significant damage. This earthquake is not expected to cause significant movement of the dam but it could damage relief wells that control the flow of water under the dam. Damage to the relief well system could eventually lead to loss of the dam. This "threshold" seismic event has an approximate probability of occurrence of once in 1800 years. Earthquakes between the 5.7 and 6.6 magnitudes cause increasing amounts of damage as the magnitude increases.

This fact sheet is published by the U.S. Army Corps of Engineers, the lead agency for the Tuttle Creek Dam Safety Assurance Program. Comments or questions about this fact sheet or the Dam Safety Assurance Program should be directed to Bill Empson of the Kansas City District, Corps of Engineers at (816) 983-3556 or by E-mail at [tcdam.nwk@usace.army.mil](mailto:tcdam.nwk@usace.army.mil).

Questions or comments about lake operations or Tuttle Creek project office activities should be directed to the on-site Operations Manager, Brian McNulty at 785-539-8511.

For additional information, visit our web site: <http://www.nwk.usace.army.mil/tcdam>



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