FERC Taum Sauk Investigation Team

Report of Findings on the Overtopping and Embankment Breach of the Upper Dam - Taum Sauk Pumped Storage Project, FERC No. 2277

Executive Summary

The Upper Reservoir of the Taum Sauk Pumped Storage Project 2277-MO was overtopped during the final minutes of the pumping cycle on the morning of December 14, 2005. Reservoir data indicate that pumping stopped at 5:15 AM with the initial breach forming at approximately the same time. Once overtopping began, erosion started at the downstream toe of the 10-foot-high parapet wall. Erosion progressed below the parapet wall, likely causing instability and resulting in the initial loss of one or two parapet wall sections. Subsequent erosion and breach of the rockfill embankment formed a breach about 656 feet wide at the top of the rockfill dam and 496 feet at the base of the dam. The peak discharge from breach was about 273,000 cfs which occurred within 10 minutes of the initial breach. The complete evacuation of the reservoir occurred within 25 minutes.

The breach flows traveled down the west side of Proffit Mountain into the East Fork of the Black River. Flows destroyed the home of the Johnson's Shut-Ins State Park superintendent, flooded motorists on Highway N, significantly damaged the park, campground, and adjacent properties, and entered the Lower Taum Sauk Reservoir. The Lower Dam stored most of the releases and had a peak spillway discharge of approximately 1,600 cfs. This equates to about 1.1 feet over the spillway crest which is well within the capacity of the lower reservoir spillway. Upon leaving the Lower Dam area, flows proceeded downstream of the Black River to the town of Lesterville, MO, located about 3.5 miles downstream from the Lower Dam. The incremental rise in the river level at Lesterville was about two feet which remained within the banks of the river.

Post-breach inspections and evaluations revealed the following information:

1. The project had historically operated with a minimum of two feet of freeboard on the lowest section of the parapet wall. Following installation of a geomembrane liner in 2004, AmerenUE operated the project to fill the upper reservoir within one foot of the lowest section of the parapet wall. Post breach evidence shows the reservoir may have been routinely filled to within 0.25 foot of the lowest section of the parapet wall.

2. The December 14, 2005 breach was preceded by significant wave overtopping that occurred on September 25, 2005. Factors involved with

this event were waves due to winds from the remnants of Hurricane Rita combined with a reservoir level pumped to within 0.4 foot of the top of the parapet wall.

3. On September 27, 2005, AmerenUE adjusted the reservoir control programming to account for the difference between the actual reservoir levels and the readings from the reservoir level instrumentation.

4. On October 3-4, 2005, AmerenUE personnel discovered that the conduit which housed the instrumentation for monitoring reservoir levels was not properly secured to the dam. Deterioration of the instrumentation tie-down allowed the conduits to move adversely impacting the reservoir level readings. The instrumentation readings showed reservoir levels that were lower than actual levels. As a safety measure, AmerenUE adjusted the reservoir level control programming to shut down the pumps when the instruments showed the reservoir levels were two feet lower than normal settings.

5. Two Warrick Conductivity Sensors were used as a safety system for shutting down the units in case of high water levels. The sensors would send a signal to shut down the units when they became wet. The sensors were physically relocated to a height that was higher than the lowest point on the parapet wall. Therefore, if the Warrick Sensors were contacted by water, the Upper Dam would already be in an "overtopping" condition.

6. Modifications made to the reservoir control programming adversely affected how the signals from the Warrick Sensors were managed and reported. The modifications required that both sensors make contact with water to initiate shutdown. This removed a layer of redundancy to the safety system.