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Simulation of Erosion, Transport, and Long-Term Fate of Coal Fly ash from the TVA Kingston Site

By

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In December of 2008 an 84-acre containment berm failed on a fly ash storage facility at the TVA Kingston Fossil Plant, releasing approximately 6 million cubic yards of ash which impacted approximately 300 acres of the surrounding area, including 3 million cubic yards of ash which deposited in the Emory River. The ash completely filled the Emory River channel adjacent to the Swan Pond Embayment, with ash transporting more than 2 miles upstream in the Emory River due to the momentum of the slurry release.

After the spill, the channel thalweg was filled with ash (ash depths up to 30 feet), thus the channel capacity was significantly reduced. This in turn resulted in an immediate flood risk for the numerous properties that were located on both sides of the channel. Studies conducted by the TVA indicated that the ash deposits in the river increased the predicted flood elevation for the 100 year flood by 8 feet.

To counter the increased flood and sediment transport risk, the TVA and EPA initiated an aggressive dredging operation to restore the Emory River channel capacity within one year of the spill. This effort involved bringing in a number of high capacity dredges that worked 24 hours a day until the channel was restored. However, a number of relatively large flow events occurred in the Emory River before the channel was completely cleared, including a three year return storm event (~70,000 cfs) that occurred in May of 2009. To better understand the impact of fly ash deposits on Emory River hydraulics and sediment transport, the EPA contracted with the Engineering Research and Development Center at Waterways Experiment Station (ERDCWES) to model the Watts Bar reservoir system. A two-dimensional sediment transport model was developed for the Emory, Clinch, and Tennessee Rivers, from Emory River Mile 4.0 to Watts Bar dam at Tennessee River Mile 530 (45 miles)

This paper presents the modeling background, procedures, and results. In addition, the concept of long-term natural recovery of Watts Bar reservoir is discussed. The model used to conduct the fly ash transport study will be utilized to evaluate the impact of natural incoming sediment load on fly ash deposits in the reservoir. Natural sediment loads will be routed into Watts Bar reservoir to evaluate the long term deposition and mixing with residual fly ash deposits. Timelines will be estimated for the dilution and burial of fly ash by the natural sediment load from the Emory, Clinch, and Tennessee Rivers.