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before the

Subcommittee on Water Resources and Environment

of the

Committee on Transportation and Infrastructure

United States House of Representatives

Hearing entitled "The Tennessee Valley Authority's Kingston Ash Slide: Evaluation of Potential Causes and Update on Cleanup Efforts."

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Good morning. Madam Chairwoman Johnson, Ranking Member Boozman, and members of the Subcommittee, my name is William Scott Almes and I am the Director of Geotechnical Engineering for Marshall Miller & Associates, Inc. I am a licensed Professional Engineer, hold a Bachelor of Science and Master of Science degree in civil engineering and have worked as a consulting engineer in the geotechnical engineering profession for nearly 20 years. I was the lead Project Manager on a peer review of the study commissioned by TVA to determine the root cause of the December 22, 2009 ash spill at TVA's Kingston Fossil Plant.

I appreciate this opportunity to testify before you regarding the results of that peer review and other observations about ash management practices at TVA. We prepared this work for the TVA Office of the Inspector General, and the details of it are incorporated into the Inspector General's report that is being made public today.

I will now summarize the results of our work, focusing on three important topics: Marshall Miller's conclusions regarding the root cause analysis; our general conclusions and observations of ash management practices; and recommendations for moving forward.

<u>Marshall Miller's Conclusions Regarding the Root Cause Analysis</u>

- In Marshall Miller's opinion, the four probable root causes identified by AECOM are technically plausible, reasonably supported by the data, and all four contributed significantly to the spill.

- However, Marshall Miller believes that the AECOM root cause analysis focused disproportionately on the significance of the thin, discontinuous, soft foundation layer (thin, weak, sensitive silt and slimes foundation layer) as one of the most probable factors/root causes. The significance of the "Fill Geometry" and "Loose, Wet Ash" (hydraulically placed/sluiced ash) indicate these factors as a probable root cause of equal or greater significance to the soft foundation soils factor/root cause and should be equally emphasized.
- In Marshall Miller's opinion, the failure was not strictly associated with the thin, weak, sensitive silt and slimes foundation layer, and more associated with the ash dike geometry and relatively low strength of the sluiced "Loose, Wet Ash" foundation and impounded material.
- This has significant implications for TVA and the industry. Other similarly constructed TVA impoundments, with or without the slimes foundation layer, could be at risk of failure and should be properly investigated.

<u>Marshall Miller's General Conclusions and Observations About Ash Management</u>

- As early as 1985, intrinsic problems related to the stability of Dike C were known within TVA. An internal memo indicated that the calculated factor of safety was less than the minimum acceptable value of 1.5 and close monitoring was recommended to detect any potential signs of failure–in lieu of changing TVA policies and procedures that would require that the ash pond be designed to the higher "dam safety" standard. No specific action by TVA appears to have been taken to improve the stability of the earthen Dike C embankment.
- In Marshall Miller's opinion, if TVA had included its ash ponds in the Dam Safety Program as discussed in December 1988 when TVA decided against this policy, the probability of identifying some or all of the conditions that led to the Kingston failure would have increased significantly.
- The construction of successive upstream stages to elevation 820 (approximate crest elevation of Dredge Cell No. 2 at the time of failure) above the original containment dike may have contributed to an additional decrease in the factor of safety of the containment dike system. In essence, at the time of failure on December 22, 2008, this increase in constructed height equated to an approximate 70-foot increase in the height of the ash pond above the crest elevation of the original Perimeter Dike C.
- The design of the Kingston coal ash dredge cells should have included a thorough engineering evaluation of all potential failure modes.

Recommendations for Moving Forward

- Since, in our opinion, the Kingston ash pond failure was not strictly associated with the "thin, weak, sensitive silt and slimes foundation layer" and more associated with the ash dike (or "fill") geometry and relatively low strength of the sluiced "Loose, Wet Ash" foundation and impounded material, other similarly constructed ash (or gypsum and/or other byproducts) impoundments could be at risk of failure and should be properly investigated.
- TVA, and the power generation industry as a whole, should strongly consider all the factors evaluated by AECOM as probable root causes of the Kingston failure when assessing the condition and structural integrity of wet ash disposal facilities. It is not prudent to presume that if the slimes layer observed in the failed section at Kingston does not exist at other plant sites, there is adequate stability of these structures. On the contrary, the information developed from the extensive studies conducted by both Stantec Inc. and AECOM indicates that there is a reasonable risk of other dike failures if changes are not made in the design construction, oversight, and operation of the wet ash disposal sites throughout TVA.
- Sound engineering practice is to design such facilities with features that provide a reasonable degree of redundancy or "second line of defense" in the event that one or more of the systems become inoperable. It is important that this design philosophy be applied to all of TVA's ash disposal facilities.

This concludes my opening statement. I look forward to answering any questions that you may have. Thank you for your time.