GEOTECHNICAL DESIGN CONSIDERATIONS FOR LANDFILL CONSTRUCTION OVER AN ASH POND

John Seymour[1], P.E., Pedro Amaya[2], P.E.,
Paul Sabatini[3], Ph.D., P.E. and Mohammad Ajlouni[42], P.E., Ph.D.

[1]Geosyntec Consultants, 134 N. LaSalle Street, Chicago, IL 60202
Ph: 312.416.3919, email: jseymour@geosyntec.com
[2] American Electric Power, 1 Riverside Plaza, Columbus, OH 43215
Ph: 614.716.2926, email: pjamaya@aep.com
[3]Geosyntec Consultants, 1420 Kensington Road, Oak Brook, IL 60523
Ph: 630.203.3352, email: psabatini@geosyntec.com
[4]American Electric Power, 1 Riverside Plaza, Columbus, OH 43215
Ph: 614.716.2926, email: maajlouni@aep.com

A new landfill was proposed to be constructed on top of an existing valley fill ash pond. The ash pond covers approximately 100 acres and the maximum depth of ash is 110 ft. The ash is primarily flyash that had been placed as a slurry over a 40-year period. The ash pond is contained by an earthen dam that is approximately 120 ft high. The new landfill would be required to contain approximately 15,000,000 cuyd of flue gas desulfurization (FGD) coal combustion product (CCP). The final landfill would be up to 300 ft high which would create compressive loads of up to 13 tsf. Further, 1/4th of the plan area of the new landfill would be constructed over an existing mine spoil fill area.

The new landfill would require an extensive bottom liner system. The bottom liner system included, from the bottom up: 1) an underdrain system, 2) recompacted soil liner, 3) polyvinyl chloride (PVC) liner, and 4) a leachate collection system.

The most significant design challenge included addressing potentially significant differential settlements between the landfill over the mine spoil area and the maximum depth of the ash in the pond and liquefaction. The ash is a loose, uniformly fine grained, compressible material that could experience an estimated 5 ft of total settlement. This large amount of settlement could create distress in the liner system, subsurface drainage pipes, and leachate drainage pipes such that flow of liquids through the pipes could be disrupted and the liner system could be placed into an unacceptable amount of tension.

A field and laboratory program was completed to more accurately calculate the amount of differential settlement. Following completion of the design and submittal of the permit application, additional work was required to obtain a construction permit to confirm the calculated differential settlements.

To address the large differential settlements and the potential for liquefaction, the following was designed and completed: 1) a preload test program to confirm the settlement characteristics of the ash, 2) removal of the mine spoil which was then replaced and recompacted to provide a more uniform subbase, and 3) a preload program was instituted to remove approximately 50% of the estimated settlement prior to landfill construction. The results of the above confirmed the design approach and design calculations and allowed the final design to be completed with a predicted 2-1/2 ft of differential settlement, effective design of the underdrain system, leachate collection system and liner system. Overall, the landfill was permitted in 18 months; the initial cell was constructed and filling of FGD began in early 2008.