Dewatering a CCP Landfill with a Horizontal Well

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Background/Objectives. Leachate discharge and/or collection from coal ash disposal facilities has become a regulation-driven priority for many operators in energy or related market sectors. Highly-publicized facility failures, combined with the discharge of metals from retained CCP into ground or surface water has generated increased interest in safe, effective and economical ways to collect leachate for treatment, as well as reduce hydrostatic head in at-risk facilities. Many, if not most historical CCP disposal sites were designed without effective leachate controls. Retrofitting for leachate removal requires new wells. Vertical well networks to accomplish this translates to multiple wells and conveyance lines, surface disruption, drilling on steep slopes, penetration of established covers or caps, and other potential hazards.

For a CCP facility in Wisconsin, leachate in a hillside landfill had filled the lined containment to overflowing, with discharge outside the landfill. Dewatering of the landfill was identified as the primary remedy, with the engineer considering vertical and horizontal wells, and deep trenching. The final design hinged on the installation of a 650-foot horizontal well that traversed the lowest portion of the landfill, with the goal to lower the head in the landfill by approximately 26 feet.

Approach/Activities. Horizontal drilling had not previously been attempted to install drains in coal ash. Several challenges were surmounted in the design and subsequent installation. The design required evaluating and selecting materials compatible with the chemical environment, specifying bore path and screen designs, and identifying and designing for installation and operational stresses. For construction, challenges included fabricating the well screen from a new material, coping with steep entry and exit angles to optimize the depth of the well, holding tight tolerances in advancing the bore near the liner, and adapting to variable landfill contents. Working in close coordination, the site owner, engineer, drilling contractor, pipe manufacturer, and well screen slotting contractor addressed each of these challenges. An advanced navigation technology was selected to drill precisely at depths from 29-80 feet, with less than five feet separating the bore and the basal liner. Construction issues included on-the-fly changes in drill tooling and drilling fluid chemistry to drill the variably consolidated coal ash, and dealing with unexpected materials found in the landfill. The first use of fusible PVC pipe in an environmental well setting also created challenges in fabrication, assembly, and pullback. Frequent communication between stakeholders advanced the project, as each of these challenges was solved.

Results/Lessons Learned. Following an aggressive well development activity, the well was placed online in late 2014. The well initially produced 25 gpm, nearly four times better than anticipated, lowering the leachate level within the landfill over five feet in the first week of operation, and 0.3 feet per day thereafter. After operating for less than four months, the leachate level was drawn down 17.5 feet. During this time, adjacent groundwater quality showed marked improvement.

Key lessons learned include a better understanding of leachate flow through landfill ash, fabrication and installation properties of a new well material, knowledge of the range of compositions and degree of cementation exhibited by landfill ash, tooling selection guidelines to best penetrate these varied materials, and general management practices to quickly coordinate refinements in approach across a multi-faceted team.