Development of Conceptual Site Models and Evaluation of Groundwater Corrective Measures for Coal Ash Sites

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Background/Objectives. The Federal Coal Combustion Residuals (CCR) Rule (40 CFR Part 257, Subpart D - Standards for the Disposal of Coal Combustion Residuals in Landfills and Surface Impoundments) includes Groundwater Monitoring and Corrective Action (40 CFR § 257.90 - 257.98) requirements applicable to certain CCR units. One of these requirements is that the owner or operator of a CCR unit must assess potential corrective measures if groundwater monitoring data provides evidence of a release (i.e., a statistically significant level exceeding the groundwater protection standard) or immediately upon the detection of a release from a CCR unit (40 CFR § 257.96). Once initiated, the owner/operator has 90 to 150 days to complete the Assessment of Corrective Measure. Due to this prescriptive timeframe, owners/operators of affected CCR units have begun to evaluate potential groundwater corrective measures prior to the detection of a release from CCR units or detection of an Appendix IV assessment monitoring constituent in groundwater at a statistically significant level exceeding the groundwater protection standard. The objective of these groundwater corrective measures evaluations was to develop corrective measure concepts and cost estimates to support future evaluation of CCR unit closure options, assessment of potential risk and financial liability associated with potential groundwater impacts, and other planning efforts.

Approach/Activities. The corrective measures evaluations began with a review of existing construction details, operation details, hydrologic, groundwater, and subsurface data associated with the CCR unit and surrounding area. Following this review, a conceptual site model (CSM) was developed using classic geology, engineering, and risk assessment concepts paired with the advanced application of environmental sequence stratigraphy (ESS), three-dimensional visualization (3DV), and groundwater fate and transport modeling, when appropriate. Based on the CSM, potential corrective measures to address CCR constituents in groundwater (primarily metals) were identified for a screening-level evaluation. Viable corrective measures paired with the CSM were then used to develop conceptual corrective action strategies and associated cost estimates. Data gap analyses were also performed during CSM and corrective action strategy development to identify information needs and the relative cost/benefit of obtaining the data.

Results/Lessons Learned. The results of these studies provided a preview of the potential scope, magnitude, and cost of future groundwater corrective actions and helped identify key data needed to further refine the understanding of site conditions and potential corrective action. Each site was unique and presented challenges based on a combination of varying hydrogeologic conditions, site constraints, contaminants, and operational considerations. The CSMs developed for each site provided a framework upon which future assessments can build when new data becomes available. The CSMs also proved useful validating CCR unit closure methods and selecting well locations and depths for monitoring networks. Both proven and innovative technologies were identified as potentially applicable for the remediation and eventual restoration of groundwater at CCR sites. The presentation will include depictions of subsurface conditions, including ESS-enhanced cross-sections and dynamic 3DV images, descriptions of corrective measures alternatives, results of alternatives evaluations, and cost data.