Remedial Design Optimization Using Environmental Sequence Stratigraphy

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Background/Objectives. In 2022, AFCEC conducted an enterprise-wide study to capture performance and lessons-learned information related to application of ESS principles to inform site remedial approaches. This presentation will examine one of the selected sites in the enterprise study and detail the modeling and groundwater monitoring decision logic that led to the refinement of the traditional conceptual site model (CSM) using environmental sequence stratigraphy (ESS) principles. The refinements of the CSM ultimately supported optimization of the groundwater remedial system to reduce life-cycle costs and accelerate the site towards the cleanup goals.

Approach/Activities. The ESS approach presented in the 2017 U.S. Environmental Protection Agency (USEPA) Groundwater Forum Technical Issue Paper (EPA/600/R-17/293) examines existing subsurface data available in the context of appropriate depositional environments (e.g., facies analogues) and uses vertical trends in grain size to identify packages of sediment deposited at roughly the same point in geological time. For groundwater restoration projects, a sequence stratigrapher identifies and correlates genetically-related chronostratigraphic units, rather than lithostratigraphic units, resulting in a more representative definition of hydrostratigraphic units (HSUs) and understanding of their connectivity. To date, the ESS approach has been applied at over fifty Air Force facilities ranging from site-specific to regional-scale investigations. These facilities encompass a wide range of depositional environments, providing an opportunity to understand benefits of using an ESS approach to implement and optimize site remediation across a diverse set of hydrogeological settings.

Results/Lessons Learned. The case study for site ST-69 at Duke Field, Eglin Air Force Base in Okaloosa County, Florida will be presented to show how modeling and groundwater monitoring led to the application of ESS principles and provided a better understand of the complex subsurface geology. Results of the case study show that application of the ESS methodology provides a better understanding of the site geology and a more effective means of designing, installing and optimizing a remedial system. Lessons-learned information related to application of ESS principles to the case study site will be provided. Specifically, the case study shows the benefits of using ESS methods to resolve contaminant migration uncertainty and target active remediation to treat contaminant mass associated with preferential pathways. The ESS method also has proven valuable in assessing feasibility of treating contaminant mass associated with low permeability contaminant storage zones and developing appropriate cost-effective remediation strategies. Relatively small upfront capital investment in analysis and data interpretation of existing site data, regardless of the current phase of site cleanup, can substantially enhance remedy effectiveness, provide significant cost avoidances, and reduce project life-cycle costs.