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Environmental Sequence Stratigraphy-Based Conceptual Site Model: The First Consideration for Characterizing PFAS

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Background/Objectives. The U.S. Air Force, and more specifically AFCEC, is developing significant experience in addressing PFAS with over 1,700 discrete area sites that are scheduled to be investigated as part of a programmatic site investigation effort. Some of their conclusions from field investigations to date are:

- Concentration is a function of release volume
- Multiple releases typical of most installations
- Background concentrations of PFCs confound site-specific investigations
- Transport potential clearly depends on chain-length (e.g., PFOS < PFHxS)
- ECF-based AFFF is generally the dominant source of PFASs at USAF sites

Considering the above in addition to the variety of PFAS release locations and scale of releases on any one Air Force facility, this poses significant challenges to characterizing the nature and extent of this highly mobile emerging contaminant.

The initial approach to characterizing PFAS subsurface nature and extent is to define the geology which is the subsurface "plumbing" that controls PFAS migration. For sedimentary aquifers, Environmental Sequence Stratigraphy (ESS) is a best practice for creating a geology-based conceptual site model (CSM).

Approach/Activities. The subsurface provides the greatest uncertainty when addressing PFAS characterization. "It's dark down there" and there are limited data (i.e., boring logs) that represent the subsurface. ESS is an established methodology that focuses on 1) a critical understanding of the sedimentary depositional environment, 2) formatting of lithology data to emphasize vertical grain-size distribution, and 3) a stratigrapher's superior knowledge of facies models and related grain-size pattern recognition. These components result in an interpretation and prediction of the geology between boring logs that significantly reduces the uncertainty and provides the framework for characterizing PFAS nature and extent. ESS is an essential starting point for PFAS characterization. It has been applied by AFCEC at numerous Air Force facilities, including the following for PFAS characterization:

- Peterson AFB, CO
- Eielsen AFB, AK
- Former Wurtsmith AFB, MI
- Joint Base Elmendorf-Richardson, AK

Results/Lessons Learned. Examples will be presented that show the efficacy of ESS as a critical path to PFAS characterization. The methodology has been successfully applied at numerous complex contaminated groundwater sites throughout the US, including over 20 Air Force facilities. It is critical that before the ever-dynamic datasets of chemistry and groundwater conditions are evaluated, one must first determine the static geologic framework within which the other data can be analyzed.