

## **Status of the 2015 Geology Revolution... Where Are We Now and Where Do We Go from Here?**

### **Moderators**

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### **Panelists**

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**Panel Description.** The 2015 Battelle Bioremediation Conference in Miami was earmarked as the “Geology Revolution” in groundwater remediation. Since that conference, Environmental Sequence Stratigraphy (ESS) was published by US EPA as a best practice for developing representative conceptual site models (CSMs). It has been established that geology is the primary control on subsurface fluid flow and the migration of groundwater contamination, yet many groundwater projects define contaminant plumes primarily with groundwater data without even a basic geologic evaluation and without representative geologic cross section. Those who have joined the Revolution to develop more sophisticated geologic models have reaped the benefits of more successful remedy designs and project outcomes. Here are a few recent examples:

- In 2022, AFCEC conducted an enterprise-wide (>80 Air Force facilities) evaluation of the elements that affect remediation success and concluded that the CSM overwhelmingly has the greatest impact on the remediation outcome.
- In a separate study conducted in 2022, AFCEC supported a third-party evaluation of the lessons learned from groundwater contaminant projects where ESS was used to develop the CSM and concluded the technology provides a better understanding of the site geology and a more effective means of designing, installing, and optimizing a remedial system.
- In 2021, Naval Facilities Engineering Systems Command (NAVFAC), as part of its Open Environmental Restoration Resources (OER2) Webinar series, presented ESS as a remediation optimization tool.

Although these examples are from the DoD space where technology research and development happens, it is important to know that geology is scaleable and the ESS practice originated from commercial projects of all sizes. As an example, the six case studies presented in the US EPA paper are all commercial projects.

A few questions to consider:

- How many in situ bioremediation projects have not met the remedial action objective or have seen significant rebound of contaminant concentrations after multiple injections?
- Were they based solely on groundwater data and estimated radius of influence of injection points?

2015 was a call to arms. Today we ask the question “where are we now and where do we go from here?”