Remediating Bedrock: What Once was Impossible is Now Possible. Three Case Studies

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In-situ remediation of fractured bedrock aquifers used to be considered near impossible. As recently as 2013, the US Department of Defense's (DoD's) environmental research arm (SERDP) wrote "One of DoD's most challenging environmental restoration issues is determining how to deal with contaminants that have seeped into the fractures in bedrock and are a continuing source of groundwater contamination." (SERDP, 2013). The U.S. Geological Survey (USGS) noted that "remedial action is delayed or stymied by the complexity of contaminated fractured-rock aquifers.".

However, environmental practitioners are curious and creative, and as our environmental industry evolves, what was once close to impossible is now routinely possible. The ITRC (Interstate Technology Regularly Council) stated that while contaminated fractured bedrock sites have often been considered too complex to be remediated, "with new strategies and technologies...fractured bedrock challenges that may have prevented site remediation in the past are now surmountable." (ITRC, 2017).

In the past, bedrock remediation failed for a variety of reasons, including variable and indeterminant groundwater flow pathways and velocities, significant contaminant back diffusion from the porous rock matrix into groundwater, and a lack of economical remedial amendments and delivery techniques. By addressing these key restrictions, the environmental industry has been able to successfully remediate contaminated bedrock sites.

This talk will present an overview of bedrock remediation challenges, before demonstrating the evolution of bedrock site remediation technologies through three recent and varied bedrock remediation Sites. One Site was contaminated with heavily impacted groundwater and separate phase PHCs (petroleum hydrocarbons), a second Site contained the dissolved chlorinated solvent tetrachloroethene (PCE) contamination, while a third Site was impacted with heavy metals, specifically hexavalent chrome.

For each bedrock Site the remediation approach will be presented along with pre-remediation and post-remediation groundwater results. Throughout the presentation recommendations and insights will be offered into state-of-the-art bedrock remediation amendments and approaches that can be employed for successful in-situ fractured bedrock remediation.

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Mr. Tunnicliffe is President of Vertex Environmental Inc., is an Environmental Engineer, and has years of experience designing and implementing remediation of chlorinated solvents and petroleum hydrocarbons. Mr. Tunnicliffe holds a Master's degree from the University of Waterloo where he studied oxidation in fractured bedrock.