



Answering the Challenges of Low Permeability Formations

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Geo Tactical Remediation Ltd. (Geo Tactical) was employed to emplace high permeability pathways by fracture injection to increase the permeability of the subsurface geology. Geo Tactical emplaced sand proppant by fracture injection, injected fluorescein tracer and conducted tiltmeter mapping at a site in Santa Clarita, California. The project consisted of a pilot and full-scale program to increase permeability to allow for future injection treatments at a low permeability site.

Low permeability formations have challenges like low permeation injection rates, amendment particle size, and the cost of drilling numerous injection wells. Fracture injection is a method that can address many of these challenges by creating a tensile parting in the soil/ bedrock geology. Fracture injection creates permeable pathways that connect secondary geological features and increase the contact area.

The pilot program confirmed the successful emplacement of the fracture network and the radius of influence (ROI) using fluorescein tracer and tiltmeter mapping. The fluorescein tracer confirmed that the fractures extended to a minimum ROI of 25 ft and upwards of 75 ft, and tiltmeter mapping showed the location and placement of these fractures to a high degree of certainty. The completed program (pilot and full-scale) delivered 83,000 lbs of sand in 9,300 gals of slurry into five boreholes and 16 emplacement pathways (EPs) (fractures).

Borehole instability and zones with higher permeability than anticipated due to sand and gravel layers extending deeper caused challenges in emplacing the mass of sand in the fullscale program (60% mass emplaced). Proper delineation and pre-fracture injection testing, including hydraulic conductivity, is strongly recommended to demarcate any potentially challenging zones. Injection wells were installed and completed in the fractured and higher permeability boreholes (no sand emplaced) for later injection treatment.

A supporting case study will show how fracture injection enhanced the permeability of an inefficient multi-phase extraction (MPE) system. Sand-propped fracture injection enhanced the permeability of the subsurface geology and reduced the number of wells required, and a surfactant increased the rate of desorption of the condensate.

Permeability enhancement for low permeability zones can improve inefficient extraction systems, emplace significant masses of amendment, extend the radius of influence, and potentially reduce drilling costs.

Understanding the formation is crucial. The appropriate injection pressure is the key to unlocking the treatment approach to low permeability zones.

Gord Guest

Gord is the Principal at Geo Tactical Remediation Ltd. based in Calgary, Alberta and is responsible for senior review and the design and support for in situ remediation projects. Gord has more than 30 years of experience in the environmental remediation industry specializing in fracture and permeation injection. He specializes in in-situ remediation design, project management, designing injection equipment, downhole injection tooling, and the field application of various injection technologies. Gord has experience with Phase I & II environmental investigations and geo-mechanical testing. He earned his Bachelor of Science in Geology from the University of Calgary, Alberta and is a registered Professional Geologist in Alberta.