Application of Sequence Stratigraphy in Developing Bioremediation Strategy in a Complex Geological Site: An Example from the Los Angeles Basin, California

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Background/Objectives. The efficacy of in situ aerobic bioremediation techniques, such as biosparging, largely depends on soil permeability for the proliferation of aerobic microbes. Therefore, accurate delineation and prediction of high permeability zones in the subsurface of a site is a prerequisite for optimal installation of bioremediation tools. However, complex geological sites with significant subsurface heterogeneity pose a major challenge in correctly recognizing the spatial distribution of target high permeability zones. The traditional method of lithostratigraphy, which relies on a “layer-cake” approach of stratigraphic investigation, tends to oversimplify the complex geometry and distribution of aquifer sediments, and thereby fails to identify the precise zone for optimal biosparging. On the other hand, sequence stratigraphy, a powerful subsurface investigation approach originally developed by the petroleum industry, can capture the true subsurface heterogeneity of aquifers and thus can be an important aid to bioremediation. This presentation demonstrates a case-study where sequence stratigraphy was used to guide the successful installation of biosparging tools at a hydrocarbon-contaminated site.

Approach/Activities. Previously, a stratigraphic correlation was undertaken at a geologically complex, LNAPL-impacted industrial site in the Los Angeles Basin, California, where the main purpose was to provide geological input for developing a cost effective and efficient bioremediation workplan for the site. However, the correlation was conducted using a lithostratigraphic approach, which did not provide sufficient resolution for identifying high permeability target zones.
In this study, a high-resolution sequence stratigraphic framework was developed, taking account of the true heterogeneity of depositional environments. The same preexisting dataset of borehole core description and cone penetration testing (CPT) logs were used for the purpose. A detailed facies analysis of the borehole data was conducted within the sequence stratigraphic framework to determine the dimensions and transmissivity of various depositional units beneath the site.

Results/Lessons Learned. Results of the sequence stratigraphic investigation at the site led to strategic placing of 60 biosparging locations with precise screening interval based on identified high-permeability zones. The biosparging tools are presently functioning at the site with optimal biodegradation of LNAPL because of their strategic positioning. Since no new geological data acquisition was required, sequence stratigraphy proved to be a cost effective and efficient way of guiding the remediation workplan for the site. This case study emphasizes the need for conducting sequence stratigraphic investigations and adequately addressing subsurface heterogeneity for achieving effective implementation of aerobic bioturbation.