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Push-Pull Tests for Site Characterization

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Push-Pull Tests for Site Characterization

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Summary

This book has described and hopefully demonstrated that the single-well, push-pull test, in all its various manifestations, is a useful tool for site characterization, pilot testing of various remediation strategies, and so on. The advantages of in situ testing are clear, and the push-pull format makes it possible to perform field experiments at relevant scales for a modest cost and with no more logistical complexity than a laboratory experiment. Often in the biogeochemical sciences, we think of research as a linear process from small-scale laboratory development to ultimate (usually at a date a long way off) full-scale field application. However, using the push-pull test it is possible to conduct field experiments in parallel with laboratory experiments and this should lead to better synergy between the two. Simple field experiments have the remarkable ability to sharpen experimental design by identifying the most important parameters to control in laboratory experiments and to quickly select the most promising small-scale procedures and techniques to further develop in the laboratory. Nevertheless, much developmental work on the push-pull test format remains to be done. Additional numerical and analytical methods for interpreting push-pull test breakthrough curves for the ever more complicated biogeochemical systems being studied are needed. The design of push-pull tests can be refined to incorporate valuable auxiliary data such as isotopic composition of test solutions, microbial community dynamics, surface chemistry reactions, and so on. To date, only a limited number of push-pull tests have been conducted (using gas phase tracers) in the vadose zone and these have focused on a single microbial process (methane oxidation). Most push-pull tests have been conducted in the near surface (<100 m deep), but the test is potentially most valuable in deep subsurface environments where the costs of drilling for sample collection are very high. Thus, push-pull tests in deep boreholes on land and beneath the seafloor hold great potential in elucidating important biogeochemical processes in those environments. Combining push-pull tests with various geophysical imaging techniques also holds great promise because of the ability to modify the subsurface environment (e.g., by injecting electrolytes that can be detected by electrical conductivity arrays) in defined ways and thus identify preferential flow paths, reactive surface areas, etc.

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