

Cost-Reliability Relationships for Reactive Barriers and Funnel-and-Gate-Systems in Heterogeneous Aquifers

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Several reviews of the field performance of PRBs and F&G-systems pointed out that the desired hydraulic performance could not be achieved in many cases. One of the reasons is that less emphasis was placed on optimizing the hydraulic system design with respect to local hydrology and groundwater flow patterns. Furthermore, uncertainties in aquifer heterogeneity have not been addressed at all or not adequately. Obviously, such a sub-optimal performance of the remediation system also has strong implications for its cost-efficiency. In this paper, a design optimization framework will be presented, that accounts for prediction uncertainties due to aquifer heterogeneity by providing total-cost-estimates of optimized design alternatives in relation to the reliability to achieve the expected capture zone. The framework combines the geostatistical description of aquifer conductivities, groundwater flow modeling, cost-estimation-functions and optimization strategies. Results of a modeling study show that the cost-reliability relationships are strongly influenced by the degree of aquifer heterogeneity as well as by the type of containment/barrier-system (e.g., number of gates, ratio of total funnel length to gate length).