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Attributing a Value Onto Groundwater Resources: The Impact of Environmental Cost on Monitoring Decisions

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European and U.S. regulations mandate a minimum number of wells in order to monitor for groundwater pollution from landfills. The optimum number and location of a network of wells is assessed by conducting numerical flow and transport simulations, which account for the heterogeneity of aquifers, and a decision-making analysis, which accounts for the probability of failure, the cost of monitoring measures, and the cost of remediation. An optimal monitoring network seeks to maximize the probability of detection, minimize the extent of polluted area, and minimize the cost of a system.
The current work focuses on the decision-making part and specifically on the impact of the environmental cost on the selection of an optimal network. The results of a stochastic analysis by Yenigul et al. are utilized to determine the optimal configuration of wells subject to the above three objectives. When the standard practice is followed to set the remediation cost as a substitute of the environmental cost the optimal decision on monitoring network coincides with the minimum-mandated number of wells. A broader definition of environmental cost is proposed here that considers that the full value of groundwater resources is not recovered after remediation. The lost value of groundwater is defined as the value change from drinking water, before a pollution event, to irrigation water, which is returned after remediation. When this expanded notion of environmental cost is utilized higher monitoring standards are seen to be optimal.