Numerical Simulation of Solute Migration Facilitated Groundwater Remedial Design under a Hexavalent Chromium-Contaminated Site

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Background/Objectives. Physical and chemical properties, distribution, storage characteristics and environmental risk of soil and groundwater pollution, are the key factors for remedial design. How to apply the theory and technology in engineering applications, and meet the national remediation demands, is the focus to promote the entire remediation business. However, the pollutant transport equations, principles and laws of many contaminated site remediation projects involving groundwater are primarily based on experimental and simulated methods. Furthermore, there are only a few cases in which contaminant migration theory and technology of groundwater system in practical engineering have been applied, thereby lacking the engineering basis for practical application. Therefore, in this research a typical hexavalent chromium contaminated site in northwest China is taken as an example to analyze the application of groundwater pollutant migration and remediation technology. The coupling model of groundwater seepage and pollutant transport is established, to analyze the hydraulic capture and removal effect of the groundwater pump and treat and vertical impermeable wall combined technology, and provides the scientific basis for the remediation in actual engineering groundwater pollution.

Approach/Activities. The topography of the study area is: miscellaneous fill, silt, silty clay, sandy gravel, mudstone. Groundwater remediation is mainly aimed at sandy gravel aquifer, using the combination technology of pump and treat and vertical impermeable wall. Based on the analysis of drilling data, stratigraphic section and pumping test, the groundwater system in the study area is generalized into heterogeneous anisotropy, spatial 3-D structure and unsteady underground water system. The 3D coupling model of hydrologic and contaminant transport was established by Modelflow groundwater modeling. It takes convection and dispersion of contaminant into consideration when transport characteristics of hexavalent chromium, Cr (VI), with pump & treat and impermeable wall in groundwater environment were numerically analyzed. The effects of vertical impermeable wall was researched and predicted. The simulation results demonstrated that the Cr (VI) concentration in groundwater decreased from 317 mg/L to 180 mg/L under the condition of continuous pumping **without** impermeable wall as the removal efficiency was 43%; and the Cr (VI) concentration in groundwater decreased from 317 mg/L to 80 mg/L under the condition of continuous pumping **with** impermeable wall as the removal efficiency was 75%.

Results/Lessons Learned. The identification and verification of the model shows that the groundwater contaminant transport model based on Modelflow can match the actual situation very well. The simulation of groundwater system in the study area shows that the groundwater in this area is abundant and the overall trend of pollutant diffusion is obvious, cause the surface water pollution in the northern part of the site easily. Therefore, during the implementation of the remediation project, it is necessary to enhance the groundwater pump-and-treat system in this area to prevent unacceptable diffusion of groundwater contamination.