

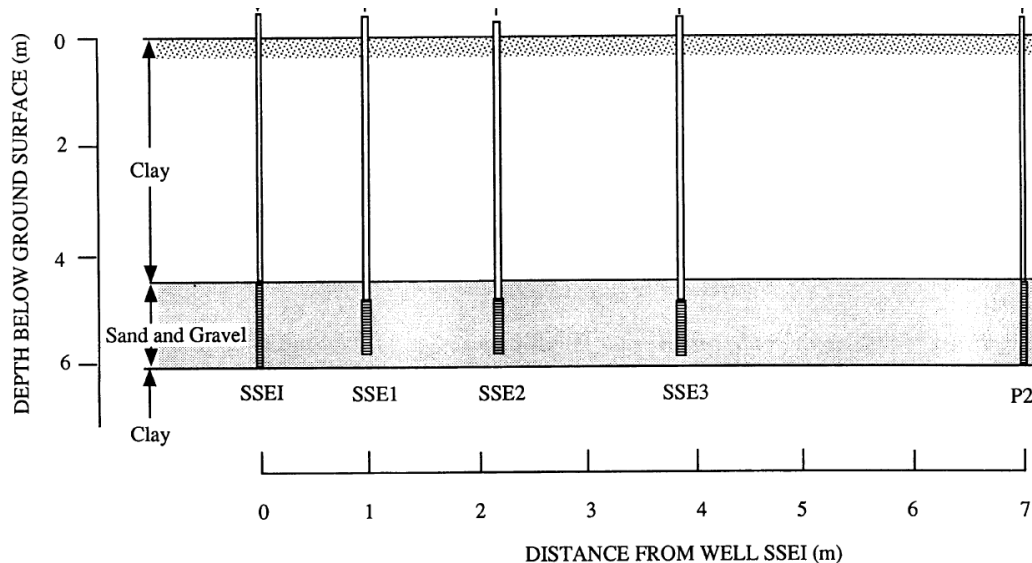
Remediation of soil and groundwater
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Problem set #3: physicochemical monitoring

Problem 1:

An *in situ* pilot study of the aerobic cometabolic biodegradation of TCE with phenol was carried out in California. Oxygen and phenol were injected in the injection well and water was extracted in the extraction well. Monitoring wells were installed to observe the processes underway.

The wells consisted of standard 5-cm polyvinyl chloride pipe installed by using a hollow stem auger. These wells contained 1.5-m slotted screens, installed 4.5 to 6.0 m below the ground surface. Based on laboratory experiments, the initial rate of degradation of TCE in the presence of phenol and oxygen is $0.05 \mu\text{g/L-hr}$. The aquifer contained approximately $40 \mu\text{g/L}$ TCE.

The goal of this experiment is to evaluate the effectiveness of this strategy for the bioremediation of TCE. Please propose a monitoring program for this experiment. Where do you propose to sample, how often, what do you propose to measure? Please consider a combined physicochemical and microbiological monitoring option.



Problem 2:

A contaminated aquifer is being characterized to help determine whether remediation is required. In order to probe the need for remediation, an environmental engineer would like to obtain cores down to 30m from the site to determine the extent of the contamination of the solid phase with arsenic (As). The top part of the aquifer is clay and starting at a depth of about 15m, the aquifer material is unconsolidated sandy sediment. What do you recommend the engineer do? What type of drilling?