Study Questions for Exam 2 - GE 498

Describe three limitations of column tests.

Which temporal moment would best describe the advective velocity?

What factors influence dispersion on a microscopic (pore size) scale?

Why do dispersivity values increase with increasing path length?

Might we expect the value of dispersivity to become relatively constant after a particular path length? Why or why not?

What data do you need to assess the relative importance of diffusion and advection in transport of solutes?

If a vadose zone is contaminated with a two-component, chlorinated-solvent NAPL mixture (TCE and carbon tetrachloride), within what phases would you expect to see contamination, and how does the contaminants partition?

Discuss two situations you might encounter in the field where the rate of diffusion would become an important mechanism of transport.

List four common reactive tracers

List the two specific tracers you would choose in a column test to differentiate between the effects of spatial heterogeneities and spatial variation in sorption.

List five methods to estimate dispersivity.

In a column experiment a chloride solution is injected as a tracer. The column, filled with sand, is 30 cm long with a diameter of 10 cm. The velocity is 1 $x10^{-2}$ cm/s. the relative concentrations (C/Co) at 46.6 and 53.3 minutes after injection were 0.42 and 0.573, respectively. Estimate the dispersivity and dispersion coefficient of the sand.

List four processes that could be responsible for the non-ideal behavior of a reactive tracer in a two well tracer test.

There has been a spill of 10,000 gallons of oil field drilling fluid. The fluid is a solution of 5% KCl and 10% $CaCl_2$ (by weight). The contaminant plume has entered a shallow alluvial aquifer and is moving at a velocity of 10 meters/year and heading toward a drinking water well located 1.4 km away. The plume shape and size is well defined by monitoring wells. Discuss the additional data you will need.

Drums of cyanide solution (CN = 5 x 10^2 µg/l) were buried near an abandoned mine site 15 years ago. Assume that the drums leak and the source dimensions area Y=25m and Z=5m and the groundwater velocity is 1 x 10^{-6} m/s. There is a stream 225 m directly downgradient form the drums. We estimate the dispersivities are 10m, 1m and 0.1m (x, y, z), respectively. Will the concentration of cyanide entering the stream exceed the MCL of 100 µg/l?