

**CE 473/573 Groundwater  
Fall 2009**

Comments on homework 7

39. Most of the problems dealt with not answering the question. Remember that total (or hydrodynamic) dispersion, which has a dispersion coefficient  $D_L$ , is the sum of molecular diffusion and mechanical dispersion, which is  $a_L v_x$ . In this case, just about all of the hydrodynamic dispersion is due to mechanical dispersion. The relative importance of advection and dispersion can be estimated with the Péclet number  $Pe = v_x L / D_L \approx v_x L / (v_x a_L) = L / a_L$ . In this case,  $Pe = 12$  suggests advection is most important, but I would retain dispersion as well.

40. Groups that did this problem should have used

$$C = \frac{C_0}{2} \left[ \operatorname{erfc} \left( \frac{x - v_x t}{2\sqrt{D_L t}} \right) + \exp \left( \frac{v_x x}{D_L} \right) \operatorname{erfc} \left( \frac{x + v_x t}{2\sqrt{D_L t}} \right) \right].$$

I find  $C = 1249.5$  mg/L.

42. The solute velocity is  $v_c = v_x / R$ , and the retardation coefficient is

$$R = 1 + \frac{\rho_b K_{oc} \phi_o}{\theta}.$$

Therefore, compounds with higher  $K_{oc}$  will have lower solute velocity.

43. Even if the compounds have the same soil conditions, flow, and source concentration, the relative lengths of the plume depend not only on the half-life but also on the MCL and sorption properties. Most groups managed these calculations by assuming values for the soil properties. If you assume them to all be one, then you assume, for example, that the moisture content is 100%—that is, there's no soil!

44. Most answers were fine here. Including dispersion gives a more accurate estimate. It is also more conservative because it predicts a longer plume. Therefore, more of the soil will be indicated for remediation.