THE PENNSYLVANIA STATE UNIVERSITY

ENERGY AND MINERAL ENGINEERING

ENVSE 408 CONTAMINANT HYDROLOGY

ASSIGNMENT 4

Two different column leaching tests are devised to evaluate the ability to remediate a site where NAPL contamination has been found. The columns, shown in the figure are flushed with water to remove TCE, in solubilized form, from the contaminated zone. In each test, the initial free phase NAPL saturation is 10%, and it is present as an immobile phase. The permeability of the sand is $k = 10^{-6}\ cm^2$. The dynamic viscosity of water is $\mu = 1.12 \times 10^{-3} N.s/m^2$ and for the NAPL, $\mu = 0.96 \times 10^{-3} N.s/m^2$. The upper water level is held constant by an overflow tank and the effluent pressure is retained at atmospheric. The samples remain fluid saturated throughout the test with $S_w + S_{nw} = 1$. Aqueous solubility of TCE is 1060 mg/l, density is 1500 kg/m^3 and the porosity, 30%.

1. Estimate effluent concentration from the cell with time following initiation of the leaching test for the parallel flow geometry. When will the effluent concentration drop below the drinking water standard of 5 ppb. Choose the simplest model you believe reasonable.

2. Estimate effluent concentration from the cell with time following initiation of the leaching test for the series flow geometry. When will the effluent concentration drop below the drinking water standard of 5 ppb.

Note that your result is dependent on the assumptions you make. State and justify all your assumptions.