

MIT OpenCourseWare  
<http://ocw.mit.edu>

1.061 / 1.61 Transport Processes in the Environment  
Fall 2008

For information about citing these materials or our Terms of Use, visit: <http://ocw.mit.edu/terms>.

**1.061/1.61: Homework 9 [10 points]**

A small stream is contaminated by TCE, a cleaning solvent, from an inflow of contaminated groundwater. The groundwater plume enters at  $x = 0$  and instantly mixes over the stream cross-section, creating a uniform concentration of 20 ug/L. Two kilometers downstream water is drawn from the stream into local drinking water wells. Assuming that water-to-air is the only removal mechanism, estimate the TCE concentration (in micrograms per liter) at this point ( $X = 2$  km). Use the following steps

- a) Estimate Henry's Law Constant for TCE using the following information. Explain its meaning.
- b) Estimate the relevant molecular diffusion of TCE - in air, water or both, whichever is needed.
- c) Estimate the TCE concentration (in micrograms per liter) at  $X = 2$  km.
- d) Are you worried that the drinking water is made unsafe?

The ditch is 10 cm deep and 100 cm across. The stream flow is 10 liters per second. The wind blows at about 4 meters per second, and the air and water temperature are both 20°C.

TCE has the following properties:

structure:	$\text{ClHC}=\text{CCl}_2$	
molecular weight	131.4 g/mol	
liquid density	1.46 g/cm <sup>3</sup>	
melting point	-73°C	
boiling point	87°C	
vapor pressure (20°C)	0.1 atm	
aqueous solubility (20°C)	0.008 mol/L	
Primary Drinking-Water Maximum Contaminant Level for TCE		5 ug/L