The investigation of the Smithville site has continued and an array of monitoring wells has been added. The extent of migration within the upper and lower aquifers is defined for February/March 1989 as shown on the attached figures. The inferred extent of DNAPL apparent in boreholes that penetrate the upper aquifer only is shown on the figures.

Recall that the parent DNAPL comprises 50% polychlorinated biphenyl (PCB), 10% trichlorobenzene (TCB), 2% trichloroethene (TCE), with the remainder as a mixture of mineral oils.

Field Parameters

<table>
<thead>
<tr>
<th>Aquifer</th>
<th>Hydraulic Gradient (m/m)</th>
<th>Hydraulic Conductivity (cm/s)</th>
<th>Overall Porosity (-)</th>
<th>Fracture Spacing (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Limestone Aquifer</td>
<td>.01 – .005 (horiz)</td>
<td>$5 \times 10^{-3}$</td>
<td>.01 – .05</td>
<td>.1 – .2</td>
</tr>
<tr>
<td>Intermediate Aquiclude (shale)</td>
<td>.3 – .8 (vert)</td>
<td>$1 \times 10^{-7}$</td>
<td>.15 – .20</td>
<td>.05 – .1</td>
</tr>
<tr>
<td>Vinemount Aquifer</td>
<td>.002 – .005 (horiz)</td>
<td>$4 \times 10^{-2} - 2 \times 10^{-1}$</td>
<td>.01 – .15</td>
<td>.3 – .5</td>
</tr>
</tbody>
</table>

DNAPL Properties

<table>
<thead>
<tr>
<th></th>
<th>Solubility in water (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCE</td>
<td>1060</td>
</tr>
<tr>
<td>TCB</td>
<td>19</td>
</tr>
<tr>
<td>PCB</td>
<td>0.2</td>
</tr>
</tbody>
</table>

Assignment

1. From knowledge of the organic fraction as $f_{oc} = 0.1\%$, estimate the distribution coefficient, $K_d$, and retardation factor, $R$, of the plume from the available tabulated data for TCE, TCB and PCB. Define and justify any assumptions you make.

2. From the observed plumes, estimate the distribution coefficient, $K_d$, and retardation factor, $R$, appropriate to the site for TCE and TCB, for each of the upper and lower aquifers. Recall that the facility was opened in March 1978. Define and justify any assumptions you make.

3. Compare the magnitudes evaluated using the empirical (1.) and field (2.) methods and discuss any similarities and differences.

4. From the concentration data available, estimate the volume of parent DNAPL that has been removed from free phase at the source for the two compounds TCE and TCB. Recall the average thicknesses of the upper and lower aquifers are 3m and 4m, respectively. Ignore the volumes locked in the till and aquiclude.
DEEP AQUIFER TOTAL TCB 137.16 LATE FEB/EARLY MARCH 1989

INFERENCE EXTENT OF DRAPL IN SHALLOW AQUIFER
INFERENCE TOTAL TCB CONC. ISOPLETH IN PPB

SOUTHWYLD SWIM SITE (0.61 Ha.)

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