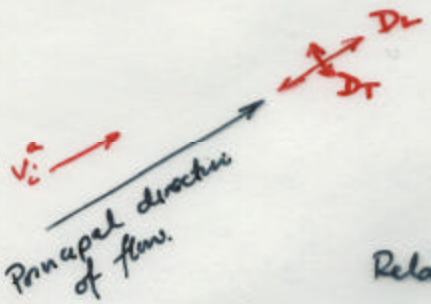
5.4 HYDRODYNAMIC DISPERSION

Hydrodynamic dispersion = Diffusion + Mechanical dispersion (L^2/T)



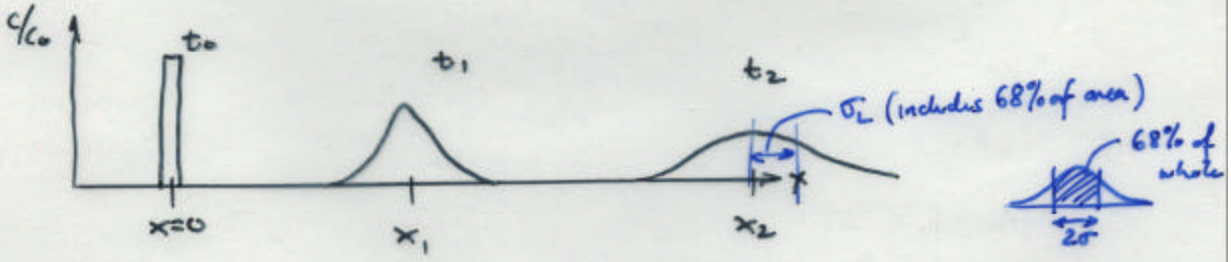
$$D_L = \alpha_L v_i^{\rightarrow} + D^*$$
$$D_T = \alpha_T v_i^{\rightarrow} + D^*$$

Relative dominance of diffusion depends on:

1) Clays, $v \rightarrow 0$ ∴ diffusion dominant
(also retardation)

2) Sands, gravels, fractured rock. $v \rightarrow$ high
∴ mechanical dispersion dominant

Measure in situ for best results.

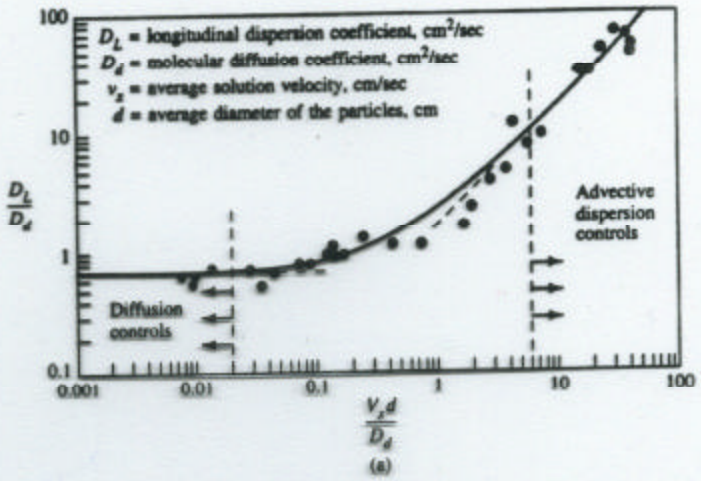


$$D_L = \frac{\sigma_L^2}{2t} \quad ; \quad D_T = \frac{\sigma_T^2}{2t}$$

σ = standard deviation

σ^2 = variance

$D_L = \alpha_L V + D_d^*$



$D_T = \alpha_T V + D_d^*$

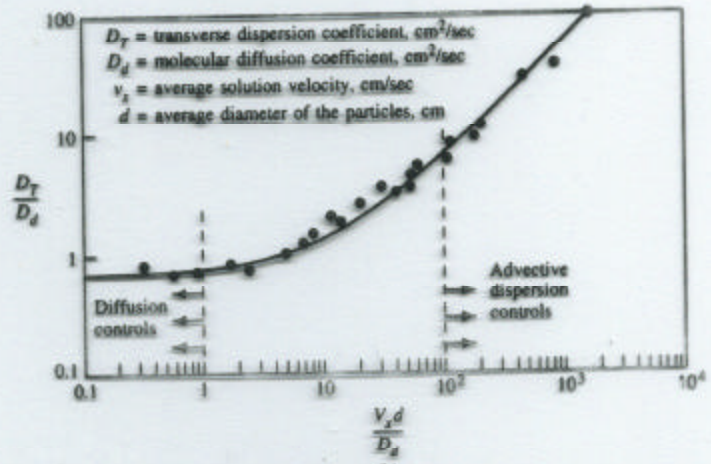


FIGURE 2.7 Graph of dimensionless dispersion coefficients versus Peclet number, $P = v_s d/D_e$ (a) D_L/D_e versus P and (b) D_T/D_e versus P. Source: T. K. Perkins and O. C. Johnson, *Society of Petroleum Engineers Journal*, 3 (1963):70–84. Copyright 1963, Society of Petroleum Engineers.

$Pe = \frac{V^* L}{D_L}$

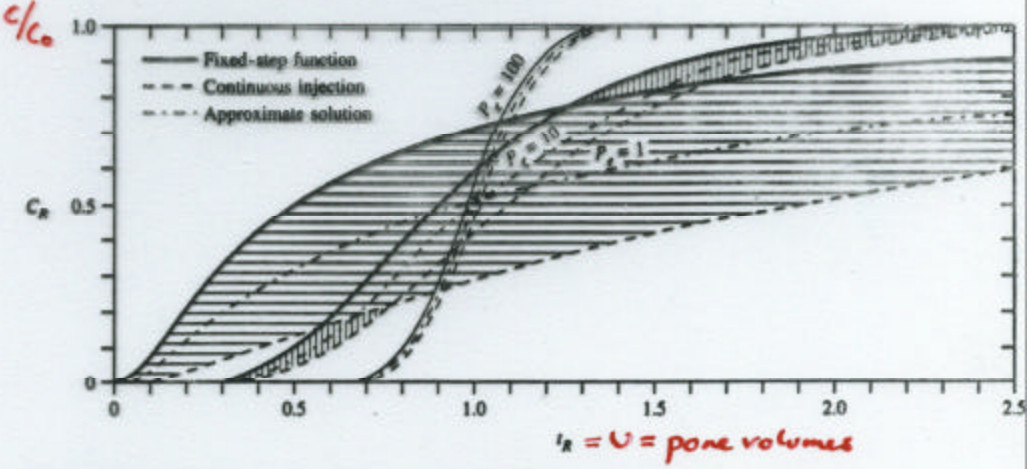


FIGURE 2.9 Dimensionless-type curves for the continuous injection of a tracer into a one-dimensional flow field. Source: J. P. Sauty, *Water Resources Research* 16, no. 1 (1980):145–58. Copyright by the American Geophysical Union.