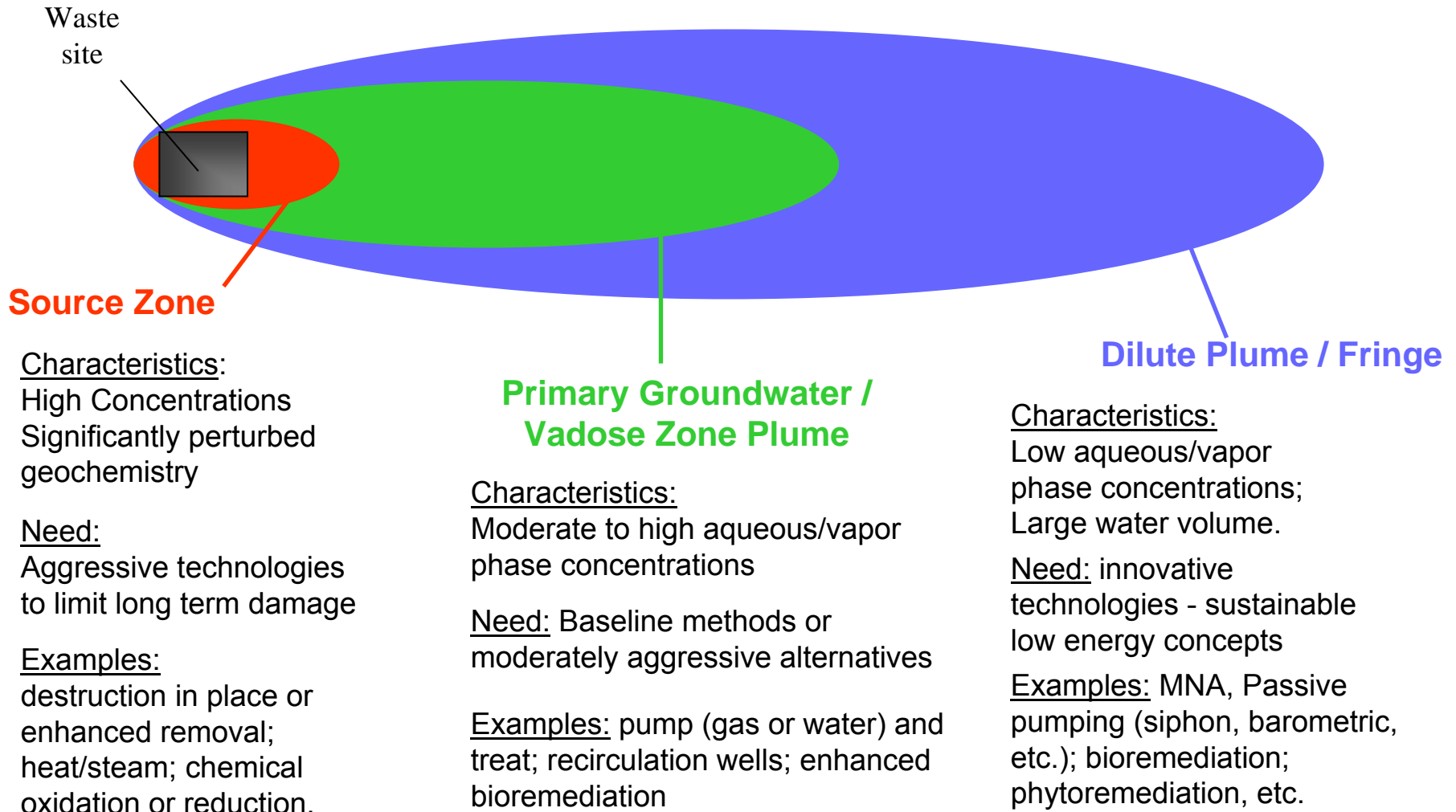
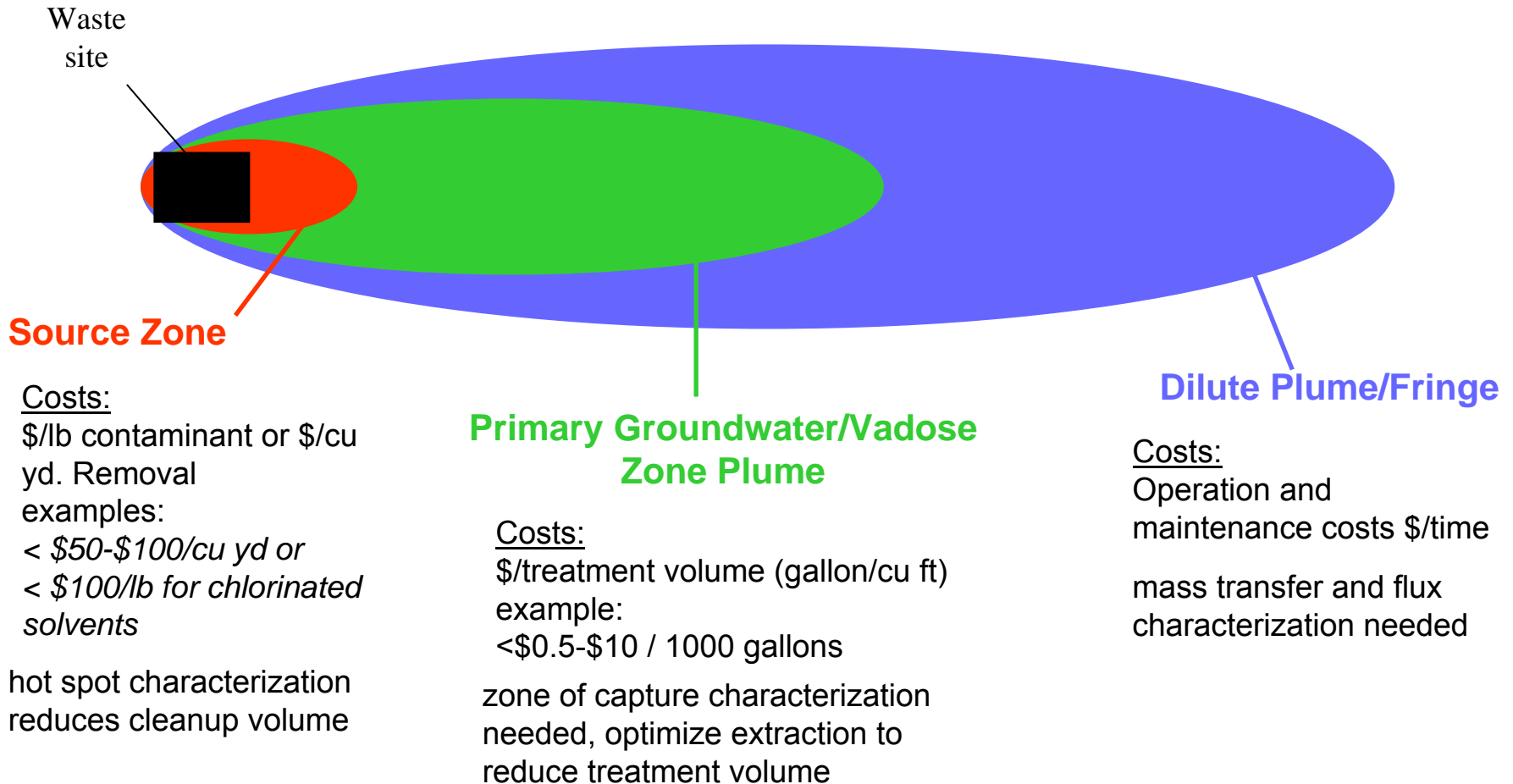


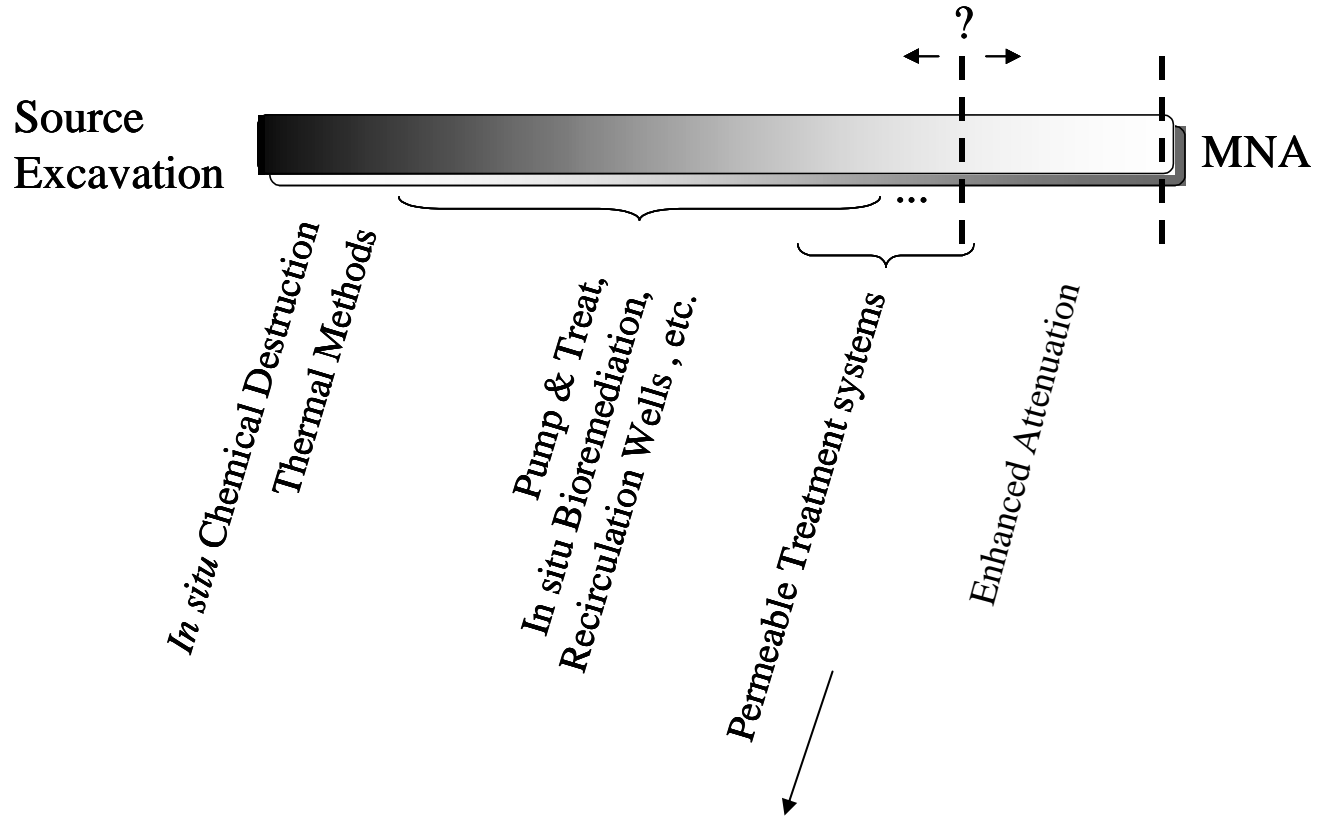
Anatomy of a Contaminated Site



Diagnosing and Treating a Contaminated Site

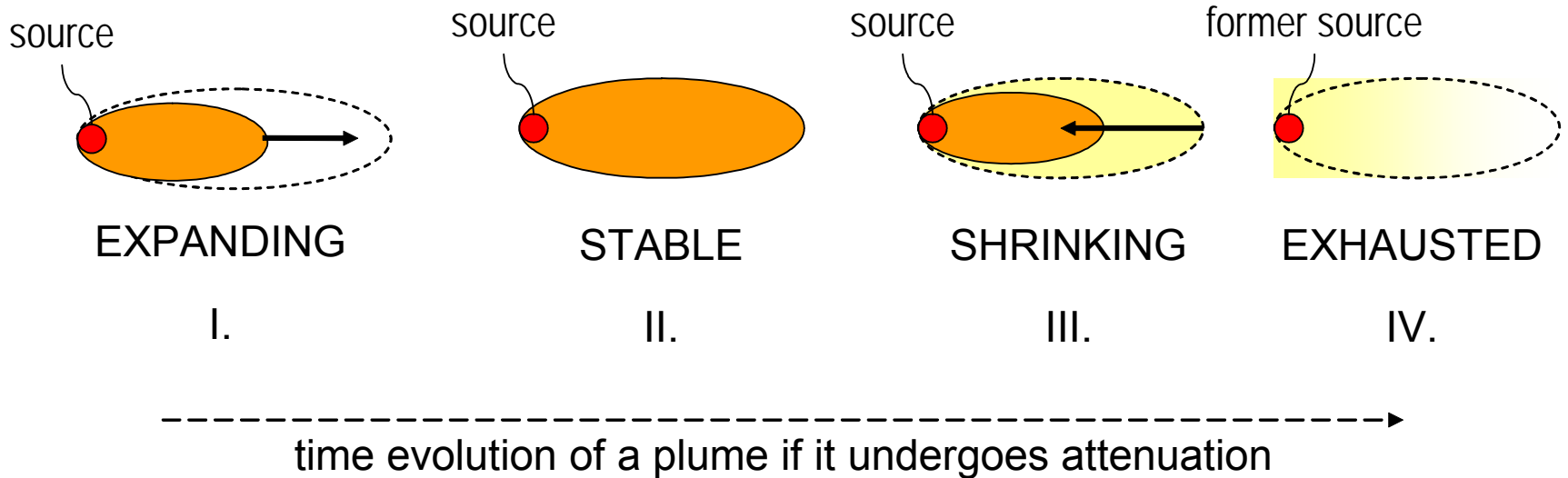


Remediation Options – A Continuum



Definition: A “Sustainable Enhancement” is an intervention that continues to operate until such time that the enhancement is no longer required to reduce contaminant concentrations or fluxes.

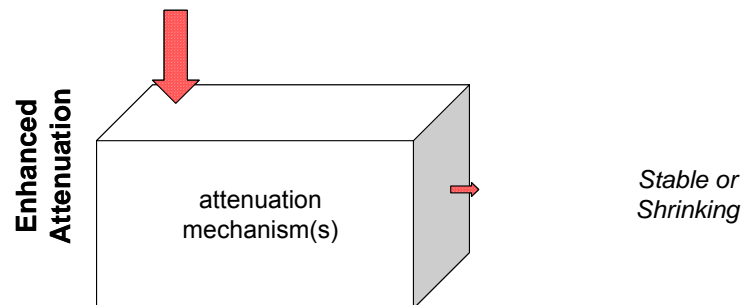
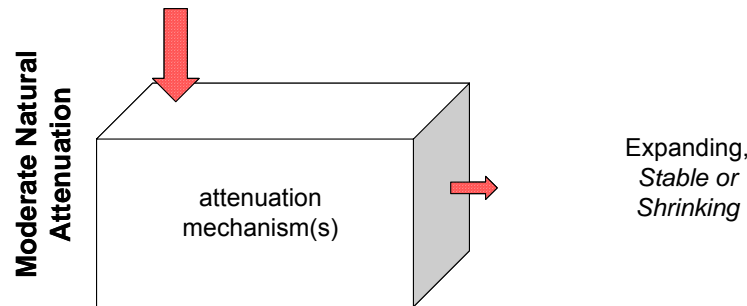
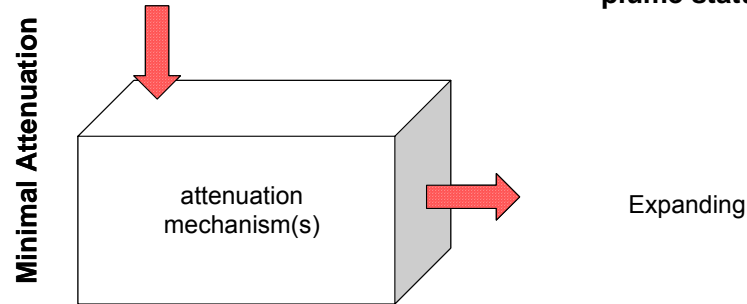
The four stages of plume development...

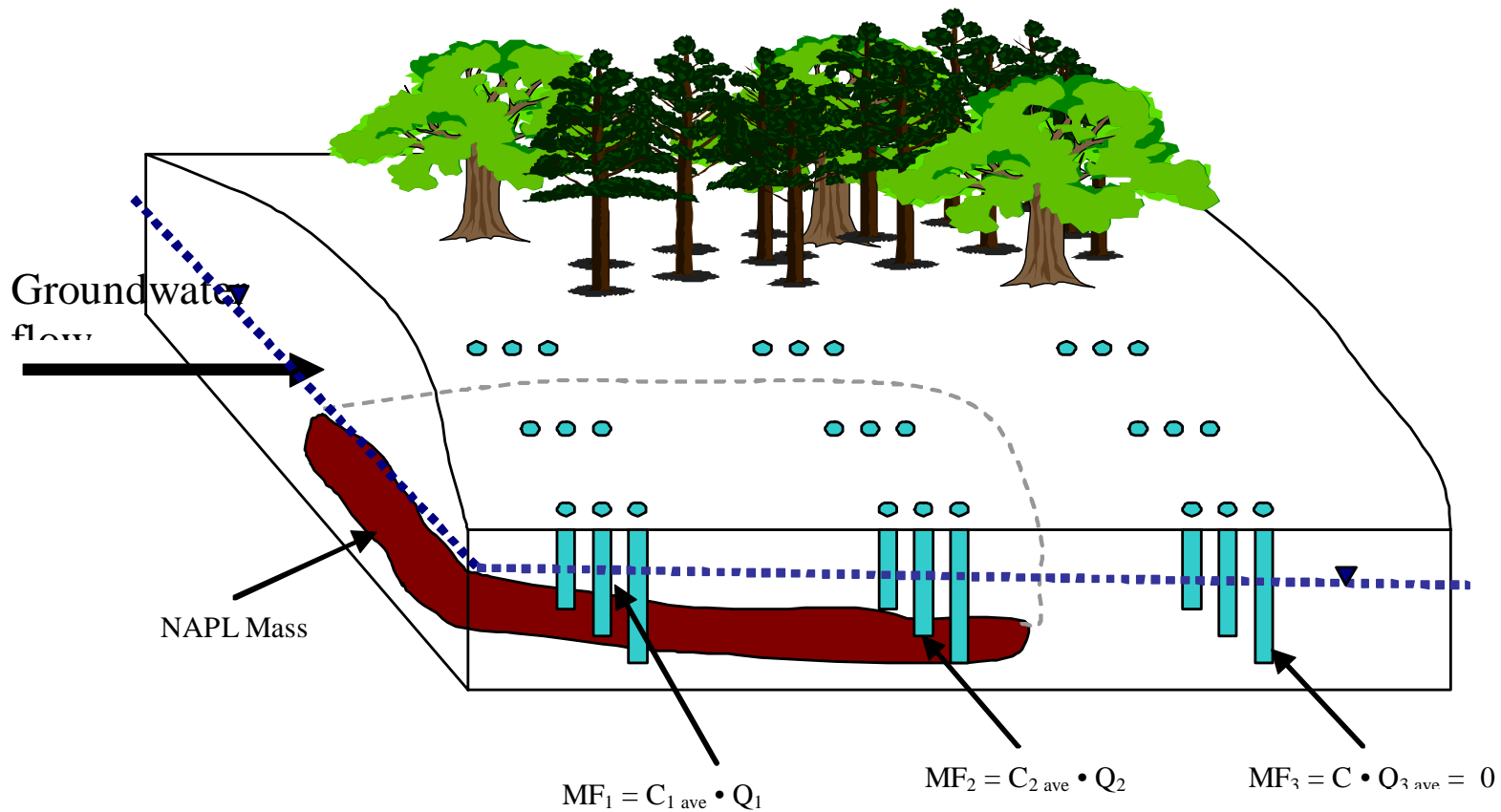


A generalization of mass balance.....

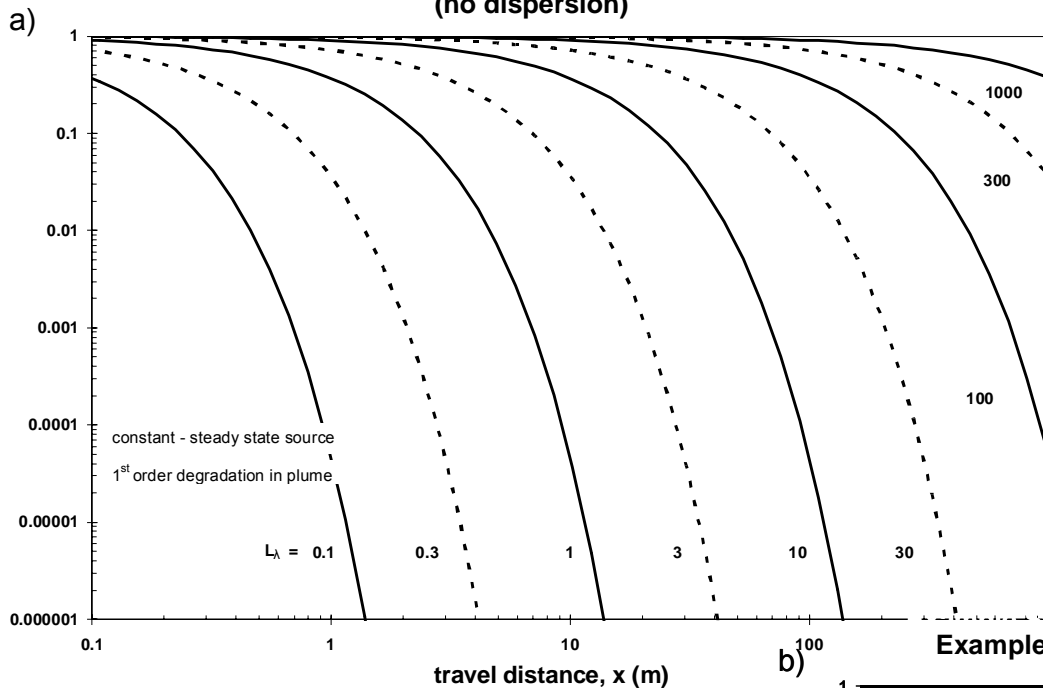
Simplified Block Diagrams

Probable
contaminant
plume status



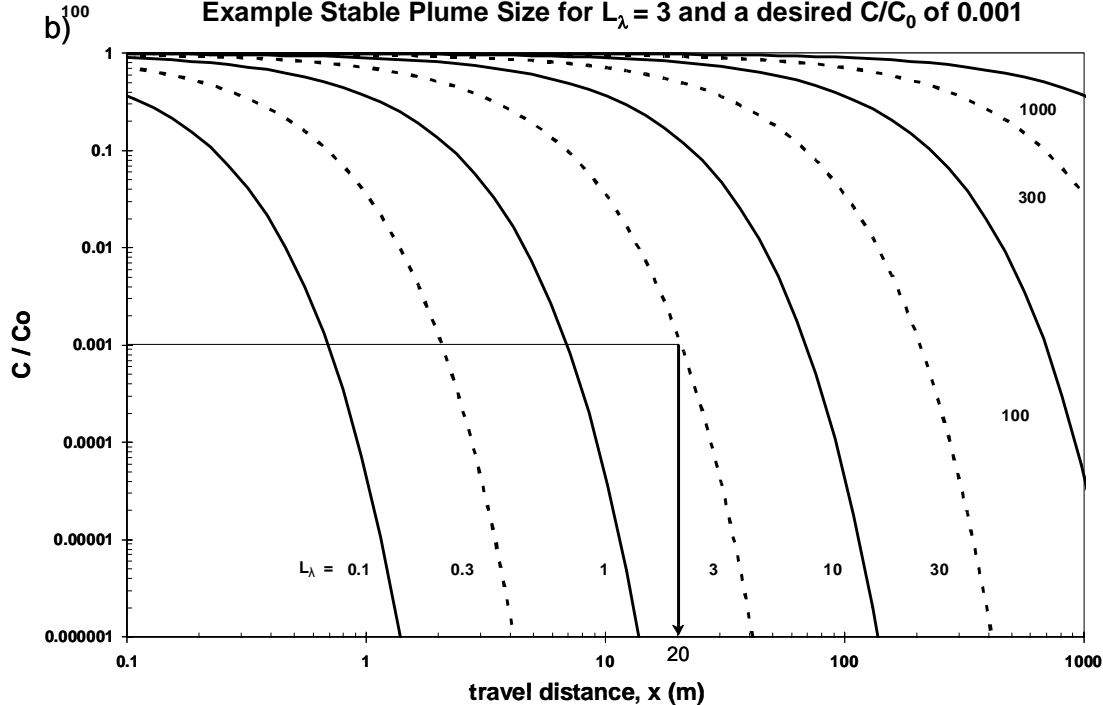


**Plume Structure - Steady State Predicted Concentration
(no dispersion)**

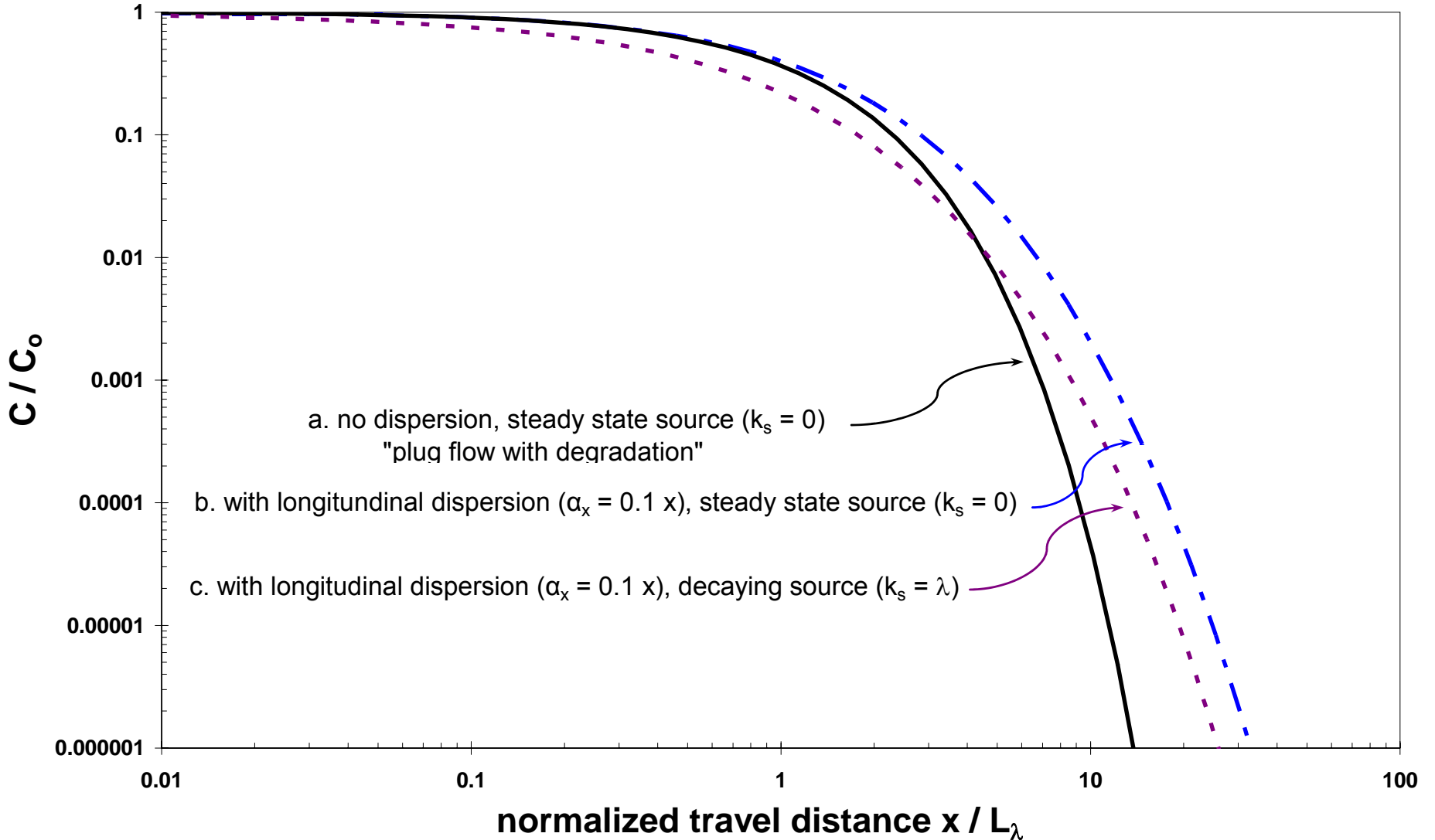


$$x = \frac{v_s}{R\lambda} \ln\left(\frac{C}{C_0}\right) = L_\lambda \ln\left(\frac{C}{C_0}\right)$$

Example Stable Plume Size for $L_\lambda = 3$ and a desired C/C_0 of 0.001

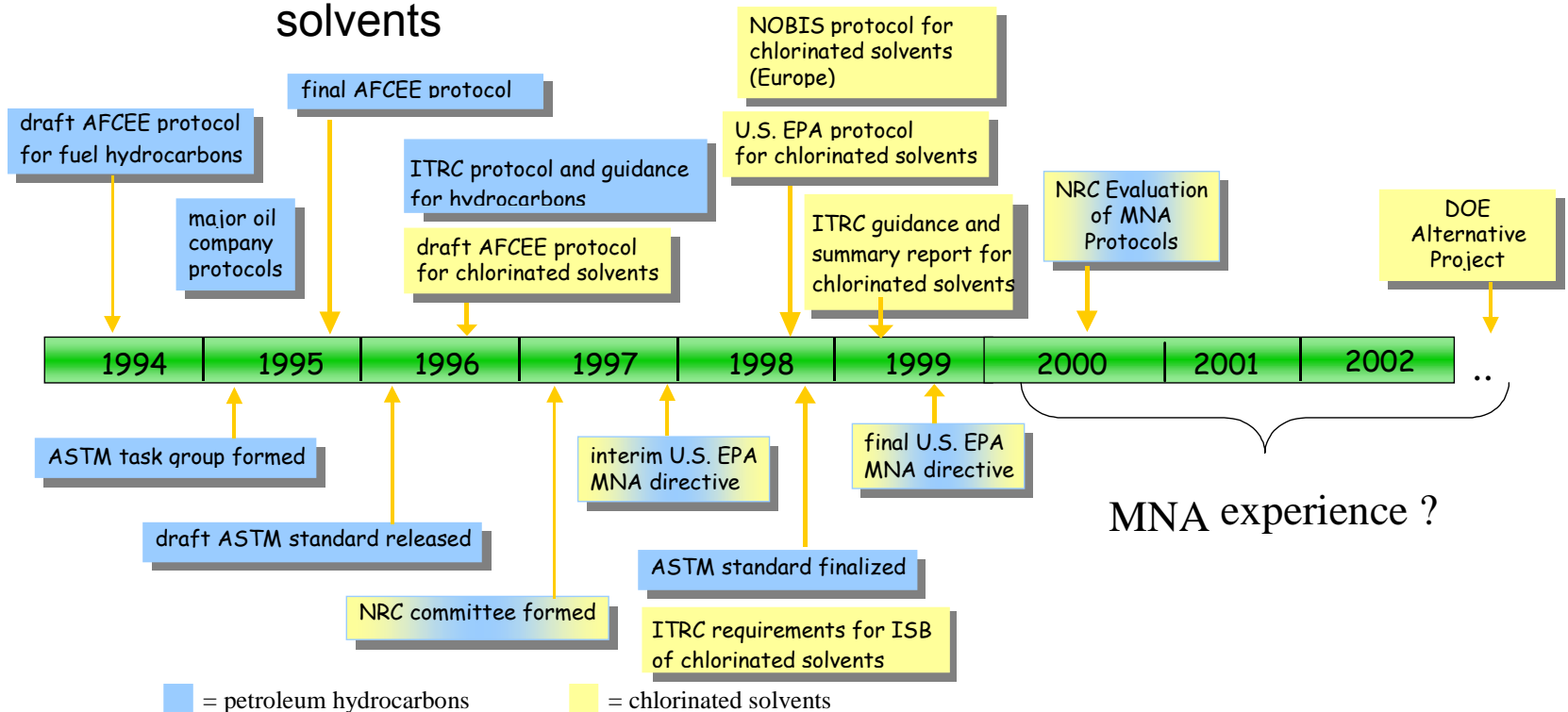


Plume Structure -- Maximum Predicted Concentration



Historical Perspective

Timeline – Natural Attenuation of hydrocarbons and chlorinated solvents



(modified from Wiedemeier and Barden, 2002)