Date: **April 15th, 2005**

Time: **10:30 AM**

Location: **Olin 305**

Speaker: **Dr. Lawrence D. Lemke**
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Title: **"Spatial Correlation of Physical Aquifer Properties: Influence on DNAPL Entrapment and Recovery"**

Abstract

Dense nonaqueous phase liquid (DNAPL) source zones comprise persistent sources of groundwater contamination that are recalcitrant to complete remediation using conventional (e.g., pump and treat) or emerging (e.g., surfactant flushing) technologies. Efforts to assess the benefits of partial mass removal from DNAPL source zones have relied heavily on analytical and computational models. However, the inherent complexity of DNAPL source zones makes their behavior challenging to model. Idealized numerical models assuming nonuniform DNAPL distributions within uniform flow fields or, conversely, uniform DNAPL distributions within nonuniform flow fields have yielded conflicting predictions of contaminant mass flux reduction in response to partial DNAPL mass recovery. Simplified models assuming positive and negative correlations between NAPL saturation and permeability have also been proposed.

This presentation describes the simulation of a tetrachloroethene (PCE) spill in a statistically homogeneous but nonuniform aquifer, incorporating nonuniformity in both NAPL saturation and pore velocities. The influence of spatial variability in porosity, permeability, and capillary retention parameters on PCE entrapment and dissolution were evaluated. Notable differences in the predicted distribution of PCE between pools and zones of residual saturation (ganglia) were observed when capillary entry pressures were scaled to permeability or modeled independently. Subsequent dissolution of PCE from models exhibiting low ganglia-to-pool ratios resulted in a greater predicted reduction of dissolved contaminant mass flux than models with high ganglia-to-pool ratios in response to removal of up to 80% of PCE mass. Although the predicted one to two order of magnitude decrease in effluent concentration is insufficient to meet maximum contaminant level guidelines for most chlorinated solvents, potential benefits of mass reductions in this range include decreased exposure risk to downgradient receptors and enhancement of the potential for natural attenuation. Models incorporating simplifying assumptions with respect to organic liquid distribution or flow field uniformity may not readily predict such benefits of partial DNAPL source zone remediation.