Tuesday, March 16, 2010

Black Lab Pub, Churchill Room • 4100 Montrose Blvd.

Social 5:30 p.m., Dinner 6:30 p.m.

Cost: $25 Preregistered members; $30 non-members & walk-ups

The HGS prefers that you make your reservations on-line through the HGS website at www.hgs.org. If you have no Internet access, you can e-mail reservations@hgs.org, or call the office at 713-463-9476 (include your name, e-mail address, meeting you are attending, phone number and membership ID#).

Brent P. Stafford, PhD, PG

Fate and Transport of Ethanol-Blended Fuels

Concerns regarding potential impacts to environmental resources from releases of ethanol-blended fuels have increased due to the rise in use and transport of ethanol fuel blends. Potential release scenarios include ethanol-blended gasoline (10-20% v/v ethanol) or E85 (85% v/v ethanol) leaking from underground storage tanks at service stations and fuel grade (denatured) ethanol (95-97.5% v/v ethanol) spills during transport or after reaching bulk terminals.

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The hydrophilic properties of ethanol drive the environmental transport of these fuels and influence the locations and geometries of generated non-aqueous phase liquid (NAPL) secondary source zones from the gasoline or denaturant fuel fractions. Also, due to the ability of highly concentrated ethanol to dissolve NAPL, large releases of fuel-grade ethanol may exacerbate impacts to groundwater or surface waters at sites with pre-existing NAPL in soils or sediments. As a result, commonly understood and utilized conceptual models used as tools for site management for released (non-ethanol blended) fuels may be inadequate for some ethanol fuel blends.

This study presents an overview of the state of knowledge of the fate and transport of released ethanol-blended fuels. Included are recent quantitative results from bench- and pilot-scale experiments that simulated releases of fuel-grade ethanol near the water table, highly concentrated ethanol in the capillary zone upgradient of a pre-existing residual NAPL, and dissolved ethanol and aromatic hydrocarbons from a steady-state simulated gasohol source in groundwater. The results show: (1) fuel ethanol releases that reach the water table will be largely confined to the capillary zone due to ethanol's physical properties. As a result, generated secondary NAPL sources from gasoline fuel fractions in fuel grade ethanol will largely form within a collapsed capillary fringe. (2) The mass transfer of ethanol from the capillary zone will determine the resulting ethanol concentrations in groundwater; thus, surface recharge, water table fluctuations, groundwater seepage velocity and dispersion, and position within and down-gradient of the source will be important determinants of aqueous ethanol concentration; and (3) pre-existing residual NAPL may be mobilized by ethanol in the capillary zone closer to the water table, which would increase hydrocarbon concentrations in neighboring groundwater.

Collectively, there have been recent significant gains in the state of knowledge of the fate and transport of ethanol-blended fuels. These compiled results from recent research and field investigations provide insight for evaluating or managing potential risks to environmental resources. ■

Biographical Sketch

Brent Stafford is an environmental engineer and hydrogeologist with Shell Global Solutions (US) Inc. In this role Brent specializes in evaluating the environmental behavior of and risks associated with alternative fuels, fuel components, and enhanced oil recovery agents used for the E&P industry. Brent's responsibilities also include providing technical consulting services for management of impacted industrial sites with complex hydrogeology and interactions between groundwater and surface waters.

Mr. Stafford's education includes a BS in Environmental Geology and Technology and graduate degrees in Environmental Engineering. His continuing education background and experience have allowed him to develop expertise in chemical fate and transport, remediation technologies, and environmental and ecological risk associated with the petroleum and petrochemical industry.