



ASSOCIATION OF ENVIRONMENTAL & ENGINEERING GEOLOGISTS
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Geology

Section Meeting

You are invited to attend the AEG KC/O Section's September 29, 2009 meeting. Dr. Marcia Schulmeister, Emporia State University, will be our guest speaker.

Date: Tuesday, September 29, 2009

Time: 5:30-6:30 Registration and Dinner-BBQ by Jack Stack
6:30 Speaker Presentation

Topic: "A New Approach to Resolving Preferential Flow and Irregular Plume Margins in the Equus Beds Aquifer, Kansas"

Speaker: Dr. Marcia Schulmeister, Associate Professor of Geology at Emporia State University

Cost: \$15/person
Students \$7.50

Location: Diastole, 2501 Holmes, Kansas City, MO

Diastole is a prominent fixture in the Hospital Hill area. It was built as Dr. E. Grey Dimond's residence which he later donated to UMKC. It contains valuable displays of 100s of artifacts that he had collected during his overseas travels. A picture and directions are available at: <http://www.umkc.edu/virtualtour/diastole.asp>

Eligible for 1.0 Professional Development Hour (PDH) for attending.

For reservations, please call Blane Wood at (913) 563-1452 or email blane.wood@pacelabs.com. Reservation **deadline is noon September 28, 2009.**

To access this information on the internet, please go to our section web page at www.vocshop.com/aeg/aegkco.html.

A New Approach to Resolving Preferential Flow and Irregular Plume Margins in the Equus Beds Aquifer, Kansas

The Equus Beds alluvial aquifer is the primary drinking water source for the city of Wichita and is heavily used for irrigation. In the last half century, its overuse caused a 40 ft. drop in the water table and an increased threat of contamination by historic oil field and natural brine plumes. In an effort to sustain this important water resource and to prevent brine encroachment, the city has implemented an Artificial Recharge System (ARS) in which surface water is introduced to the aquifer. Multiple phases of ARS installation have been completed or proposed. Over 100 monitoring and irrigation wells exist in the vicinity of the associated recharge basins.

Hydrostratigraphic features commonly exist within stratified alluvial sediments such as the Equus Beds that can significantly influence the distribution and transport of the contaminants. Efforts to design and maintain the Equus Beds ARS would benefit from a knowledge of the heterogeneity within the aquifer. Conventional well logs typically do not allow for detailed assessment of preferential lateral flow and irregular plume margins in heterogeneous sediments, as they are often too widely spaced or screened to detect subtle variations in hydrologic and chemical conditions. The mobility of direct-push-mounted sampling and profiling tools may allow for collection of more detailed information than is currently available. Our research explores the possible advantages of using direct-push methods in Equus Beds characterization and monitoring activities. Four direct-push approaches are being considered for their ability to yield useful details about the aquifer, both independently and in concert.

In an initial investigation, continuous profiles were obtained using electrical conductivity (EC) and hydraulic profiling tools (HPT) at five locations along a transect across the plume margin, and compared to adjacent conventional drillers lithologic logs. Brine samples and slug tests were obtained from multiple depths at each location using discrete-depth sampling tools. Baseline EC and HPT logs from an uncontaminated part of the aquifer corroborated the presence of the three dominant sand layers and thin, bounding clays identified in drillers logs, and also revealed new information about the layers' thicknesses and textures. High EC and HPT values associated with the clay layers in this profile were observed at similar depths, generally supporting previous assumptions of restricted vertical brine movement within the aquifer. In several cases, the EC logs identified additional clay layers or high permeability zones within clay layers, and clarified discrepancies between multiple adjacent drillers' logs.

Brine samples collected from multiple depths near each EC log indicate lateral specific conductance and Cl⁻ gradients across the site, coincident with an increase in electrical conductivity at the same depth. Associated electrical conductivity values in the most contaminated sand layers were well below those for clay, allowing variations in contaminant levels to be easily distinguished. The lack of a concomitant increase in HPT logs suggests constant hydraulic properties across the aquifer at this depth. Slug test data obtained from the sampling depths support these findings.

The research demonstrates that the coupled direct-push approach may be used to enhance models of brine distribution and movement in unconsolidated sediments where fine-scale stratification

exists. Our ongoing work will examine the relative importance of multiple direct-push approaches to variety of applications within the Equus Beds, and the efficiency with which it they may be used in other unconsolidated aquifers.

Biography:

Marcia Schulmeister is an Associate Professor of Geology at Emporia State University where she teaches courses in hydrogeology and environmental geology, both on-campus and online. She holds B.S, M.S, and Ph.D. degrees in Geology from The University of Illinois, Michigan State University, and The University of Kansas, respectively, with an emphasis in hydrogeology and geochemistry. She has worked as a professional or research hydrogeologist at the Illinois State Water Survey, Michigan Department of Environmental Quality, Kansas Department of Health and Environment, and as a postdoctoral researcher at the Kansas Geological Survey.

Her research interests lie in ground-water chemistry and hydrogeology, and have been complemented by numerous collaborations. The work she'll present is part of a larger emphasis on understanding ground-water movement and contaminant fate in heterogeneous, unconsolidated sediments. Working with UW-Madison, the Wisconsin DNR, and U.S. EPA, a similar evaluation of BTEX migration was conducted in glacial lacustrine sediments, as part of an evaluation of contaminated-site closure protocols. As a visiting scientist with the Chinese Academy of Science, she examined recharge mechanisms and moisture distribution in the thick unsaturated fluvial sediments of the North China Plain. Other projects include ongoing stream-aquifer studies at ESU's Hydrogeology Research Station; investigation of radionuclide sorption to alluvial clays at Los Alamos National Lab; evaluation of buried soil organic carbon in river valleys of the U.S.; and the paleohydrology of the Cheyenne Bottoms migratory bird sanctuary in Kansas. She is currently advising six graduate students and has mentored or served on committees for more than 20 students during her six-year tenure at ESU.

Dr. Schulmeister has been a reviewer for numerous journals, books, and panels. She has served on the management board of the Geological Society of America's South-central section for the past three years. As its current Vice Chair, she is planning the 2010 joint-sectional meeting, which will be held in Branson Missouri, in cooperation with Missouri State University. She is also the section's representative to GSA's Hydrogeology Division.