

# UNIVERSITY of HOUSTON

## CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

### *Distinguished Lecture Series*

**Albert J. Valocchi, Ph.D.**

University of Illinois at Urbana-Champaign

#### **Impact of Mixing-Controlled Reactions on the Transport of Groundwater Contaminants: Modeling and Pore-Scale Experiments**

**Monday, February 11, 2013**

10:30 to 11:30AM

Seminar Room D3 W122



#### Abstract

Contamination of groundwater resources from waste disposal activities remains a significant environmental problem. Several studies have demonstrated the important role played by mixing and dispersion along the lateral fringes of dissolved chemical plumes that emanate from source zones. Under some favorable conditions (so-called natural or intrinsic remediation), biogeochemical reactions can occur in the fringe mixing zone resulting in natural degradation of the contaminant. Field, laboratory and theoretical studies have demonstrated that the length scale of transverse mixing zones can be very small, often on the order of centimeters or less. This presents challenges for numerical simulation models which typically employ large grid blocks for field-scale applications. To study dispersion, mixing and reaction at this scale, we use pore-scale numerical simulation models and micro-fluidics laboratory experiments. I will present an overview of our methods and findings, including comparisons between direct numerical simulations and laboratory experiments. I will also discuss the use of classical mechanical dispersion coefficients to quantify mixing-controlled reaction. Our work has improved understanding of coupled flow, transport and reaction processes; however, there remain significant challenges for applications to larger field scales.

#### About the speaker

**Professor Albert J. Valocchi** received his B.S. in Environmental Systems Engineering from Cornell University in 1975 and did his graduate studies at Stanford University in the Department of Civil Engineering, receiving his M.S. in 1976 and Ph.D. in 1981. He has been on the faculty of the Department of Civil and Environmental Engineering at the University of Illinois since 1981, and currently holds the rank of Professor. From 2004 to 2012 he was Associate Head of the Department and Director of Graduate Studies.

Dr. Valocchi teaches undergraduate and graduate courses in water resources engineering, groundwater hydrology and contaminant transport, groundwater modeling, and numerical methods. His research focuses upon computational modeling of pollutant fate and transport in porous media, with applications to groundwater contamination, geological sequestration of carbon dioxide, and impacts of model uncertainty on groundwater resources management. He has approximately 90 publications in refereed journals, and he has also served as a member of the National Research Council Committee on Environmental Remediation at Naval Facilities.

Dr. Valocchi has received several awards in recognition of his research and teaching accomplishments. He was a Shell Faculty Career Fellow from 1984 to 1987, and he has been awarded fellowships to lecture and conduct research from NATO and the Danish Research Academy. In 2002 he received the Collins Award for Innovative Teaching from the University of Illinois - College of Engineering. In 2003 he was recognized as an Associate in the Center for Advanced Study at the University of Illinois. In 2009 he became a Fellow of the American Geophysical Union. In 2011, he was named an Abel Bliss Professor in the College of Engineering at the University of Illinois.

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