*Spring 2009 Seminar Series*

# CHALLENGES AND INNOVATION IN CIVIL AND ENVIRONMENTAL ENGINEERING

## Recent Advances in Tracking Nutrient Sources in the Mississippi River Basin: Implications for Managing Gulf of Mexico Hypoxia

### Richard B. Alexander
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**Wednesday, February 25, 2009**
**129 DeBartolo Hall**
**4:30pm – 5:45pm**

The increased availability of reactive nutrients (nitrogen and phosphorus) in past decades has benefited society via food and energy production; however, the corresponding rise in stream nutrient loadings has contributed to stressed trophic conditions and seasonal hypoxia (i.e., low oxygen levels) in many coastal ecosystems globally. In the United States, elevated nutrients in the Mississippi River have contributed to hypoxia in the Louisiana coastal waters in the northern Gulf of Mexico. Effective management of Gulf hypoxia requires an improved understanding of the intensity and location of upstream nutrient sources in relation to management practices and the climatic and landscape properties that control nutrient delivery to coastal waters. This is especially challenging in large watersheds, such as the Mississippi River Basin, where coastal waters are separated from upstream sources by hundreds to thousands of kilometers.

The presentation highlights recent advances in geospatial data and watershed modeling tools that have enhanced understanding of nutrient sources and the factors affecting nutrient transport in large watersheds. Results from a recent U.S. Geological Survey study are discussed that used these modeling tools to track nitrogen and phosphorus sources and transport in the Mississippi River Basin. The study reveals the importance of agricultural sources as major contributors of nutrients to the Gulf of Mexico, with nitrogen originating primarily from corn and soybean cultivation and phosphorus predominantly from animal manure. Nutrient delivery to the Gulf is also controlled by hydrological and biogeochemical processes that scale with stream size, although phosphorus delivery displays large local- and regional-scale differences caused by reservoir trapping. The presentation stresses the importance of accounting for nonlinear interactions between aquatic transport processes and nutrient sources to develop efficient nutrient reduction strategies for the Mississippi River Basin. The discussion will also illustrate how these advances in understanding can benefit assessments of the effects of land-use change, such as the projected doubling in corn-based ethanol production over the next decade, on stream nutrient loads and delivery to the Gulf.

**RICHARD B. ALEXANDER** is a Research Hydrologist with the USGS NAWQA (National Water Quality Assessment) program and has been with the USGS for 27 years. His research focuses on the development and use of water-quality modeling techniques to investigate pollutant sources and contaminant transport processes in surface waters. He is a co-developer of the USGS SPARROW water-quality model. His studies include assessments of nutrient sources and processes in streams of the Mississippi River Basin and their influence on nutrient delivery to the Gulf of Mexico. He has also developed models of nutrients and pathogens in the surface waters of New Zealand as a visiting scientist with the National Institute of Water and Atmospheric Research. He is a coordinator and instructor for USGS technical courses on statistical methods and water-quality modeling and the Associate Editor for water-quality modeling for the Journal of the American Water Resources Association. His educational background includes a M.S. in Water Resources Administration from the University of Arizona and a B.A. from the University of North Carolina-Charlotte.

*A reception and an opportunity to meet the speaker will take place at 4:00pm in the CE/GEOS office conference room, Fitzpatrick 156, before the seminar*