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by **Jim Rine**  
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# Mapping Aquifer Sensitivity by Combining 3-D Geologic Analysis and Groundwater Hydrology—An Application of GIS for Preemptive Protection of Groundwater Underlying Oil Production and Processing Facilities

If groundwater resources underlying areas of petroleum production and processing are “preemptively” protected, the high costs of remediation could be avoided or significantly reduced. This talk describes two case studies that tested aquifer sensitivity maps produced by combining stack-unit geologic mapping with groundwater hydrology. These maps can be used to locate hazardous facilities in less vulnerable areas or help direct assessment and remediation efforts in the event of a spill. One case study compared aquifer sensitivity maps with documented plumes of the contaminant tetrachloroethylene (PCE) found at the Department of Energy’s (DOE’s) Savannah River (SRS) site, SC. In this study, deconstruction of the sensitivity map combined with the groundwater hydrology explain the placement and geometries of the PCE plumes as they progress from the ground surface through multiple aquifers and confining units of the study area at SRS. In the second study at the Marine Corps Air Station (MCAS) in Beaufort, SC, the analysis determined aquifer sensitivity throughout the 22 km<sup>2</sup> airbase using a GIS-based stack-unit mapping methodology that integrated historic hydrogeology data, new high-resolution reflection seismic profiles, core analysis from over 40 boreholes and wells, and hydrologic models based on multi-seasonal water level monitoring. The resulting combined hydrologic and geologic models show that within the study area at MCAS, including areas overlying low permeability

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strata, contaminants released on the ground surface could reach critical underlying aquifers within tens of years due to rapid groundwater flow. These studies demonstrate that both geologic mapping and groundwater modeling are necessary to accurately delineate areas of high and low aquifer sensitivity. The studies also demonstrate an effective tool for avoiding costly groundwater contamination and cleanup. ■

### Biographical Sketch

**JIM RINE**, a Senior Geologist at OMNI Laboratories, Inc., has over 25 years experience in sedimentologic and petrologic studies and is a recognized researcher in the fields of clastic sedimentology, hydrogeology and marine science. He received a doctorate in Marine Geology & Geophysics in 1980 from the Rosenstiel School of Marine and Atmospheric Science, University of Miami. Jim and co-author H. R. Wanless were awarded Best Poster at the 1976 AAPG annual meeting. Jim was awarded Outstanding Paper for 1985 in the Journal of Sedimentary Petrology with R.N. Ginsburg. Dr. Rine worked for Cities Service Research, Inc., State University of New York at Stony Brook, and the University of South Carolina (USC) prior to joining OMNI Laboratories in 2004. The research he is presenting was performed during his 14 years as a research professor at the Earth Sciences and Resources Institute at USC.