

## Uncertainty Recognition for Ground Water Professionals

by Michael Barcelona

***"I'm convinced that we can do better on behalf of our collaborators, clients, and communities if we simply acknowledge uncertainties where they exist and better communicate them."***

Editorial pieces in leading environmental science, engineering, protection, and resource management journals by editors or guest columnists have expressed deep concerns about the future of the industry in general. Trends toward the "rationalization" of environmental policy and regulation, industrial proactive stances on stewardship, and budget wranglings have combined to stall the related economy for weeks to months on end. A central lesson that has been brought home is that the industry is going through an inevitable stage of change after a long period of growth. The underlying message for ground water professionals is that we are a fragile sector of the economy whose future relies on the recognition of uncertainty.

We must come to terms with the real uncertainties involved in determinations of the routine parameters conducted in the course of site characterization, monitoring, and remediation projects. I'm not addressing solely the spatial and temporal variability in aquifer properties; geochemical or contaminant conditions that should be reflected in predictions of long-term ecological, public, or environmental exposures; or health risks. I believe that the economic costs and benefits of our activities must be more carefully quantified and made clearer to the public or our credibility may be questioned.

This need is made real most clearly in presentations of remedial options for subsurface contamination situations where either natural "attenuation" or risk-cost-based options at relatively low costs are proposed. However feasible the option, confident public acceptance and a clear-cut long-term monitoring program will be required for the issue at hand to be resolved. Numerical expressions of excess deaths or other

potential health risks among exposed populations fall rather flat when presenters before the community are unable or unwilling to put these fundamentally economic conclusions in real terms. Troubling thoughts persist as clearly as the nightmare visions of frightened children disturb their sleep.

I'm convinced that we can do better on behalf of our collaborators, clients, and communities if we simply acknowledge uncertainties where they exist and better communicate them. Where can we start? The reader, author, or editor will have different immediate responses perhaps linked to their own concerns. Among these are practical conclusions immediately applicable to current projects, the technical edge and credibility gained from publication, or useful contributions to the body of literature that advance our field. Some of you may take issue with this distillation of complex concerns to a few trite statements, but the entire enterprise of ground water resource monitoring, remediation, and management could be in the balance. It's given me pause to think about how quickly we've turned from intrusive or active source remediation approaches like venting, sparging, and solubilization toward assumptions of steady-state source release that can be linked with plume monitoring to effect public and environmental protection. This stance calls for a leap of faith that we must defend technically. We're open to comment and thought-provoking pieces on how the field may continue to advance with strength despite uncertainties. Please feel free to share your thoughts with us here at *GWMR* while you're having a great summer!

*Dr. Michael J. Barcelona is with the Department of Civil & Environmental Engineering, University of Michigan, Ann Arbor, Michigan. He is editor of Ground Water Monitoring and Remediation.*