C32 Hidden Trails to Unexpected Culprits and Victims of Groundwater Contamination— Go With the Flow

John B. Robertson, PG, J.B. Robertson Consulting, 40107 North 3rd Street, Desert Hills, AZ*

Groundwater hydraulics and flow patterns are the most important single aspect of understanding the origin, fate, and potential impacts of groundwater contaminant plumes, but must be considered in concert with chemistry and other relevant evidence.

Among the most common and challenging questions posed to environmental scientists associated with groundwater contamination problems are: "Where and when were the contaminants originally released?" and "Who has been or who potentially will be exposed to the contaminants in the future?" This paper will provide three interesting case histories on how three-dimensional and time-variant groundwater hydraulics and flow patterns have proved to be the key in providing unexpected or previously unknown answers to the questions.

Groundwater contamination problems are typically discovered long after the contamination event(s) occurred or contamination process began. The discovery is virtually always by chemistry or environmental/human health impacts. Because chemical evidence is almost always the primary initial focus, it is also often the only evidence initially used to draw conclusions regarding the source and potential fate of the contaminants. In many cases, for example, a discovery of chlorinated solvents like trichloroethene (TCE) in groundwater will lead investigators to look for the nearest industrial plant that would use such solvents and to conclude that it is the likely source. However, diligent examination of groundwater flow patterns may prove that source to be impossible or highly unlikely. Similarly, present delineation of a contamination plume may suggest that areas currently not coincident with the plume position have had any impacts from the contamination. However, reconstruction of past changes in groundwater flow patterns can sometimes show that the plume was formerly in an area now apparently clean and that people may have been exposed in those areas.

One case history involves a large municipal well field in a shallow aquifer that became contaminated by chlorinated solvents. A nearby, apparently upgradient, industrial and military complex was blamed for the contamination. However, close examination of the groundwater flow patterns together with the individual contaminant concentration histories of each well in the well field showed that the major source had to be in a different location than the accused source. A second case history shows that under past pumping conditions, flow patterns were sufficiently different to cause a supply well to school to become contaminated, even though it appeared clean and out of the plume in recent years. The third case history demonstrates that groundwater flow patterns can be used, in combination with individual well chemistry, to disprove a claim that most of the groundwater contaminants being remediated in a plume were originating from other, off-site sources.

Groundwater, Hydraulics, Contaminant Fate and Transport

 ** Presenting Author*