

# Field Studies of Chlorinated Solvent Plume Behaviour in Sedimentary Rock: From Source to Discharge Zones

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## Abstract

Chlorinated solvent source zones and plumes in fractured sedimentary rock have been investigated intensely at several industrial sites in Canada, USA and elsewhere. A comprehensive methodology, referred to as the Discrete Fracture Network (DFN) Field Approach has been developed providing a toolkit for characterizing these sites. The sites show many common features providing the basis for a general conceptual model for source zone and plume behavior. Contamination was initiated by DNAPL releases decades ago; however the source zones have evolved or “aged” over decades due to dissolution and diffusion processes, such that nearly all mass now occurs as dissolved and sorbed phase in the matrix, causing reduction in source strength such that mass input to the plume may be controlled more by back diffusion. While nearly all groundwater flow and downgradient transport occurs in the interconnected fracture network, diffusion in the plume also causes mass transfer from groundwater flowing in fractures to the rock matrix, causing strong retardation of rates of plume front migration and strong attenuation of mass discharge within the plume. In many cases, the combined effects of declining source strength and diffusion causes the plume to be essentially stationary at present time or possibly even retreating if even slower rates of contaminant degradation are also occurring. This presentation will provide an overview of the DFN Approach, insights from its application at several sites, and implications for understanding long term plume behavior, risk assessment and remedial efficacy.

## Biography

Beth L. Parker has a Bachelor degree in Environmental Science and Economics, Masters in Environmental Engineering and PhD in Hydrogeology. She is Professor in the School of Engineering and Director of G360 - The Centre for Applied Groundwater Research at the University of Guelph. She has more than 25 years of experience as a groundwater professional investigating subsurface contamination issues at industrial sites around the world. Her current research activities emphasize field and laboratory studies of DNAPLs in sedimentary rocks, clayey deposits, and heterogeneous sandy aquifers, and focus on the effects of diffusion into and out of low permeability zones and on DNAPL fate, plume attenuation, and controls on remediation. She is currently involved in research and technology demonstration projects at Superfund and RCRA facilities in the United States and similar sites in Canada, Europe and Brazil. In July 2007, she was awarded an NSERC Canada Industrial Research Chair in Fractured Rock Contaminant Hydrology. In December 2009, she received the John Hem Award from the Association of Groundwater Scientists and Engineers of the United States National Groundwater Association. <http://g360.uoguelph.ca/our-people>