**INDUCED BOILING IN FRACTURED ROCKS**

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Many sites contaminated with chlorinated volatile organic compounds (CVOCs) are underlain by fractured rocks or soils with significant matrix porosity. Remediation options for treating these sites are limited because low matrix permeability and unknown fracture locations make the delivery or recovery of fluids a challenge. Thermal methods hold promise for remediation of fractured media because the mechanisms of thermal conduction and electrical resistance heating can efficiently transfer heat without any fluid flow. Once a fractured rock or soil is heated above the water boiling point, subsequent depressurization of the fracture network by vacuum extraction may induce boiling in the matrix, leading to large gas-phase pressure gradients and a steam stripping effect that can remove the contaminants from the matrix. These contaminant removal mechanisms, however, have not been demonstrated in the laboratory.

Numerical simulations show that these processes may be very sensitive to the details of the gas and liquid phase relative permeabilities, and to the intrinsic permeability and other rock properties. Our current focus in this SERDP project (ER-1553) is on experimentally demonstrating the boiling phenomena using one-dimensional rock cores with a simulated fracture at one end. These cores are instrumented with thermistors and electrodes to allow measurement of temperature and electrical conductivity, respectively. Electrical conductivity is a strong function of water saturation, and once calibration curves are developed for a particular rock type, the electrodes can be used to measure changes in liquid saturation in the core. The core is heated by thermal conduction from the outside, and is sealed and contained in a pressure vessel to simulate a confining pressure. The core is initially saturated with water, and then heated, while the simulated fracture at one end of the core is depressurized. Current experiments involve uncontaminated water, to focus on the fluid and heat flow aspects of the boiling process. Future experiments will use water that is contaminated with CVOCs to focus on the contaminant mass transfer itself. The results of the experiments will be evaluated with numerical analyses, which will then be used to evaluate field-scale implementation at contaminated sites.