Plumes of groundwater contaminated with a mixture of explosive compounds emanate from a group of former ordinance decommissioning washout ponds at the Pueblo Chemical Depot (PCD), east of Pueblo, Colorado. The major constituents of the plume are hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX), 2,4,6-trinitrotoluene (TNT), 2,4-dinitrotoluene (2,4-DNT), and 1,3,5-trinitrobenzene (TNB). An electrolytic-based permeable reactive barrier (e^-barrier) was installed through a shallow portion of the plume near the source area in January 2006, and started in late March 2006. The objective of the demonstration is to evaluate the performance and cost efficacy of this approach relative to the current plume mitigation activities (pump and treat with activated carbon adsorption).

The active component of the e^-barrier is two sets of closely spaced planar mesh electrodes. Application of a low voltage dc potential difference between the electrodes promotes contaminant degradation through an initial reductive step at the cathode surface. Periodic groundwater samples and continuous electrical system monitoring are used to evaluate contaminant flux reduction through the e^-barrier as a function of the applied potential difference between the electrodes (from 2.3 to 5 V). Laboratory studies at these conditions were conducted using a two-dimensional analog of the PCD e^-barrier. RDX, TNT, and 2,4-DNT concentrations were reduced by 90, 95, and 94 percent, respectively, through the system. These effluent levels are sufficient to meet the regulatory requirements at the facility and therefore supported the design of the field-scale barrier. In the field, early results at modest applied potentials show a flux reduction through the e^-barrier for all species that range from about 75 to nearly 100 percent. Due to the remote location of the site within PCD, power is supplied to the electrodes using a 16-panel photovoltaic cell array. The result is a stand-alone system with the capability to modify the applied reaction conditions on-the-fly, and operate at a minimal O&M cost.

This presentation will cover system operating principles and description, site characteristics, and demonstration results. Preliminary costs estimates of a full-scale implementation are competitive with the current plume mitigation activities. Coupling the results of this demonstration with an earlier field-scale evaluation of the technology in a chlorinated solvent plume illustrates the broad scope of conditions and contaminants under which e^-barriers may be applied.