



CASE STUDY

SITE: RETAIL GASOLINE SITE, NORTHGLENN, COLORADO

CLIENT: SHELL OIL PRODUCTS US

INTRODUCTION

LTE was contracted by Shell Oil Products US (Shell) to conduct a pilot test program at a petroleum hydrocarbon impacted retail facility north of Denver, Colorado. The goals of the pilot program were to: 1) determine the viability of using a carbon-based injectate to remove hydrocarbons from soil and groundwater; 2) assess transient hydraulic conditions resulting from the injection; and 3) demonstrate that biological breakdown of hydrocarbons was occurring.

Impacted groundwater was found in a very dense clay zone. Benzene concentrations at the pilot well (MW-10) varied between 1.0 and 7.0 milligrams per liter (mg/L) since 2005. The pilot injection program was deliberately under-dosed to determine if the injectate would be effective and to allow for a more precise measurement of the full scale requirements.

EVALUATION

A limited site assessment was performed to determine the vertical profile of impacted soils and groundwater, and quantify the amount of petroleum hydrocarbons present. Three piezometers were installed within 20 to 50 feet of MW-10 to determine the radius of influence of the injection and to understand the hydraulic effects that result when an injectate is placed into the subsurface. In addition, LTE obtained and evaluated a variety of parameters including oxidation reduction potential (ORP), pH, and dissolved oxygen, nitrate and sulfate concentrations following the actual injection event.

DESIGN / INSTALLATION

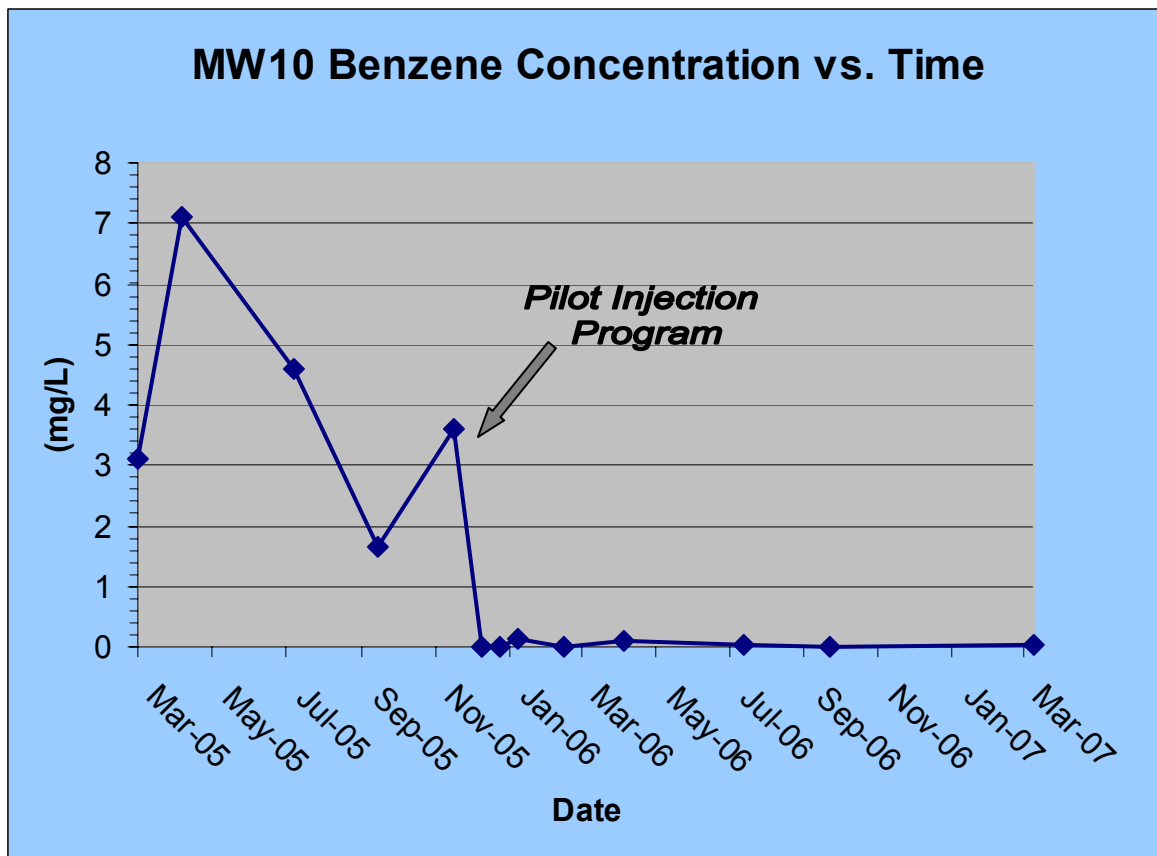
The injection program was developed based on targeted hydrocarbon concentration reduction of 75% with the quantity of injectate and placement of injection locations targeted toward the more highly impacted soil horizons. The treatment injectate consisted of 3,000 pounds of a carbon-based product (BOS 200[®]) injected into 10 locations on a 10-foot triangular grid pattern surrounding MW-10.

Prior to completing the injection program, LTE obtained a Rule Authorization (RA) from EPA Region VIII to inject the carbon-based material into the subsurface.



RESULTS

Within four weeks of the injection program, benzene concentrations had been reduced from 2.59 mg/L measured immediately prior to the injection to 0.144 mg/L in MW-10 and has continued to decrease throughout 2006. In early 2007, the benzene concentration in MW-10 had been reduced to 0.030 mg/L. Biological activity removing the petroleum hydrocarbons was demonstrated by the steady decrease of sulfate concentration in the groundwater. Mounding of groundwater during injection was determined to be negligible and very transient (less than one day in duration).



The full scale injection program was recently designed based on the results of the pilot program at MW-10 and is awaiting regulatory approval.