



CASE STUDY

SITE: PIPELINE RELEASE BRANNON #1, TEXAS

CLIENT: DEVON ENERGY CORPORATION, OKLAHOMA

INTRODUCTION

LT Environmental, Inc. (LTE) completed a remedial action to remove petroleum hydrocarbons for Devon Energy Corporation (Devon) at the D.C. Brannon # 1 well, located in Panola County, Texas. Site facilities include a pipeline that leaked natural gas condensate in 1995. LTE used its **TerraCert™** program to evaluate and treat the petroleum-hydrocarbon impacts. Due to the sale of the property, the project was time sensitive with Devon requesting closure quickly. A local third party firm was retained by Devon to confirm sampling and negotiate with the State of Texas.

EVALUATION

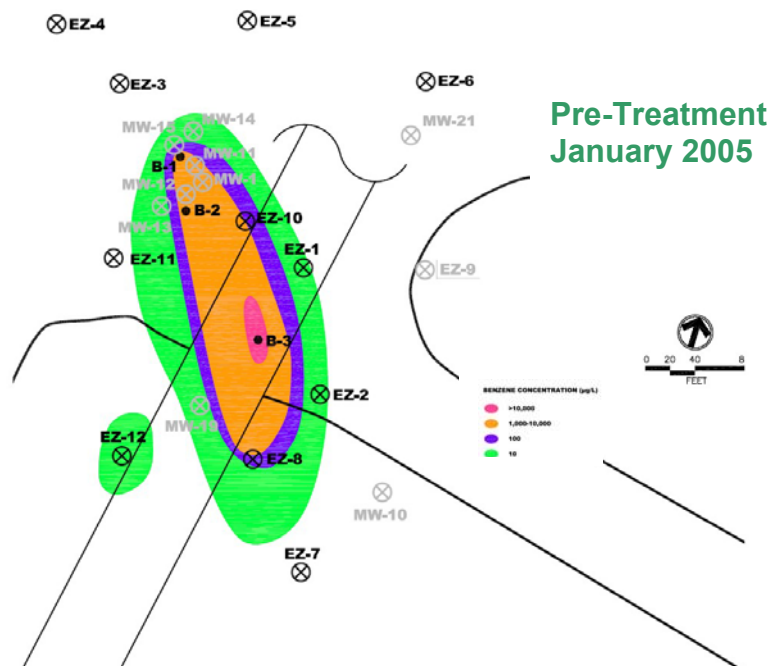
Initial site assessments conducted by Devon between 1995 and 2002 created a network of monitoring wells. LTE conducted additional site assessment activities in September 2004 to establish baseline conditions in both the soil and groundwater.

Based on LTE's site assessment, the hydrocarbon plume at the Devon site was estimated to have an aerial extent of approximately 24,000 square feet and a vertical distribution that ranged from approximately 21 feet to 28 feet below ground surface (bgs).

DESIGN / INSTALLATION

An injection plan to mitigate the groundwater impacts was prepared by LTE in October 2004 and implemented in January 2005. LTE obtained a Class V Injection Well Inventory/Authorization permit from the Railroad Commission of Texas (RCT) to place the injectate into the subsurface.

LTE prepared an injection plan for the purpose of removing detectable petroleum hydrocarbons throughout the plume. The plume was divided into five areas, based on petroleum-hydrocarbon concentrations observed in the groundwater. Rather than





conduct initial pilot testing to evaluate the effectiveness of the potential injectates, some of the areas were purposely under-dosed.

Direct-push equipment was used to administer a carbon-based injectate (BOS 200[®]) throughout the impacted zones. Injection locations were laid out in 5-foot triangular grid patterns in the more impacted area and in 10-foot triangular grid patterns in the other four areas. This layout created a series of “staggered” lines of injectate that intercepted the groundwater flow regime. The carbon-based slurry with supplemental sulfate and cultured bacteria was injected at multiple depths at each grid location. The multiple injection depths were also staggered in adjacent boreholes in order to provide adequate coverage throughout the vertical distribution of hydrocarbon.

LTE injected a follow-up treatment after the August 2005 results were evaluated. Additional injections were made in two areas due, in part, to the planned under-dosing of portions of the plume.

RESULTS

Following the completion of the initial injection program, post-treatment groundwater monitoring was conducted between February and May, 2005. Significant reductions were apparent throughout the five treatment areas. Wells where benzene concentrations had ranged from 1.4 milligrams per liter (mg/L) to 5.5 mg/L were reduced to below the Texas Risk Reduction Program’s protective concentration level (PCL) of 0.005 mg/L following treatment.

The exceptions to the successful treatment at the site consisted of two areas. The first was a particular monitoring well (B-3), where the benzene concentration persisted above the PCL during the three month performance-evaluation period. Although a 79% reduction (from 10.7 mg/L down to 2.2 mg/L) was observed, additional treatment was warranted to achieve the PCL in the desired timeframe. The second area was where the injectate was under dosed and although the benzene concentrations were reduced to levels below the PCL, modest rebounds were eventually observed.

Concentrations below the PCL were achieved after the second injection. Sampling in October 2006, resulted in non-detect for hydrocarbons. The site is presently in the final confirmation sampling period with closure anticipated for June 2007. Using the **TerraCert™** program resulted in a cost-effective timely solution to Devon.

