



CASE STUDY

SITE: TANK BATTERY, WELD COUNTY, COLORADO

CLIENT: DEVON ENERGY CORPORATION

INTRODUCTION

LTE was requested by Devon Energy Corporation (Devon) to remediate residual soil and groundwater impacts at an exploration and production site in Weld County, Colorado. Soil impacts were found from the surface to 24 feet below ground surface (bgs) and were a result of produced water sump and aboveground storage tank overfills.

Benzene concentrations in the groundwater were up to 2,900 micrograms per liter ($\mu\text{g/L}$) in one well within the bermed area. LTE first completed an excavation program to remove the shallow and most highly impacted soils. In May 2004, LTE applied its **TerraCert™** program to address the remaining groundwater impacts.



EVALUATION

A site assessment was performed to determine the vertical profile of residual impacted soils and to define the horizontal extent of the groundwater hydrocarbon plume. The site was very remote with no utilities, including electricity, and the underlying soils were primarily sand which made in situ injection a very attractive option. Because the site had been recently sold to another oil company, Devon required a no further action (NFA) letter from the Colorado Oil and Gas Conservation Commission (COGCC) as soon as practical.

To achieve NFA designation at this site, the COGCC required that the benzene concentration in all impacted wells to be less than 5.0 $\mu\text{g/L}$.

DESIGN/INSTALLATION

First, LTE completed a three-dimensional model of the impacted soil and groundwater through the use of two continuously sampled soil borings and several temporary groundwater sampling implants. The aerial extent of the groundwater plume was determined to be 5,500 square feet with the vertical distribution ranging from 15 feet to 24 feet bgs.



The **TerraCert™** injection program was developed based on hydrocarbon concentration, with the quantity of injectate and placement of injection locations targeted toward the more highly impacted zones. The treatment injectate consisted of 7,000 pounds of a carbon-based product (BOS 200®) and 20 gallons of cultured bacteria injected into 50 locations on a 10-foot triangular grid pattern.

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

In four weeks following the injection, LTE began a one year performance monitoring program to track the effectiveness of the injectate and meet COGCC requirements.



RESULTS

Within four weeks of the initiation of the **TerraCert™** injection, benzene concentrations had been reduced to below 5 µg/L in all of the wells.

CLOSURE

After the required four quarterly sampling events a closure request was submitted to the COGCC in May 2005 approximately 13 months year after initiation of the project. A NFA letter was received by Devon in June 2005.