



# CASE STUDY

**SITE: DENVER, COLORADO**

**CLIENT: GATES DEVELOPMENT COMPANY, DENVER, COLORADO**

## INTRODUCTION

In March 2005, LT Environmental, Inc. (LTE) implemented its **TerraCert™** program, a precision remediation process, to treat groundwater impacted by trichloroethene (TCE) and other regulated chlorinated hydrocarbons at the Gates Development Corporation (Gates) facility located in Denver, Colorado. **TerraCert™** involves evaluation, design, and installation significantly enhances the availability of injectate to the contaminants in the subsurface.

The project was high profile and required rapid closure due to the potential for redevelopment of the property. As a result of the sales-purchase agreement, the property was divided into north and south parcels. Due to the client desire to obtain a No Further Action (NFA) letter, the contaminants of concern (COCs) and the fast track nature of the project, the site appeared to be an ideal candidate for the **TerraCert™** program. Voluntary Clean-up Plan (VCUP) applications were submitted to the Colorado Department of Public Health and Environment (CDPHE). The objective of the project was to obtain an NFA letter to meet the sales agreement and allow for rapid development of the property.

Subsurface impacts to groundwater were apparently the result of releases from two separate sources: an underground TCE storage tank, and TCE-laden sludge, discovered in a former disposal area. These TCE sources were the result of luggage manufacturing operations conducted from 1923 to 1971.

## EVALUATION

The presence and extent of TCE impacts are based on results for groundwater samples collected from a network of monitoring wells established by a third party independent





consultant between July 2004 and March 2006. LTE completed a detailed site characterization to determine the geometry of a groundwater plume which covered approximately 100,000 square feet and contained TCE at concentrations up to 1,200 parts per million. Using direct push technology, LTE determined the concentration of chlorinated solvents both spatially and vertically throughout the site.

Based on the analytical data, LTE designed a pilot test program to evaluate the efficacy of a carbon-based injectate (BOS100<sup>®</sup>) to remediate the chlorinated solvents in soil and groundwater. The carbon-based injectate treats chlorinated solvents *in-situ* in weeks rather than years. The injectate consists of an activated carbon catalyst (a very strong adsorbent) impregnated with nano scale reactive iron. Contaminants are indiscriminately trapped by the carbon, thus collocated in concentrated form with the reactive iron, and effectively treated by reductive dechlorination as a result of direct contact. The advantage of the carbon based process is that the adsorptive carbon carrier captures or traps the initial contaminant and retains the toxic daughter products until complete reductive dechlorination by the reactive iron occur, thus protecting groundwater quality throughout the clean-up cycle.

During the pilot test, approximately 3,000 pounds of BOS100<sup>®</sup> were injected into the soil and groundwater in an area where TCE concentrations up to 55,000 micrograms per liter ( $\mu\text{g/L}$ ) were reported. Upon completion of the pilot test injection activities, LTE conducted a performance sampling program to observe contaminant reduction and to obtain other response information regarding mass-removal rates. Within 18 weeks, TCE concentrations had dropped from 55,000  $\mu\text{g/L}$  to under 5  $\mu\text{g/L}$ .

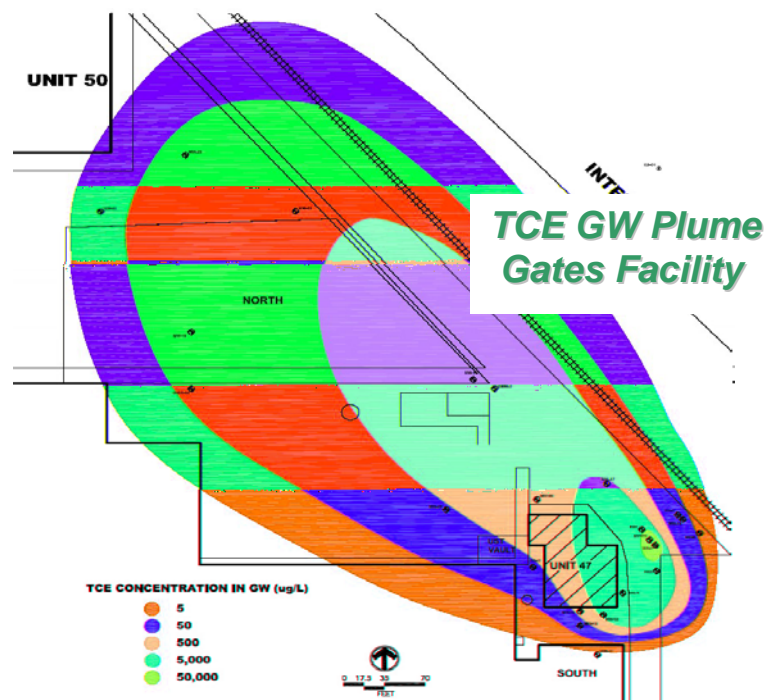
### “Gates sees dramatic results in plume clean-up bid”

“After applying an iron-carbon solution to an area with TCE levels of 52,000 parts per billion, the reading dropped to 100 parts per billion, the Gates representative said. Gates will monitor the effects of the test for a few more weeks before deciding if it can be used to clean the entire site.”

**Denver Post Newspaper**  
**Fridav March 4, 2005**

## DESIGN/INSTALLATION

Implementation of the full scale injection program at the Gates facility began in April 2005. The goals for the injection design were to protect the property boundaries, manage the hydraulic effects of injections so that the COCs, if pushed, always moved toward a region of higher concentration or into a region where injectate had already been placed and, third, to ensure that the aerial extent of impacts in soil or





groundwater decreased to below the CDPHE clean-up goals.

The injection program was sub-divided into 14 treatment regions, each with specific detailed injection plans. The Rule Authorization application was submitted to the EPA by LTE. Direct-push and high pressure pump equipment were used to emplace the carbon-based slurry.

Injection locations were laid out in five to 15-foot triangular grid patterns in order to create a series of “staggered” lines of injectate that intercept the groundwater flow regime. The carbon-based slurry was injected at multiple depths either using top-down” or bottom-up techniques depending on the lithology present. In some instance, both techniques were used at different horizons in the same location. An estimated 54,000 pounds of carbon-based injectate was placed in more than 850 locations during the installation phase of the project.

## RESULTS

Performance sampling using temporary well implants was conducted throughout the installation phase to ensure that the stated goals were being met.

Once the installation had been completed, in January 2006, LTE initiated a formal quarterly monitoring program for a period of one year. As stipulated by the CDPHE, groundwater samples were collected from specific locations within the defined plume and along the property boundary.

***TCE or the daughter products were not detected in any of the stipulated wells in the north parcel by January 2007 approximately 22 months from initiation of the plume definition.***

Based on the results, the north parcel VCUP application has been accepted and a NFA letter has been received from the CDPHE. Supplemental treatment in two source areas in the south parcel has been completed, and the parcel is presently in the monitoring stage. Closure of the south parcel is scheduled for the end of 2007.

The application of the **TerraCert™** process met all the goals of the project. The client expectations of meeting regulatory requirements within the constraints of the property transaction were achieved. In addition, the costs for applying the **TerraCert™** program were well below both conventional approaches and newly developed *insitu* biological methods for treating chlorinated solvents in groundwater.

