



# Kelly project uses 'trenchless' permeable reactive barriers

Permeable reactive barriers that don't require trenches are being installed to clean up groundwater contaminated by chlorinated solvents and metals in areas around the former Kelly AFB in San Antonio.

Five PRB segments of varying lengths will be installed from 22 feet to 35 feet below ground level on public streets, at a private property and along a Union Pacific Railroad right of way.

The PRB is a "wall" made up of millions of iron filings the size of a medium grain of sand.

As the groundwater percolates through the iron filings a chemical reaction takes place, destroying the perchloroethylene and trichloroethene contamination.

PCE and TCE are common solvents that were used at Kelly to degrease engine parts. Over the years, the chemicals entered the shallow groundwater as a result of leaks, spills or disposal practices that were approved at the time, said Walter Peck, project manager with the Air Force Real Property Agency.

The AFRPA oversees environmental remediation at closed Air Force bases.

In total, 330 injection and 10 monitoring wells will be installed and 985 tons of iron filings will be injected into the ground by the time the walls are completed, said Mr. Peck.

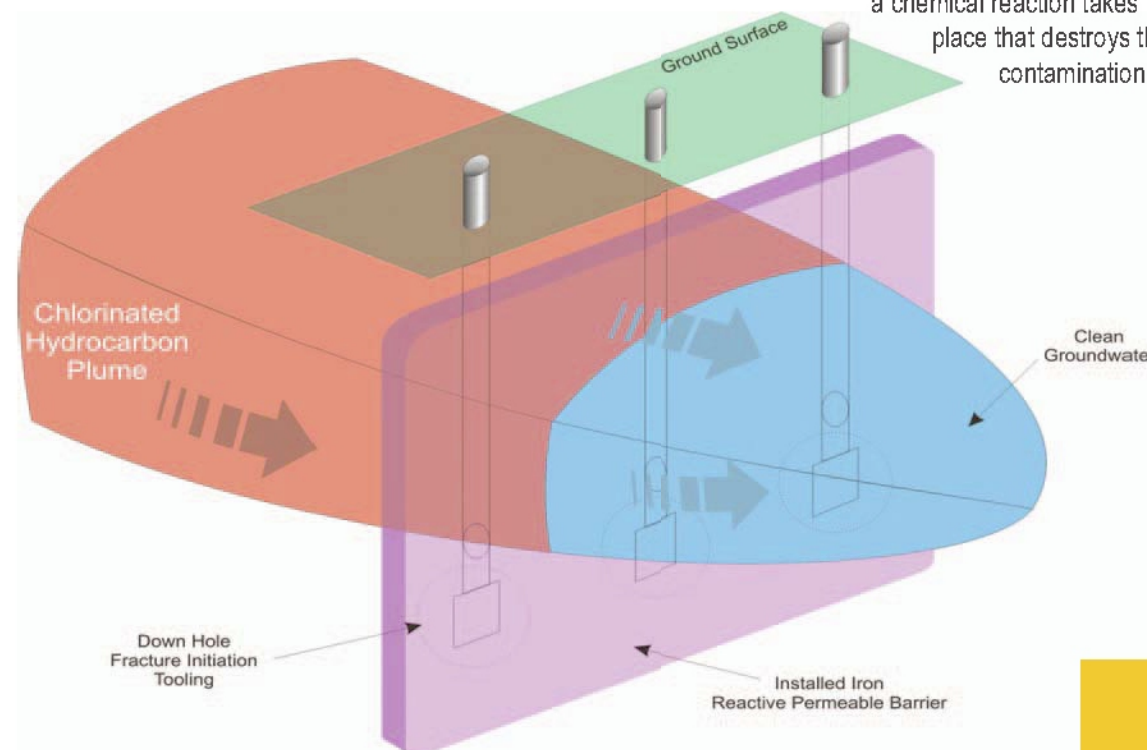
PRBs are the favored way to clean up PCE and TCE contamination because the process produces no toxic byproducts, and when the groundwater exits the barrier it is expected to meet drinking-water standards, said Vivian Perez, AFCEE's Kelly team leader.

Also, PRBs can operate year-round for 15 years or more, requiring no maintenance, external energy source or surface infrastructure.

Other cleanup methods, such as pump-and-treat, require large surface space for the equipment, which must be maintained by personnel and secured with fencing.

Additionally, pump-and-treat systems produce air emissions and thus require ongoing air monitoring. The innovative "trenchless" technology, developed by the Atlanta-based firm GeoSierra, offers even more advantages, particularly when used in a crowded urban environment, said Ms. Perez.

Drawing shows how the "trenchless" permeable reactive barriers being installed in the former Kelly AFB area will clean up groundwater contaminated by chlorinated solvents and metals. The PRB is a "wall" made up of millions of iron filings. As the groundwater percolates through the barrier a chemical reaction takes place that destroys the contamination.



*Workers drill a well along a street near the former Kelly AFB. Five permeable reactive barriers of segments of varying lengths will be installed below ground level on public streets, at a private property and along a Union Pacific Railroad right of way. Since no trenches will be dug to install the PRBs, residents of surrounding neighborhoods should experience only minor inconveniences.*



Instead of having to dig an open trench, workers drill six-inch holes every 11 feet along the length of the wall. Fracture casings are then placed in the holes through which the iron filings will be injected.

The filings are mixed with a food-grade starch and a special additive that causes the starch to turn into a highly viscous gel containing 10 pounds of iron per gallon. An enzyme also is added to the mix.

The pumping of this material into each casing causes it to open, creating a fracture in the ground into which the iron-filled gel flows. In about two or three hours the added enzyme reduces the gel to harmless water and sugar, leaving only a permeable wall of iron filings.

The precise positioning of the wall is made possible by an imaging technology that allows technicians to view the gel/iron filings injection in real-time on a computer monitor.

A low voltage charge injected into the mixture causes it to emit a signal that can be picked up by receivers in the hole and transmitted to what is called the "Frac Trac" computer system on which the injection is displayed.

Because no trench is involved, at the end of each work day the streets where the drilling is taking place can be re-opened to normal traffic.

The only ongoing disruption is during the iron injection.

"The process could be summarized as non-invasive outpatient surgery," said Ms. Perez.

City of San Antonio officials have allowed the injection equipment to remain on the streets Monday through Saturday, with overnight security and one-lane of traffic open at night.

All injection equipment is removed on Saturday and brought back to the site on Monday to resume work.

"This allows the off-base neighbors to go about their day-to-day business at the times they are home from work or school," Ms. Perez noted.

Added Mr. Peck: "Selecting this less intrusive remedy eliminates potential utility interference problems and thus maintains neighborhood goodwill."

Construction of the first four PRB segments is ongoing, with completion expected in October. After that, work will begin on the PRB in the railroad area, where the work being is done by the firm CH2M Hill.

AFRPA officials said that quality assurance/quality control tests were conducted before the work began to ensure that the PRBs are truly permeable and will not impede the natural flow of water.

Tests were conducted also to confirm that the iron filings will destroy the contaminants and to determine the required wall thickness.

In the community relations area, an AFRPA community involvement team has worked extensively in the local area over the past year to inform residents of the Kelly project before the work actually began.

These efforts have included sending out letters to residents within a four-block radius of the project sites, publishing fact sheets, preparing signs in both Spanish and English and generally keeping residents aware of the purpose and nature of the project.

"In the long run, using PRBs to do the cleanup will save the Air Force money by avoiding an expensive operation," said Ms. Perez. "You avoid costs because you don't need people working at the site, fuel to keep equipment running or the expense associated with obtaining permits."