

# Advanced Chemical Oxidation Achieves Site Closure for Petroleum Hydrocarbons and MTBE in Los Angeles, California

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## Project Background

Four leaking underground storage tanks (LUSTs) ranging in size from 12,000 to 20,000 gallons were discovered at a former service station during a site investigation in 1998. Initial groundwater samples contained elevated levels of total petroleum hydrocarbons as gasoline (TPHg), benzene, toluene, ethylbenzene, and xylenes (BTEX) and methyl tert-butyl ether (MTBE) above the maximum contaminant levels (MCLs). A resulting contaminant plume covered more than 6,000 square feet and reached concentrations of 52,000 parts per billion (ppb) TPHg, 10,000 ppb BTEX, and 7,000 ppb MTBE.

## Remedial Activities

### Excavation

In the year 2000, excavation activities removed the four LUSTs, fuel dispensers, and fuel product lines. A total of 312 tons of hydrocarbon-impacted soil was excavated, removed from the site and replaced with clean backfill.

### In-Situ Chemical Oxidation (ISCO)

In December 2005/January 2006, an ISCO pilot test was performed using 3,200 pounds of RegenOx™ to treat petroleum hydrocarbons in an area of deep groundwater (~40 feet bgs). RegenOx was applied through 8 direct-injection points around well EW1 (Figure 4) with six-feet between each injection point and approximately 40 pounds of RegenOx per vertical foot.

The success of the pilot test (Graphs 1, 2 and 3) led to a full-scale application of RegenOx in December 2006 where a total of 12,420 pounds of RegenOx was applied into 30 injection points in the vicinity of EW1, EW2, EW4, MW2 and MW3 (Figure 4). RegenOx was pressure injected at approximately 800 pounds per square inch (psi) to a depth of 40 to 50 feet below ground surface (bgs).

## RegenOx™ – Chemical Oxidation Technology

RegenOx is a solid alkaline oxidant built around a sodium percarbonate complex, which is activated using a proprietary, multi-part catalytic formula. The product is received on-site in two parts. The two parts are combined and then applied to subsurface soils and/or groundwater using direct-push injection or soil mixing equipment. Once in contact with the contaminated media, RegenOx produces an efficient and relatively rapid oxidative reaction comparable to that of Fenton's Reagent without an exothermic hazard.



Figure 1. RegenOx Part A and Part B

## Pilot Application Results

The RegenOx pilot application produced significant reductions in TPHg, BTEX and MTBE over a short, 30 day period. TPHg was reduced from 4,956 ppb to 199 ppb, BTEX from 330 ppb to 2 ppb and MTBE from 440 ppb to 165 ppb. Some mobilization of residual contamination from the soil occurred shortly after the RegenOx injection causing a temporary spike in concentrations. A persistent decline followed as the chemical oxidation reactions reduced concentrations across the board.



Figure 2. RegenOx Material On-Site



Figure 3. RegenOx Direct-Push Application

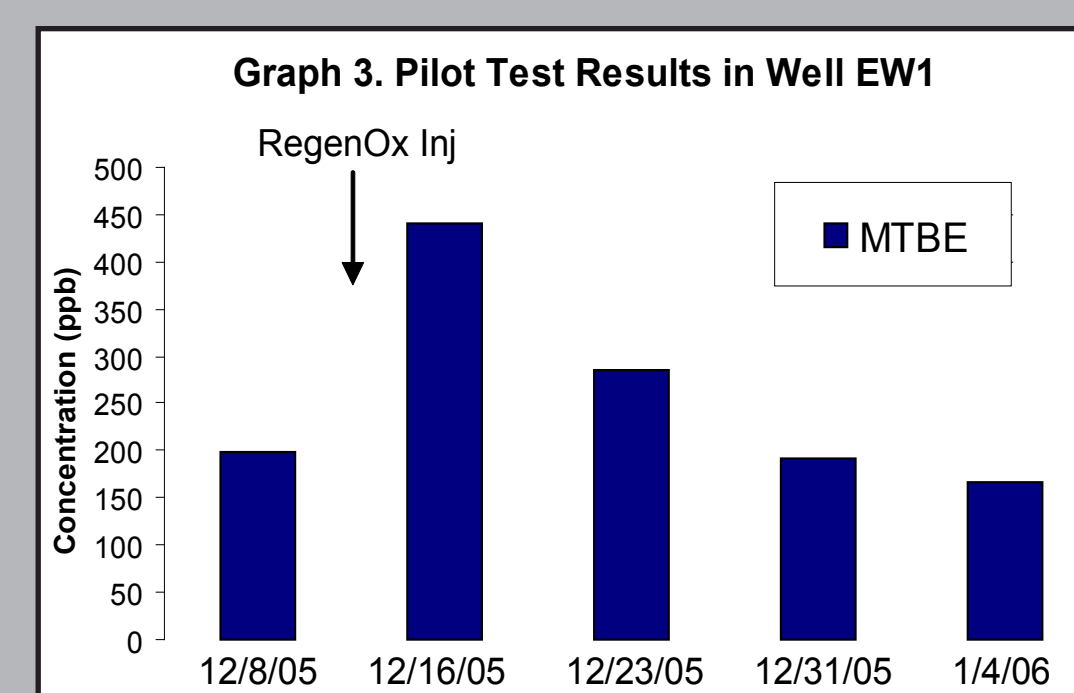
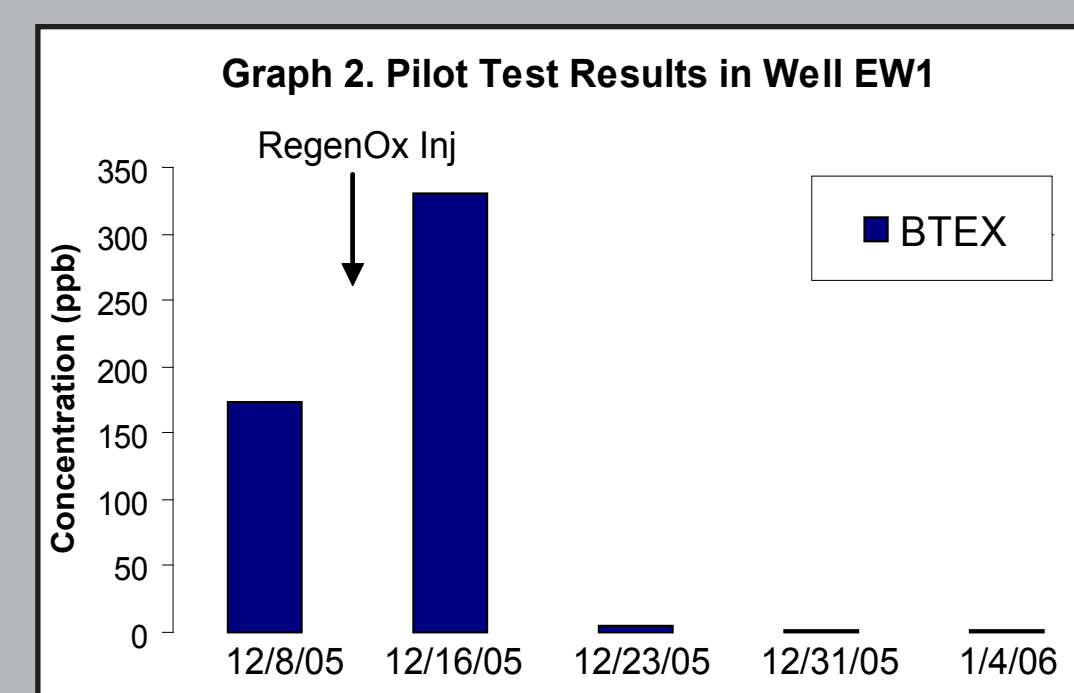
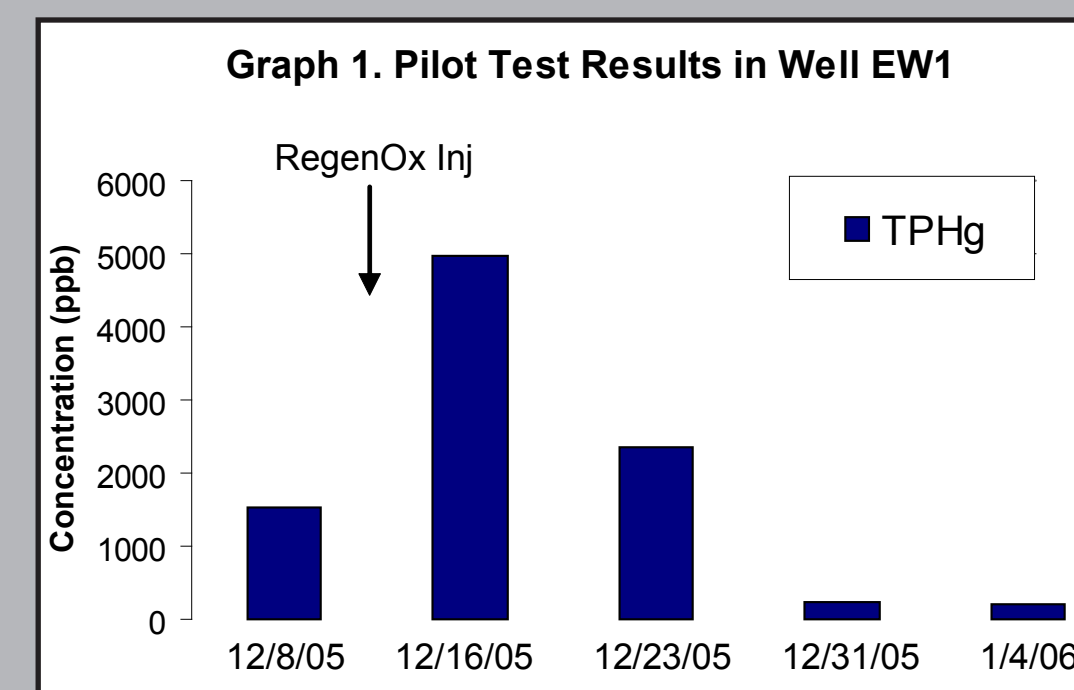
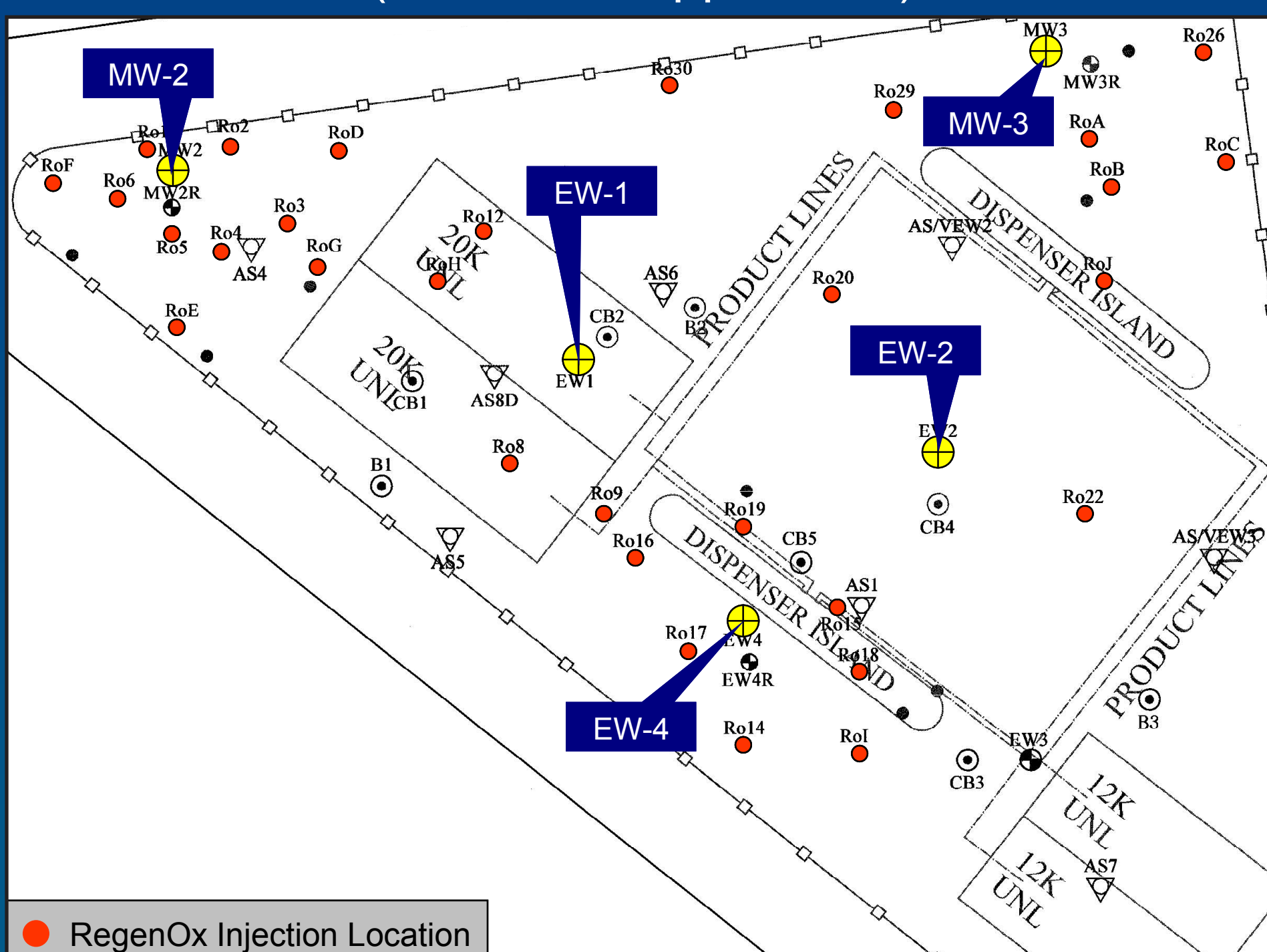


Figure 4. Site Map with RegenOx Injection Locations (Full-Scale Application)



## RegenOx Full-Scale Application Results

### TPHg Concentrations

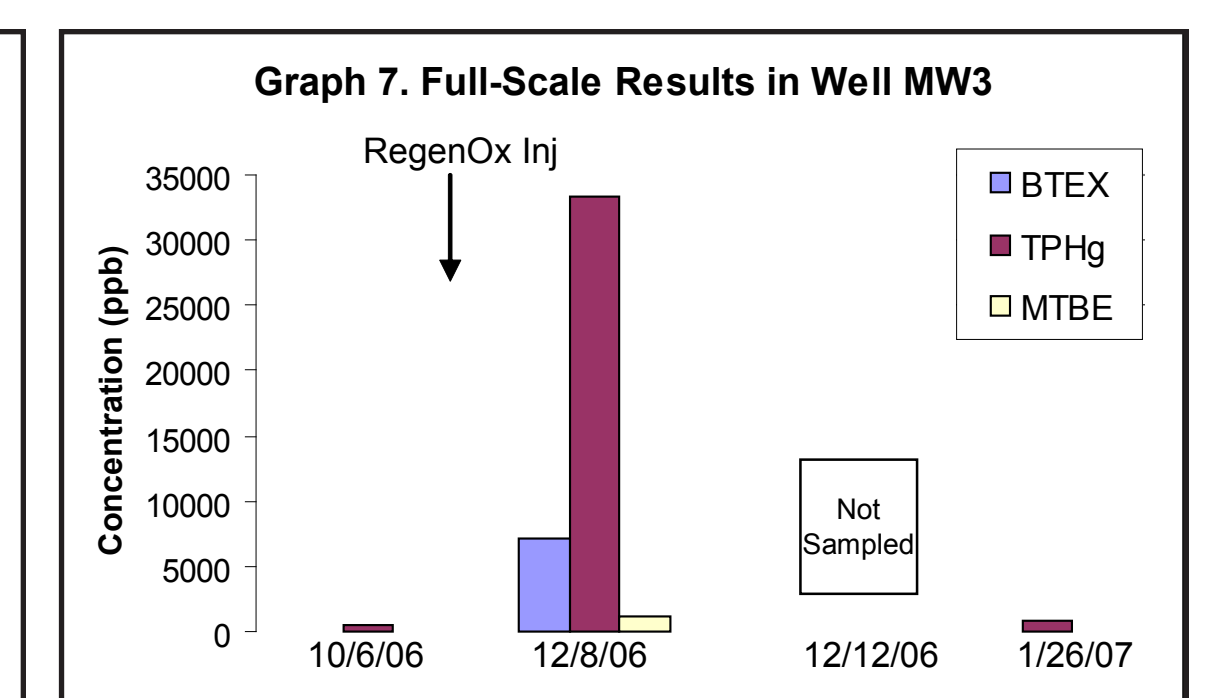
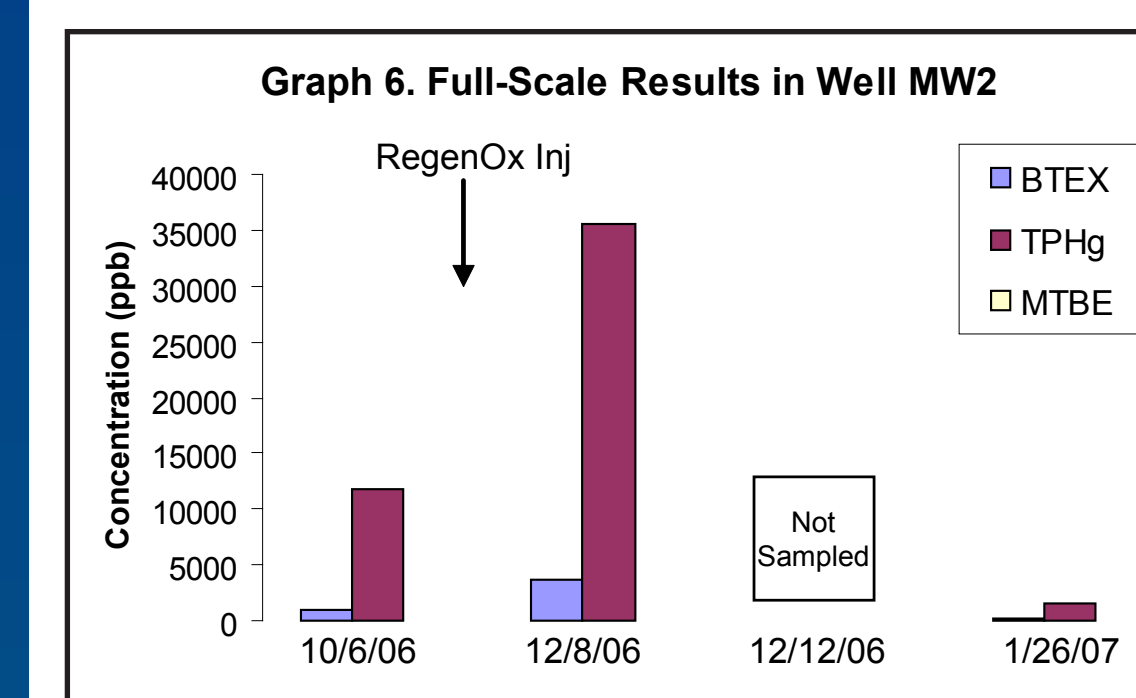
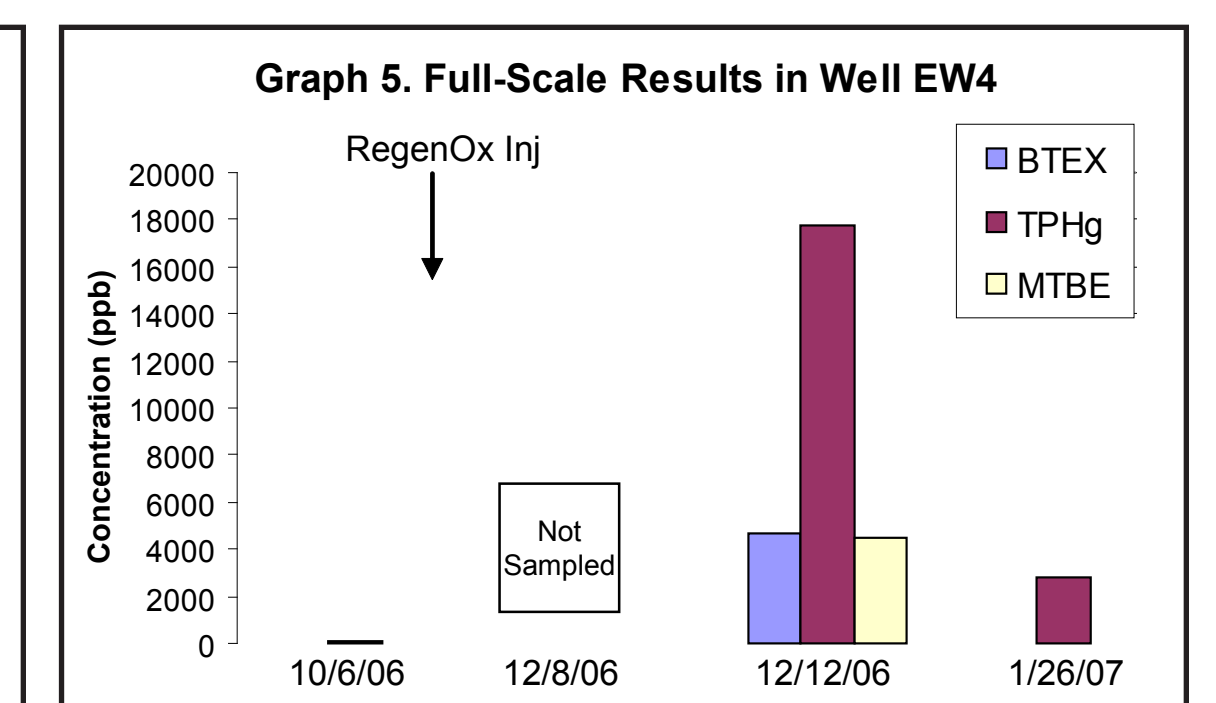
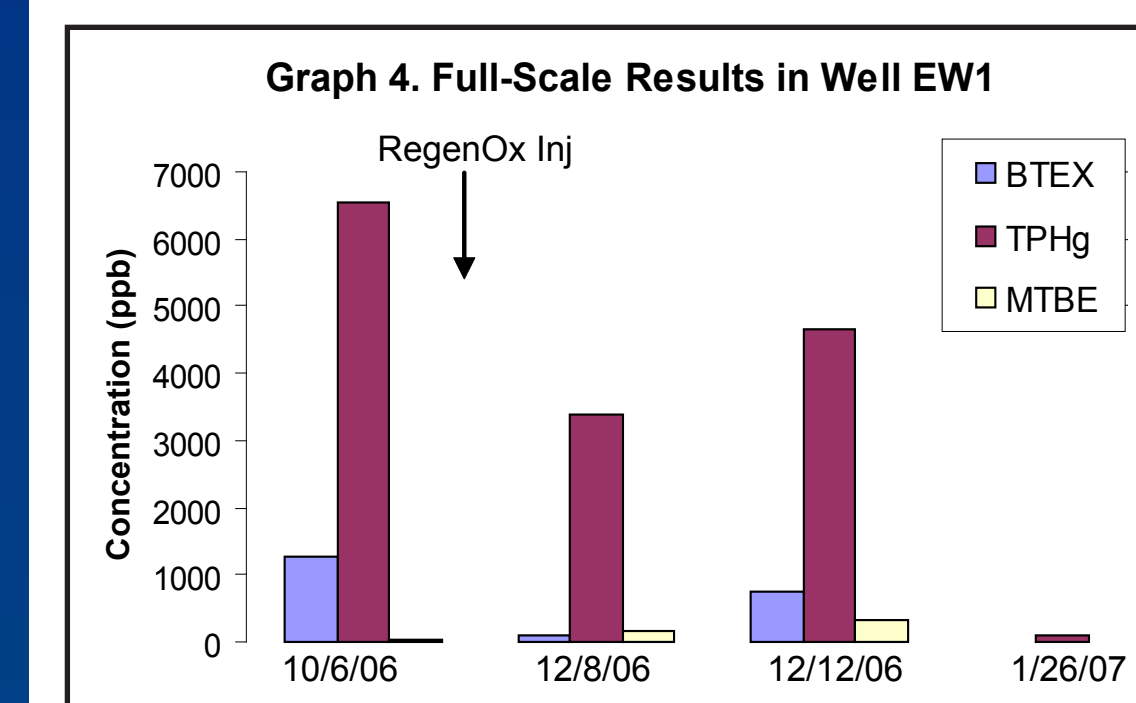
Within days of the RegenOx injection, TPHg concentrations in EW1 declined by almost 50% (Graph 4). Reduction continued over the next month as TPHg reached a concentration below the detection limit. In Wells EW4, MW2, and MW3 a spike in concentrations was observed shortly after RegenOx application as a result of residual contamination desorption (Graphs 5, 6 & 7), however concentrations rapidly declined by more than 80% in all wells within 2 weeks.

### BTEX Concentrations

Well EW1 contained the most significant BTEX concentrations at 1,270 ppb. Within 2 months, concentrations were reduced to 9.6 ppb. Similar to TPHg, BTEX concentrations spiked in EW4, MW2 and MW3 following injection. However, a reduction of more than 95% was observed in all three wells within 2 months.

### MTBE Concentrations

MTBE concentrations were reduced significantly in all wells following RegenOx injection. Some increases were measured after application, reaching as high as 4,459 ppb in Well EW4. Within 2 months time, concentrations were reduced to below the detection limit in 3 of the 4 wells.



## No Further Action

RegenOx rapidly and successfully reduced petroleum hydrocarbon concentrations in deep groundwater (~40 feet bgs). As concentrations at the site continued to decline or remain insignificant, a No Further Action letter was issued by the Los Angeles Regional Water Quality Control Board in August 2007.