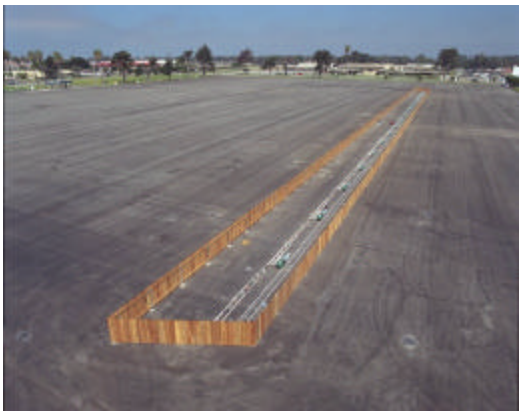
NETTS PROJECT/DEMONSTRATION SUMMARY



Title: In-Situ Bioremediation of MTBE in Groundwater using a Bacterial Culture NCBC-45-00

Lead PI/Affiliation: NFESC
Co-PI's/Affiliations: ASU
Equilon
AFRL

Date/Duration:
Initiated - 01/00
Completed - 09/02

Abstract:
Methyl tertiary-butyl ether (MTBE), a common fuel oxygenate, is a chemical of concern at gasoline and other fuel (e.g., jet fuel) contaminated sites. It poses unique remediation challenges due to its high mobility and low natural degradation potential. Namely, it migrates farther and faster relative to gasoline compounds benzene, toluene, ethyl benzene, and xylene (BTEX), the other contaminants of concern typically found at such sites. This project will focus on developing a cost-effective treatment approach for MTBE contaminated sites using a bacterial culture injected into the subsurface.

For the past 9 years, researchers at Equilon Enterprises Ltd. (formerly Shell Oil and Texaco) have focused on MTBE biodegradation. This has led to the cultivation of BC-4, an enriched, mixed bacterial culture that degrades MTBE aerobically. Organisms for BC-4 have been isolated from the activated sludge found in chemical processing and wastewater treatment plants. Using conventional enrichment practices, BC-4 has been acclimated over an extended period of time with MTBE as its only source for carbon. As such, it is a natural microbial consortium and has been shown not to be a source of pathogenic bacteria.

Using BC-4 in flow-through reactors, MTBE has been biodegraded from 300 ug/L to less than 0.02 ug/L at a hydraulic retention time of 25 hours. Laboratory sand columns inoculated with BC-4 achieved similar results with simulated groundwater velocities as high as 4 ft/day. Of importance is the fact that BC-4 degrades MTBE whether or not BTEX compounds are present.

Initial testing of the BC-4 in an MTBE only area of a naturally oxygen deficient aquifer at Port Hueneme, California, was successful in that the MTBE was largely degraded. This current study will provide a better understanding of that degradation process. The culture will be injected into the source zone of the plume and be established as a migration barrier in a mixed BTEX/MTBE plume. A 100 x 100 ft flow-through bioreactor will be constructed to include an oxygen delivery system and monitoring wells. Once the system is operating, monitoring the reductions in MTBE concentrations will assess performance of the BC-4 inoculated bioreactor. The demonstration will focus on identifying optimal methods for delivering bacterial cultures to a target treatment zone in the subsurface with the goal of reducing MTBE concentrations to below drinking water standards (< 50 µg/L.)

From late 1984 to early 1985, approximately 10,800 gallons of gasoline leaked from two storage tanks and piping under the Naval Exchange (NEX) gas station at the Naval Base Ventura County Port Hueneme Site (NBVC). Since 1985, the Navy has taken actions to prevent any further damage to the environment from the leaks. The MTBE remediation technologies demonstrated at NBVC Port Hueneme Site are part of the overall strategy in the NEX Plume Management plan for containment and control of the plume to prevent any further damage to the environment.

Results/Conclusions: Ongoing project

Publications: None