
TCE Lab Scale Bioreactor System (Tyndall Air Force Base)

Challenge

Envirogen was requested to conduct a feasibility study and ultimately design a field scale pilot system for Tyndall Air Force Base. The goal of this work was to design and operate a laboratory-scale biological treatment system capable of degrading trichloroethylene (TCE) and benzene from initial concentrations as high as 50 ppm, to concentrations of 4 ppb or less per contaminant. This objective was to be achieved by simultaneous or successive degradation of both contaminants by selected organisms in an integrated bioreactor system.

Solution

The degradation capabilities of three strains of TCE degradative microorganisms were determined. Although Envirogen TCE degraders were unable to grow on benzene as the sole carbon source, each organism could degrade benzene. A bacterial consortia capable of degrading benzene was isolated using enrichment techniques. It was demonstrated that TCE does not inhibit the degradation of benzene by these organisms, nor is TCE degraded by them.

A two-stage reactor system was designed and tested. The first stage targeted the degradation of benzene in the liquid phase by the bacterial mixture, and the second stage targeted the degradation of TCE in the vapor phase by a known TCE degrader.

Results

The lab scale testing showed, at starting concentrations of 50 ppm, more than 99% of the benzene was degraded and more than 90% of the TCE was degraded by the Envirogen method.

Envirogen began the second phase of contract work the following year, which involved a field-pilot system demonstration. The contaminated groundwater contained not only benzene and TCE but also contained significant concentrations of dichloroethylene, ethyl benzene, toluene, xylenes, dichlorobenzenes and other volatile organic compounds.