

## INVESTIGATION OF WETLAND-ENHANCED HYDROCARBON NATURAL ATTENUATION

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Laboratory microcosm experiments were conducted to investigate mechanisms of natural attenuation of Guadalupe diluent hydrocarbons in simulated wetland and dune sand aquifer (DSA) conditions. Mid-range hydrocarbons were used as a diluent to facilitate pumping oil from the site, and diluent leaks resulted in hydrocarbon contamination of the soil and groundwater at the site. Three types of microcosms were constructed using 1- gallon glass jars with Teflon-lined lids and stainless-steel fittings. The first type contained dune sand aquifer sand and groundwater with groundwater re-circulated for one pass through the sand for a 30-day run. The second type of microcosm simulated a wetland environment and contained wetland sediment and groundwater from the site. These surface water (SW) microcosms were aerated with ambient air at a typical aeration in a natural wetland. Petroleum hydrocarbons volatilized from the SW microcosms were trapped with activated carbon for quantification. The third type of microcosm simulated the transition from DSA to SW contained both a layer of sand and a layer of wetland sediment. Groundwater was circulated for one pass through the sand and sediment layers for 30 days. Duplicate killed controls were run for each microcosm type investigating of hydrocarbon adsorption to sediments. Initial and final groundwater samples were analyzed for total petroleum hydrocarbon (TPH) concentration and fractionated with a silica gel column to separately quantify the aliphatic, aromatic and polar fractions.

Significant biodegradation was observed in the DSA. Killed DSA controls maintained nearly constant TPH concentrations, indicating little or no adsorption to the DSA sand or the microcosm apparatus. In contrast, TPH concentrations decreased similarly in the controls and biologically active microcosms for both the SW and transition microcosms suggesting adsorption to sediments was a significant mechanism of TPH loss for these conditions. Volatilization from the SW microcosms accounted for only 0.4% of the observed TPH loss.

The initial groundwater used in these experiments contained only 0.06 and 0.1 mg/L TPH in the aliphatic and aromatic fractions, with the remainder (4.7 mg/L) in the polar fraction. Aliphatic and aromatic concentrations are only slightly higher than the detection limit of 0.05 mg/L, making it difficult to track their fate in the microcosms. The aliphatic and aromatic fractions were reduced to below detection after 30 days in the DSA microcosms, presumably due to biodegradation. These fractions were also removed from the SW microcosms.

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