
Title: Nonaqueous Phase Liquid Transport and Fate at the McCormick and Baxter Site, Portland, Oregon.

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The McCormick and Baxter site located in Portland, Oregon, is a former wood treatment facility contaminated with creosote, pentachlorophenol, oils and heavy metals. Surface and subsurface investigations have been conducted at the facility since 1983, and remedial activities are ongoing under the direction of the Oregon Department of Environmental Quality. Two primary source areas for contaminants have been identified, the former waste disposal area (FWDA), and the tank farm area. The
FWDA is located in the southwest corner of the property adjacent to the Willamette River, and is the subject of this investigation.

In the FWDA, both light nonaqueous phase liquids (LNAPLs) and dense nonaqueous phase liquids (DNAPLs) have been identified in soils, sediment, and monitoring wells. These nonaqueous phase liquids (NAPLs) are complex mixtures of diesel and light fuel oils, pentachlorophenol, and creosote containing polycyclic aromatic hydrocarbons.

The purpose of this investigation was to develop a better understanding of the transport and fate of NAPLs migrating from the former waste disposal pond, and into sediments of the Willamette River. The investigation examined the distribution, density, and chemistry of NAPL and residual NAPL in sediments. A simplified conceptual model was developed to integrate the observations and data collected from the FWDA.

Based on a review of available data, several conclusions were drawn concerning transport and fate at the site. Large quantities of NAPLs were introduced into the disposal pond and travelled vertically through the vadose zone. Upon encountering the water table, LNAPL compounds were distributed over a large area in response to local water table fluctuations and gradients. DNAPL compounds, only slightly denser than water, sank below the water table and migrated laterally towards the Willamette River in response to groundwater flow directions and discontinuities in the aquifer. Several discontinuous silt aquitards served to pond DNAPLs and partially prevent downward migration. As NAPL migrated through the vadose and saturated zones, capillary forces
retained small amounts NAPL, depleting the mass of contaminates.

Water table profiles in the FWDA indicated a gradient sloping towards the river during low tides, and towards the center of the FWDA during high tide. Tidal fluctuations affected LNAPL thickness in monitoring wells, but LNAPL migration patterns are poorly understood. DNAPL thicknesses in monitoring wells were not appreciably affected by tides.

Polycyclic aromatic hydrocarbons (PAHs), and total aliphatic hydrocarbons (TAH) representing diesel or light fuel oils, decreased in concentration with depth. TAH/PAH ratios generally increases with depth, possibly the result of a dissolved aliphatic hydrocarbon plume, or preferential retention of PAHs in sediment. The ratio of low molecular-weight to high molecular-weight PAHs in sediment increases with depth, representing degradation or dissolution of the lighter and more soluble low molecular-weight PAHs. The preferential degradation and dissolution of low molecular-weight PAHs may cause NAPLs to fractionate into denser compounds, which sink below the water table.

Chemical analyses of NAPL collected from extraction wells indicated PAH compounds and pentachlorophenols were primary constituents of wastes placed in the former disposal pond. Aliphatic hydrocarbons were present only in trace amounts in the NAPL, but were present at higher levels in sediment.