Compatibility of Soil/Bentonite Slurry Wall Backfill with Coal Tar at a Former Mid-Western MGP Site

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A backfill mixture for a slurry wall at a former mid-western manufactured gas plant (MGP) was selected using a three-phase laboratory permeability testing program. The specifications required a mixture with a permeability below 10^{-7} cm/s and compatibility with the site's groundwater and dense non-aqueous phase liquid (DNAPL), coal tar. Samples were tested in triaxial and rigid wall permeameters. Potable water was used as a permeant in Phase 1 to estimate average permeabilities for each of the three geologic units at the site. In Phase 2, soil/bentonite mixtures were permeated with potable water to select a mixture that had a permeability below 10^{-7} cm/s. Phase 3 evaluated the compatibility of commercially available bentonite and attapulgite with the coal tar found at the site. The Phase 3 test protocol was altered after new research (McCaulou and Huling, 1999) indicated that hydrated soil/bentonite soil mixtures may develop desiccation cracks when permeated with DNAPL. Filter cake tests were utilized as a screening tool to determine whether bentonite or attapulgite appeared more resistant to desiccation. Compatibility was then evaluated by permeating viable mixtures sequentially with site groundwater and coal tar. The average permeabilities of the fill, alluvium, and till from Phase 1 tests were $1.3x10^{-4}$, $1.0x10^{-3}$, and $8x10^{-8}$ cm/s, respectively. Phase 2 tests indicated that either the 4% or 6% bentonite mixture would have an acceptable permeability ($<5.08x10^{-8}$ cm/s). Phase 3 filtrate testing showed bentonite to be more compatible with the sites DNAPL. Site groundwater had no effect on either of the 4% or 6% bentonite mixtures. Subsequent permeation with DNAPL decreased permeability slightly ($2.5x10^{-8}$ cm/s). Photographs taken after testing show 1/8"-1/4_cracks that penetrated 1/8"-3/4" deep into the top of the sample. Despite the surface cracks, short-circuiting of DNAPL was not observed and Darcian flow was maintained. Both mixtures are conservative since the gradients used in the lab are much higher than those expected in the field. Moreover, groundwater extraction pumps at the site will create an inward gradient away from the slurry wall.