Enhanced In Situ Solidification and Stabilization (ISS) Blends: Impacts of Adding Sodium Persulfate, and Water Content

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In situ chemical oxidation (ISCO) and in situ stabilization and solidification (ISS) technologies are two established remediation technologies that have been used to treat a wide assortment of environmental contaminants of concern around the world. ISCO is a contaminant mass destruction technology that is effective when contact between a sufficient dose of activated oxidant for the contaminant mass is established. ISS solidifies the soil matrix which decreases the contaminant flux from the source area soils.

These technologies can be combined during a single soil mixing application to treat contaminated soils or sediments using the inherit alkalinity within Portland cement to create alkaline activation conditions for persulfate.

Activities

The objective of these studies was to evaluate the impact of different ratios of binder and sodium persulfate to treat the same soil matrix. Binders tested include Type I/II Portland cement (PC) and a blend of the same Portland cement with blast furnace slag (BFS). These blends were varied to assess the benefit of varied binder, sodium persulfate, and moisture content on key geotechnical characteristics including compressive strength over time, hydraulic conductivity, and volume of displaced soil (bulking) during the soil mixing application.

Results

The data show that binder content and blend ratios can have significant impacts on the key geotechnical design parameters. PC only and PC/BFS blends solidify at different rates with PC only reactors achieving a higher unconfined compressive strength (UCS) in early time points but the PC/BFS resulted in greater UCS after 28 days. Water content had a deleterious impact on UCS, but minimal to no impact on the actual hydraulic conductivity. Adding low levels of sodium persulfate to the binders resulted in higher UCS than binder only and in a lower overall volume (less bulking) to achieve the same UCS as binder only blends.

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Dr. Brant Smith is the Technology Director for Persulfates and Soil & Groundwater for Evonik Active Oxygens group. With over 20 years of experience, Dr. Smith has designed and implemented numerous field applications and bench scale tests involving ISCO, in situ bioremediation, in situ chemical reduction, and metals stabilization. He has been an author on over 90 presentations at national and international conferences and his research have been published in journals including *Environmental Science and Technology*, *Journal of Contaminant Hydrology*, *Environmental Toxicology and Chemistry*, *Journal of Environmental Science and Health*, *and Journal of Environmental Engineering*. Dr. Smith obtained a Bachelor's of Science with the majors of Civil and Environmental Engineering and Economics from Worcester Polytechnic Institute, and a Master of Science and Ph.D in Civil Engineering from Washington State University. He is a registered Professional Engineer in Washington State.