

USE OF ORGANOCLAY AS A STABILIZING AGENT FOR SOLIDIFICATION/STABILIZATION TREATMENT OF CONTAMINATED SOILS AT A MANUFACTURED GAS PLANT SITE

Lawson, M.A., Venn, J.G., Pugh, L.B., and Vallis, T., "In-situ Solidification/Stabilization Pilot Study for the Treatment of Coal Tar Contaminated Soils and River Sediments", Stabilization and Solidification of Hazardous, Radioactive, and Mixed Wastes, 3rd Volume, ASTM STP 1240. T. Michael Gilliam and Carlton C. Wiles, Eds., American Society for Testing and Materials, 1996. www.astm.org

Coal tar contamination was encountered from near surface to down to below the groundwater table at a former manufactured gas plant site in Manitowoc, WI. Excavation and ex-situ remediation would have been costly because of the need to dewater the impacted soils. Thus, in-situ solidification/stabilization (S/S) of the contaminated soils was investigated.

The organic contaminants present in the soils could retard the set rate and ultimate strength of cement and pozzolanic S/S systems. A literature review indicated that organophilic clay and activated carbon can act as stabilization reagents. The organophilic clay and activated carbon adsorb organic contaminants in the waste. A treatability study was performed with various mixtures of Portland cement, fly ash, organophilic clay [bentonite modified w/ dimethyl di(hydrogenated tallow) ammonium chloride] and powdered activated carbon (PAC). From the treatability study, it was concluded that organophilic clay and PAC were beneficial for reducing the mobility of semi-volatile organic compounds (SVOCs). The treated samples also exhibited good strength and durability characteristics and excellent hydraulic conductivities. Based upon the treatability study, a composition of 60% (by wt.) Portland Type I, 32% Type F fly ash, 9% organophilic clay and 9% PAC was specified for a pilot test.

In the 1992 pilot study, three overlapping 5-foot diameter columns of impacted soil were treated. The field equipment consisted of hollow, horizontal mixing blades attached to a hollow, vertical Kelly bar shaft. A Kelly bar drive rotated the shaft, which caused the blades to agitate soils below the surface. A progressive cavity pump delivered the reagents through the Kelly bar and the tool, and injected the reagents through orifices in the blades to the soils at a controlled rate. The S/S reagents were injected into the subsurface at a rate of 680 lb/yd³ of treated soil. Half of the grout was injected as the shaft was lowered and the other half as the shaft was raised. The mixing equipment was capable of reaching down to the bedrock depth of approximately 32 feet.

In-situ S/S of the coal tar contaminated soils was shown to be effective. Samples were taken with hollow stem auger equipment. Extractable metal concentrations were comparable to those observed during the treatability testing. Leach concentrations of most PAHs were below detection limits (see Table 1).

Table 1. Pilot Test PAH Results

Parameter	Untreated media conc., mg/kg	S/S leach conc., mg/l
Acenaphthene	150	0.007
Acenaphthylene	690	0.061
Anthracene	500	<0.005
Benzo(a)anthracene	660	<0.005
Benzo(a)pyrene	330	<0.005
Benzo(b/k)fluoranthene	380	<0.005
Chrysene	670	<0.005
Fluoranthene	1,100	<0.005
Fluorene	430	0.012
Naphthalene	650	0.94
Phenanthrene	1,500	<0.005
Pyrene	910	<0.005

Treated soils, under both saturated and unsaturated conditions, achieved the target unconfined compressive strength of 50 psi within 28 days. Wet/dry durability testing yielded weight losses of 3.44 and 5.45% and freeze/thaw durability testing yielded weight losses of 6.63 and 6.85%. Both the wet/dry and freeze/thaw results were well below the site criteria of $\leq 15\%$ weight loss.

The treated soils exhibited hydraulic conductivities of 1.9 to 2.6×10^{-7} cm/s. This was approximately one order of magnitude higher than the treatability study. The difference in performance compared to the treatability study is likely due to less efficient mixing in the field compared to the laboratory.