In-Situ Solidification/Stabilization of a Former Wood Treatment Site

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In-situ portland cement-based solidification/stabilization treatment technology was selected to remediate soil at a former wood preserving site in Washington State. The remediation effort was to prepare the site for eventual redevelopment. Known as the J.H. Baxter-Renton Site, the property is an 8-hectare (20-acre) site located on the southeastern shore of Lake Washington near Renton. A wood treatment plant operated at the site from 1955 until it closed in 1982. Plant operations included use of chemicals commonly associated with industrial treatment of wood, including creosote and pentachlorophenol (PCP). A 1983 site assessment conducted for possible site redevelopment identified polycyclic aromatic hydrocarbon (PAHs) and PCP in site soil and groundwater.

Specially designed auger for soft peaty soils.

The Washington State Department of Ecology (Ecology) was responsible for approving the remediation plans for the site. In 1992, the site was divided into the North and South Baxter Properties. In February 2004, Ecology approved remediation contractor plans and specifications for remediation of the upland portion of the South Baxter Property. Ecology's approval of solidification/stabilization (S/S) treatment of the organic contaminated soil at the J.H. Baxter site was based in part on positive experience with S/S technology at previous clean-ups.

Treatment of successive soil columns.

In-situ treatment of contaminated soil at the J.H. Baxter site was selected over common "dig and dump" clean-up plans for several reasons. First, excavation of contaminated soil would have been complicated and costly. The high water table at the site would have required constant dewatering of an excavation and treatment of the water removed. Next, transporting excavated contaminated soil and replacement fill would have required major earth-moving equipment and heavy truck traffic through adjacent residential areas. Finally, off-site disposal of nearly 9,000 cubic meters (12,000 cubic yards) would have been costly. In-situ S/S treatment avoided these problems, public risks, and costs.

Start of a new mixing column.

S/S treatment at the J.H. Baxter site involved mixing portland cement and bentonite into the contaminated soil while the soil remained in place. These S/S binding reagents were mixed into the soil with a soil mixing auger. The auger was specially designed for use in the soft peaty soil at the site. At 2.5 meters (8.5 feet) in diameter, the auger

S/S at the Renton, WA, site.

S/S binding reagent mixing plant.

delivered the cement and bentonite grout mixture into the soil primarily through jets in the pilot bit. The S/S mix design was approximately 20% addition of portland cement and 1-2% addition of bentonite. The auger was advanced into the soil up to a depth of 7.3 meters (24 feet). An overlapping pattern of mixing columns was used to ensure complete treatment of the soil. Approximately 8,950 cubic meters (11,700 cubic yards) of soil was treated. S/S treatment at the site was completed in about two weeks.

Solidification/stabilization treatment protects human health and the environment by reducing or preventing the release of hazardous constituents from treated material. This is accomplished by physical and chemical changes to the treated material. Leaching of organic contaminants from in-situ S/S-treated soil is reduced by changing the permeability of the soil to groundwater and surface water. Reducing the permeability (or hydraulic conductivity) of treated soil by an order of magnitude results in the groundwater and surface water flowing around the treated mass instead of through it.

At the J.H Baxter site, performance specifications for the treated soil included a maximum hydraulic conductivity of $1X10^{-5}$ cm/sec and unconfined compressive strength (UCS) of between 0.07 to 0.34 MPa (10 to 50 psi) at 28 days. Successful treatment was accomplished with tested field samples having hydraulic conductivities less than $1X10^{-5}$ cm/sec and UCS of between 0.2 to 0.52 MPa (30 to 75 psi).

Additional remediation at the site included excavation of contaminated sediment from the adjoining lakebed and a lagoon on the site, demolition and removal of concrete tanks, excavation and removal of shallow contaminated soil around the tanks, and contouring and planting of excavated areas.

Credits

Remediation Designer:
The RETEC Group Inc., Seattle, Washington

Solidification/Stabilization Treatment Contractor:
Envirocon Inc., Missoula, Montana

Portland Cement Supplier:
Lafarge North America Inc., Seattle, Washington

Photography:
Russ Simonson, Near Point Photography
Courtesy of Lafarge North America Inc.

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