Effectiveness of a novel sediment capping technology, AquaBlok, as a biological barrier between contaminated sediments and biota.

Alice Benzecry(1), Marion McClary, Jr.(2), and Carolyn S. Bentivegna (3)

(1) Fairleigh Dickinson University, 1000 River Road, Teaneck, NJ 07666, 201-692-2385, 201-692-7349, benzecry@fdu.edu, http://inside.fdu.edu/pt/benzecry.html
(2) Fairleigh Dickinson University, 1000 River Road, Teaneck, NJ 07666, 201-692-2606, 201-692-7349, mcclary@fdu.edu, http://inside.fdu.edu/pt/mcclary.html
(3) Seton Hall University, 400 South Orange Ave., South Orange, NJ 07079, 973-275-2113, 973-761-9772, bentivca@shu.edu, http://www.shu.edu

As a result of agricultural, commercial and industrial activities conducted in the absence of environmental regulations and enforcement in the past, sediments contaminated by organic compounds, heavy metals, and other potentially toxic chemicals have accumulated in many of the world's deepwater and wetland environments. Capping is one strategy for reducing biota exposure to sediment contaminants. This investigation studied the ability of a novel capping substrate, AquaBlok (AB), to improve the environmental health and support the growth of wetland vegetation of Kearny Marsh, an oligohaline wetland located in the New Jersey Meadowlands, USA. SubmerSeed, a AquaBlok composite seeding technology was also used as an alternative to traditional means of plant propagation in permanently inundated conditions.

Environmental health was assessed by plants and benthic macroinvertebrate (BMI) abundance and diversity. Plant germination and growth was recorded during two consecutive growing seasons. Plant health was determined by the plants root system and plant dry weight. Plant Root systems growing in AquaBlok were much less robust (50 to 65% smaller) than the root system of plants growing on marsh sediment. Similarly, total plant dry weight was lower on AquaBlok treated areas. BMI were collected during 2.5 years using cores and Hester-Dendy. BMI Biodiversity was low with no improvement for any treatment: Shannon-Weiner Index equaled 0 – 0.733. Compared to sediment control, AB did increase BMI total abundance 3-7x in summer and fall. This increase was associated with higher levels of DO and redox.

Sediment and water contaminants (heavy metals, PCBs and OCPs) were measured once a year. Water quality parameters (pH, temperature, DO, redox, salinity, conductivity, and depth) were measured thee times a year during spring, summer and fall. Results for organics showed that PCBs and OCPs were about 9x lower in AB than control sediments. PCBs and OCPS in water overlaying AB and sediments were similar and variable over time. Heavy metals (Cd, Cr, Cu, Hg, Ni, Pb and Zn) were about 5-18x lower in AB than sediment. Heavy metals in water overlaying AB and sediment were similar; however, concentrations spiked right after capping then declined over time. In summary, AB contained lower contaminant levels than uncapped sediment over time. Heavy metal concentrations in water improved after an initial spike. Biodiversity of both plants and BMI did not improve over 2.5 years; however, abundance of dominant fauna increased on AB plots.