Solidification/Stabilization Treatment of Dredged Material from the Port of San Diego

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S/S blending head.

Cement-based solidification/stabilization allowed the Port of San Diego to economically and safely dispose or reuse material dredged from the harbor. Dredging of channels and berths is a vital activity to keep harbors open for business. Disposal of dredged material is a significant cost to maintenance dredging. This is especially true when contaminants in the dredged material prohibit ocean disposal and require up-land disposal and increased costs. Cement-based solidification/stabilization (S/S) is a treatment technology that can be used to manage dredged material safely and effectively.

Project Description

This project involved dredging, treatment, and disposal of approximately 12,500 cubic meters (16,500 cubic yards) of sediment at the Tenth Avenue Marine Terminal in San Diego, Calif. Sediment was dredged to ensure safe ship maneuvering and docking conditions. The dredged material was primarily storm drain runoff sediment discharged into San Diego Bay out of the City of San Diego's Switzer Creek storm drain outfall. Normal ocean disposal of the dredged sediment was prohibited since the material was contaminated with below hazardous levels of copper, zinc, lead, pesticides, and polychlorinated biphenyls (PCBs).

Contaminated sediment is often disposed of in a confined disposal facility (CDF). CDFs are dedicated landfills (or monofills) for dredged sediments. Temporary CDFs can also be used to dewater or dry sediment prior to off-site disposal. CDFs are often located near the areas that are being dredged and can take up precious land near port areas. This was the case at the Port of San Diego. A CDF was not preferred and another sediment management solution was needed.

Cement-based S/S was selected to treat the dredged sediment allowing for disposal in a local municipal solid waste landfill (MSWL). Cement-based S/S involves mixing portland cement into the contaminated material being treated. Cement reacts with water in the sediment to chemically bind free water and dry the material. Cement hydration reacts physically and chemically to immobilize hazardous contaminants within the treated material. The dredged sediment drying time for this process is a small fraction of that required for air drying dredged material in a CDF. S/S treatment reduces contaminant leachability allowing reuse or disposal in a MSWL rather than a hazardous waste landfill. Reuse of treated dredge material as engineered fill, as landfill cover material, or disposal in a MSWL, is dramatically less expensive than disposal of the contaminated dredged material in a hazardous waste landfill or CDF.

Dredging and Treatment

Sediment was dredged from the Bay using a clamshell dredge and loaded into a barge tied alongside of the dredge vessel. A double-walled silt curtain (turbidity barrier) encircled the dredge area, including the dredge vessel and barge. Free water captured with the sediment during clamshell dredging was pumped back into the dredge area within the silt curtain after it separated from the sediment in the barge over several hours. The barge was then docked alongside the terminal and an S/S blending head mounted on the end of a long reach extend-a-hoe was used to mix a slurry of portland cement and water into the dredged material. The mixing resulted in a 2% to 5% addition of portland cement to the sediment.

Clam shell dredging.

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Within a few hours the material was transferred by clamshell into a k-rail bordered holding area on the terminal next to the mixing barge, loaded into dump trucks lined with visqueen to keep the treated sediment from sticking when it is dumped, and hauled to a local sanitary landfill. The treated sediment was tested for pH and free liquids. The MSWL criteria to accept the material for disposal was a pH below 12 and above 2, and no free liquids per Paint Filter Test (EPA SW846 Method 9095).

In all, 12,600 cubic meters (16,500 cubic yards) of material were dredged and treated (approximately 27 barges). Actual dredging, free water removal, mixing, curing, loading, hauling, and disposal operations required an average of 3 days per barge. By operating two barges simultaneously, the work was accomplished in approximately 30 working days.

Benefits

Significant benefits resulting from the use of cement-based S/S for dealing with the dredged sediment material include:

- Eliminates the need for a CDF.
- Binds soluble constituents and reduces chloride mobility in the resulting soil cement matrix.
- Generates soil cement with excellent engineering properties for use as landfill day cover, pre-conditioned (cement-treated) roadway pavement base, slope or drainage channel surfacing base, or structural fill material.

Credits

Plans and Specifications:
San Diego Unified Port District's Engineering Design Division, San Diego, Calif.

Dredging and Treatment Contractor:
R.E. Staite Engineering, Inc., National City, Calif.

Solidification/Stabilization Mix Design:
Ninyo & Moore Geotechnical and Environmental Sciences Consultants, San Diego, Calif.

Solidification/Stabilization Blending Head:
WBR Services, Inc., Newport Beach, Calif.

Photographs:
Port of San Diego

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S/S treatment using blending head.

Silt curtain encircles dredge area.

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