Sediment Dewatering Re-Enters the Spotlight

By Robert McIlvaine

Examining dewatering techniques & the role of polymers in enhancing their performance

In April, the U.S. Environmental Protection Agency (EPA) announced one of the largest Superfund cleanups ever proposed—a $1.7-billion plan for bank-to-bank dredging of the Passaic River in New Jersey that would remove more than 4 million cu yd of contaminated sediment from the lower 8 miles of the river.

The cleanup plan, which has been under study for 25 years, calls for dredging 2.5 ft in most of the river and up to 15 ft in some areas to accommodate a navigation channel. Once the contaminated sediment is removed, a protective cap of 2 ft of sand and 1 ft of habitat support would be placed over the dredged area. The dredged material then would be taken by barge to a local facility for dewatering. The water would be treated and returned to the river; the sediment would be transported by rail for thermal treatment or landfilling.

Finalizing the cleanup plan and conducting the engineering and design work will be carried out over the next few years, and EPA estimates that it will take another five years to dredge the 8 miles of river bed. While the details of the plan are far from final, EPA's announcement has renewed interest in sediment dewatering and remediation technologies. This article is intended to describe and compare various types of mechanical dewatering techniques and will examine the role of polymers in enhancing their performance.

Dewatering Techniques

There are four primary dewatering techniques:

1. Passive, which refers to a reliance on natural evaporation and drainage to remove moisture. Geotextile tubes fall into this category;
2. Chemical aids, including polymers, which aggregate smaller particles to form larger composite particles. Chemical flocculants may be used as a stand-alone dewatering technique, but typically are used to enhance the performance of mechanical separation equipment;
3. Mechanical, which requires the input of energy to squeeze, press or draw water from the hydrated material; and
4. Integrated systems, which use a combination of chemical and mechanical methods to achieve rapid dewatering. The Genesis Rapid Dewatering System falls into this category.

Polymers (long chain-like molecules) are used in dredging projects to improve solids capture and increase cake dryness. Polymers aggregate suspended solids by flocculation, which improves solids capture in downstream dewatering devices. Flocculation occurs when polymers act like bridges between particles, resulting in larger particles called flocs. In the case of contaminated sediments, polymers also are able to enhance the attachment of contaminants to the large flocculated sediment particles, thus leaving cleaner sediment behind. This reduces the amount of contaminated sediment that needs to be treated, disposed of or contained.

Selecting a Dewatering Method

The variables that influence equipment choices are many and must be considered in conjunction with the overall objectives of a given sediment dewatering project.

The driest cakes are generated by plate and frame presses and geotextiles. This is due to the length of time the solids are exposed to hydraulic pressures and the relatively low shear forces exerted during their use. Larger amounts of chemical additives are required to build stronger bonds, which can withstand stronger shear forces in certain types of equipment. Accordingly, chemical dosing is lowest for plate and frame presses and geotextiles with low shear forces.

Ease of operation depends on the operating complexity of the equipment. Geotextiles are the easiest to operate because there are no moving parts. On the other hand, they also require large amounts of space. Plate and frame presses also have relatively large footprints because they operate in batch mode, and multiple units are required to ensure a continuous operation.

The overall cost takes into account the initial capital cost, as well as labor, maintenance and energy expenses, and the cost of chemical additives. Centrifuges are the largest expense due to their high initial capital cost and high maintenance costs; however, their operating flexibility and other aspects may make them the best overall choice in many situations.

The massive Passaic River cleanup plan recently announced by EPA has refocused attention on sediment removal and dewatering techniques. Many types of proven dewatering techniques are available, but the overall objectives of a given sediment dewatering project and other variables must be considered before making equipment selections. iWWD

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