Is Geotube® Technology a Good Fit for Residuals Management at your Facility?

Brian J. Mastin PhD, Gregg E. Lebster, Glenn M. Lundin, and Vicki S. Ginter

The Problem

Municipalities across the Midwest typically operate at greater than 80% capacity and run out of biosolids and back-filter (lime and alum) residual storage capacity when land application contractors (if applicable), drying beds, and storage lagoons are unable to keep up with volume demands. Land application may not be economically or operationally available, an operations timeline for solids removal prompts onsite dewatering, and residuals may be contaminated with metals (e.g., Cu, Fe, Hg, Mo, Ni, Pb, Zn, etc.), oil and grease (O&G), nutrients, pathogens, or pesticides. Several mechanical dewatering options (e.g., belt filter press, centrifuge, etc.) are available as short-term or long-term remedies for onsite dewatering but are capital intensive for municipalities and contractors that already operate on competitive budgets. The objective of this study was to evaluate Geotube® containers as a residuals dewatering option for a municipal wastewater treatment facility (WWTP) and a water filtration plant (WTP) including cost effectiveness, ease of operation, solids retention, handling time, flow and volume rates, and seasonality.

Geotube® container sizing

The WWTP produces approximately 500,000 gallons (2,475 yd^3) of biosolids contaminated with molybdenum per year at 5-6 percent dry weight solids. It was calculated that 130 linear feet (lf) of 60' circumference Geotube® container would be needed to dewater and contain this annual volume to 20 percent solids, sufficiently dry to pass a paint filter test and haul off site to an appropriate landfill. The resulting volume and mass of residuals at 20 percent solids would be 562 yd^3 and 472 tons, respectively.

The WTP produces approximately 1.19 million gallons (5,874 yd^3) of back-filter residual per year at 1.0 percent dry weight solids. It was calculated that 96 lf of 45' circumference Geotube® container would be needed to dewater and contain this annual volume to 20 percent solids, sufficiently dry to pass a paint filter test and haul off site to an appropriate landfill. The resulting volume and mass of residuals at 20 percent solids would be 345 yd^3 and 248 tons, respectively.

Chemical Conditioning

WaterSolve performed bench-top dewatering trials for biosolids and back-filter residual samples (two-gallons) collected from the WWTP's liquids storage tank and WTP's equalization basin, respectively. Dewatering polymers were evaluated based on water release rate, water clarity, and flocculent appearance. In addition, dosing rate(s) were determined during these bench-top dewatering experiments and recommendations provided to the facilities during this phase of the program. Polymer was added to a sludge sample (150 mL) with a 10-mL plastic syringe and moderately tumbled five to ten times. We recommended using Solve 214 D at a dose rate of 300 ppm (2.4 lb/wet ton) for dewatering the WWTP's biosolids and Solve 152 at a dose rate of 100 ppm (0.13 lb/wet ton) for dewatering the WTP's back-filter residuals.

Bench-scale Evaluation

Water release rates during pumping to a Geotube® container were evaluated by adding 150-mL flocculated residual samples to a filter apparatus with a GT500 Geotube® filter. Water release rate and volume were measured with a 500-mL graduated cylinder over 12 hours. Remaining solids were collected and measured for percent dry solids by U.S. EPA Method 160.3.

The Solution

Geotube® containers, with the aid of dewatering polymers, were recommended to and implemented by a water filtration plant and a wastewater treatment facility into which solids were pumped directly from an equalization basin and above ground storage tank, respectively. After inline flocculation, the permeable textile that forms the Geotube® container allows efficient dewatering while containing the fine grain solids and the filtrate water returns to the head-works of the facility. Overall, this dewatering methodology greatly reduced the volume and mass of residual solids and costs associated with hauling and disposal while allowing continual operation of the facilities. For containment and dewatering of biosolids and back-filter residual, Geotube® dewatering (including polymer and feed equipment) cost less than $0.03/gallon, required minimal technical assistance to install and operate, retained greater than 95 percent solids, solids dried sufficiently for hauling and disposal (18 to 40 percent cake solids), and did not interfere with plant operations. Compared to the previous management techniques (i.e., belt filter press or hauling to a landfill), these Geotube® projects saved both facilities nearly $25,000 after the first year of operations.