After a plant evaluation, Farmville officials agreed the facility's sludge management scheme needed an update.

Greener Pastures

By Christopher L. Komline

In the late 1990s, Farmville, N.C., upgraded its wastewater treatment plant by converting to a single-stage biological nutrient removal process. There was a proposal at that time to install a sludge management system consisting of sludge dewatering and lime stabilization with disposal on permitted farmland. But because of cost and the town's concerns about the technology, the sludge stabilization system was not pursued. Farmville's Class B liquid sludge was land applied on permitted fields to meet U.S. Environmental Protection Agency (EPA) disposal standards.

All-American city turns to effective biosolids management

ARTICLE SUMMARY

Challenge: The existing sludge system in Farmville, N.C., did not function correctly because of poor mixing and aeration of sludge.

Solution: The city installed a biosolids drying system designed to dry 10 wet tons per day of wet cake at 18% dry solids.

Conclusion: The Komline-Sanderson biosolids system makes sludge disposal easy and green.

When the plant was constructed in the late 1970s, approximately 60% of its influent was from industrial sources. The treatment process was a two-stage activated sludge system consisting of a bar screen and grit removal followed by aeration basins, then rectangular secondary clarifiers and chlorination facilities. Aerobic digesters were provided to biologically stabilize the waste sludge.

Future Regulations & Efficiency Goals

In 2002, with an eye on future regulations and a better overall and more efficient operation, Farmville Town Manager Richard Hicks asked Morris Brookhart, a consulting engineer, to conduct a complete plant evaluation, including a possible upgrade to incorporate dewatering and drying to achieve Class A biosolids. Some additional minor fixes were needed, such as modifying the existing secondary clarifiers and replacing the influent screening equipment. The most pressing need, however, was to reinvestigate Farmville's sludge management scheme.

The system at that time involved collecting sludge in the two existing aerobic digesters, which had never functioned correctly because the floating aerators were not capable of mixing and aerating the waste sludge. Therefore, the operators would thicken the waste sludge by allowing it to settle and decanting the supernatant until the remaining sludge was at 2% to 3% solids. A contractor would then come to the plant and stabilize the sludge with lime until it met Class B requirements for land application.

Everyone involved was earnestly seeking an alternative to lime stabilization. Because several other dewatering projects were underway in North Carolina at that time, it was appealing to follow their lead and reduce the amount of sludge for disposal.

Funding Challenges

Funding is always an issue, and several sources came together at the appropriate time. The Clean Water Management Trust Fund in North Carolina indicated interest in making a grant to Farmville for a sludge drying project, the State Revolving Fund made a long-term loan and there was an EPA grant for a small portion of the cost of the upgrades.

Farmville is a member of an electric cooperative and could obtain electric power at the bulk wholesale rate during off-peak time. Most importantly, a cost analysis indicated that drying to Class A biosolids using off-peak electricity would be cheaper in the long run than hauling liquid sludge to the permitted farms.

Technology Solution

Komline-Sanderson (K-S) was able to custom-design its system to fit the existing building, going so far as to have the thermal fluid heater redesigned to fit into a very small space. The major components of the biosolids drying system fit into an area 42 ft long by 18 ft wide. including walkways and clearance for maintenance. The K-S system is designed to dry 10 wet tons per day of wet cake at 18% dry solids.

The Kompress belt filter press, model G-GRSL-1, was chosen as the preferred dewatering method. This three-belt design has an independent gravity zone that allows the operators to adapt to changes in the incoming feed solids by varying the speed of the gravity belt without changing the speed of the pressure belts. Farmville normally feeds the belt press at 1% to 2% solids, but there are times, such as when recently cleaning out the digesters, when the solids rose to more than 3%. The discharged dewatered cake ranges from 18% to 22% dry solids.

The redesigned plant has a design and permitted flow of 3.5 million gal per day (mgd). Flow at the time of commissioning was between 2 and 2.4 mgd. Then a large industrial factory closed, which decreased the wastewater plant influent by almost 1 mgd.

The biosolids drying system is comprised of several components working together. A live bottom bin is mounted directly beneath the belt filter press. The

A biosolids drying system was retrofitted into the existing space in Farmville.

Due to off-peak electricity restrictions, operating personnel are required to adjust what time of day they run the dryer based on the time of year.

The new system was up and running in September 2007 and now produces Class A biosolids.

augers in the live bottom bin ensure that the dewatered cake is fed consistently into the variable-speed progressive cavity pump affixed to the bottom of the bin.

The K-S Paddle Dryer is indirectly heated, meaning that the product comes into contact with a heated metal surface and not the heating medium itself. Once the biosolids are dried, they must be cooled to less than 120°F for safe handling. This is accomplished at Farmville with an inclined screw conveyor with a jacketed trough cooled with plant effluent. After cooling, the dry product is conveyed to a waiting farm vehicle.

Because Farmville had an inexpensive source of electricity, an electrically heated thermal fluid system was chosen as the heat source. An additional consideration is the high efficiency of an electric thermal fluid heater. Hot thermal fluid is pumped to the dryer, where it heats the metal surfaces and then returns to the heater. This heater is controlled by monitoring the temperature in the dryer. To maintain a consistent dry product, the thermal fluid heater output must be varied in response to changes in the feed solids content.

The water that is evaporated turns to vapor in the dryer and must be removed and treated. This off-gas usually contains odiferous compounds. Therefore, after passing through a spray condenser, the condensed liquid is pumped back to the headworks and the noncondensable gas is compressed and sent to a coarse bubble diffuser located at the bottom of the aeration basin, 700 ft away. The gas is scrubbed by passing through several feet of mixed liquor.

Due to the reduction in influent volume after the project began, Farmville operates the belt filter press and biosolids drying system one or two days per week, depending on flow. During the summer months, Farmville may only run the system once per month. Due to off-peak electricity restrictions, operating personnel are required to adjust what time of day they run the dryer based on the time of year.

The K-S Kompress and biosolids drying system were installed in the spring of 2007 and accepted in September of that year. According to James Shoulders, plant superintendent for United Water, the systems make it easier to dispose of sludge. Ever since, the farmer who takes the Class A biosolids—with startup testing of 7% nitrogen—is making crops of hay, corn and soybeans green with what used to be brown. WWD

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