

McLanahan Sand Separation System used to Pre-Treat Manure before Anaerobic Digestion at Penn State



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Travis Edwards
Penn State

Penn State is one of the leading universities for dairy nutrition related research in the United States. The dairy complex, located at Penn State University Park in State College, Pa., is home to 365 milking cows and 345 heifers.

The dairy serves three main purposes: to provide a place for the faculty to conduct their research, to give the students enrolled in the animal science program hands-on experience working with the cows, and to increase education and outreach by functioning as a typical dairy farm. They ship their milk to a cooperative and receive the same price as commercial dairy farms.

Challenge

The dairy fills its freestalls with sand bedding because sand is inorganic, doesn't promote the growth of bacteria and provides a cool, comfortable resting place for the cows. However, because sand is abrasive, sand-laden manure can cause wear and tear on manure handling equipment.

At the Penn State Dairy Barns, the sand-laden manure also presented another problem.

“Farm operations have a lot of acres near the airport,” Dairy Unit Co-Manager Travis Edwards explained. “Cow manure tends to have a lot of grain in it, so when they'd spread that grain at the airport, it would attract birds. Birds in the airport are a no-no, so they were limited with where they could apply manure.”

The solution to this problem was to install an anaerobic digester, which would remove most of the grain from the manure before land application, but anaerobic digestion systems used on sand-bedded dairies are susceptible to sand settling. The settled sand would build up inside the digester, requiring the time-consuming task of emptying and cleaning it out. The dairy wanted to limit the number of times it would have to do this but still wanted to use sand bedding.

Solution

The dairy considered installing a sand separation system so that it could process its manure through the anaerobic digester and recycle sand for reuse in the freestalls.



"We were very adamant that we did not want to stop using sand for bedding," explained Nadine Houck, Co-Manager of the Penn State Dairy Barns. "We felt that it was very important to the herd, so we started looking at options for sand separation systems."

The dairy installed a McLanahan Closed-Loop Sand Separation System consisting of an Inclined Manure Auger, Sand-Manure Separator, Agricultural Hydrocyclone, Agricultural Sand Dewatering Screen, Rotary Drum Separator, Sump and Pump.

The system allows the dairy to separate as much sand from the manure as possible ahead of the digester, while providing a clean, recycled sand that can be put back under the freestalls within days. The closed-loop aspect of the system allows it to generate its own process water for use in the sand separation process.

Results

The McLanahan Closed-Loop Sand Separation System has allowed the dairy to make use of anaerobic digestion and still use sand bedding.

"We needed to get the sand out of the manure and then we could send that manure to the digester," explained Edwards. "It allowed us to keep using sand as bedding, which is very, very important to us from a cow health standpoint and a milk quality standpoint."

In addition to cow health and milk quality, the recycled sand has provided the dairy with an added economic benefit of reducing the amount of sand needed from two triaxle loads of sand a week to approximately two per month.

Penn State students can see how sand separation may be used on farms all over the world to provide a clean, dry recycled sand bedding, as well as how the system can be used as anaerobic digestion pre-treatment. Having exposure to different systems can broaden the students' educational experience in dairy management. It helps to teach them sustainable best practices that can be utilized on any size dairy for improving cow health and milk quality as well as reducing environmental impact.

