

MANURE

Manager

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**KREIDER FARMS
harnessing nutrients**



Kreider Farms, located in Manheim, Penn., used to be owned by William Penn in the 1700s and later was purchased by the Hershey Family – better known for chocolate than for farming. Contributed photo



Harnessing nutrients in PENNSYLVANIA

By Diane Mettler

Bion's new Environmental Management System at Kreider Farms could remove up to 80 percent of the nutrients from the livestock waste effluent, reduce air emissions and save taxpayers money.

Kreider Farms, located in Manheim, Penn., has been unique from its inception. In the 1700s, the farm was owned by William Penn, and later was purchased by the Hershey Family (better known for chocolate than for farming).

In 1935, Noah Kreider married Mary Hershey and their two young sons, Richard and Noah Jr., moved onto the small farm with a dozen dairy cows and 200 chickens. Through hard work, the farm grew to what it is today with Noah Jr.'s son, Ron, leading a staff of 225 and the farm milking 1,400 cows plus handling more than five million laying hens. Kreider Farms is also known for being one of the most environmentally progressive farms in the state.

Bion Environmental Technologies, Inc. is also unique. It's developed a new technology that can eliminate up to 90 percent of the air and water pollution associated with livestock waste while

simultaneously recovering high levels of renewable energy from the waste biomass.

Bion wanted to test the system and demonstrate that large-scale agriculture could be sustainable. Kreider Farms seemed like the ideal candidate. The farm was forward thinking, had won numerous environmental awards and was located in an environmentally sensitive area – the Chesapeake Bay watershed.

"Bion was looking to partner with a farm and we wanted a host that was competent, where a handshake meant something, and they weren't going to cut corners," says Jeremy Rowland, CEO for Bion. "Ron Kreider is a businessman, a forward thinker and an amazing operator."

Bion presented its plan to Kreider in 2009 and Ron Kreider jumped on board.

"Through the years we have had different presentations, especially from European countries, but none of them made as much sense as Bion's program because it has value base – it can reduce nutrient loads, and at a lesser cost," says Tom Beachler, vice-president of operations.

Construction began in November 2010, and the technology, although new, turned out to be fairly straightforward. Manure must be collected frequently, which is no problem at Kreider Farms because they scrape every hour or so.

"This step is important from an environmental standpoint," says Rowland. "There is a lot of reactive nitrogen in manure, and the quicker we can get it into our bioreactor where it changes form, the less ammonia loss there is. Besides the environmental benefit, there is also

more nitrogen available for use on crops."

The waste flows to a collection pit – which was also already located on the farm – and is mixed and prepared for treatment. It then moves on to an enormous FKC screw press – roughly 30 feet long. The cellulose is separated out and taken by conveyor to a loading bay, where it is used for bedding and could also be used for biofuel in the future. The separated liquid makes its way to the bioreactor.

The bioreactor is a converted 1.2-million-gallon manure storage tank, which was part of Kreider's existing manure management system.

"We added micro-aeration. It's different from traditional farm aeration systems, and promotes the type of biological growth we want," says Rowland.

Bion is calling its patented process a micro-aerobic digestion system (MADS).

"There are two main things that happen inside that bioreactor – first nitrification and de-nitrification," Rowland explains. "Some portion of the nitrogen goes off to the atmosphere as odorless N₂ gases, which is an atmospheric gas, so it's not a pollutant. And second, there is a nutrient uptake process. The microbes within the reactor take up and process the nutrient, so the nutrient goes from a soluble form, to a particulate form."

In short, the microbes in the bioreactor are starved for oxygen and as they grab up oxygen, they also grab up the nitrogen and other elements as well, creating a supercharged liquid.

"It's the microbial uptake process that is the basis of our nitrogen credits, which is

One of the benefits of the Bion technology is that it has a data and equipment automation system and Kreider's staff can run the machinery themselves. The data control system also enables Bion to monitor the system remotely. Contributed photo

our revenue stream," says Rowland.

After being in the bioreactor for 40 to 45 days, the supercharged liquid moves on to centrifuges.

"We can isolate 80 percent of the farm's nutrients within about 20 percent of the flow," says Rowland.

In the end, Kreider Farms has more control of the nitrogen content from the start, creating high-potency liquids and solids for fertilization, saving them the cost of commercial nitrogen fertilizer and reducing the flow of nutrients making their way to Chesapeake Bay.

Although the technology may be high tech in many respects, one of its attributes is that it has a data and equipment automation system, and Kreider's staff can run the machinery themselves.

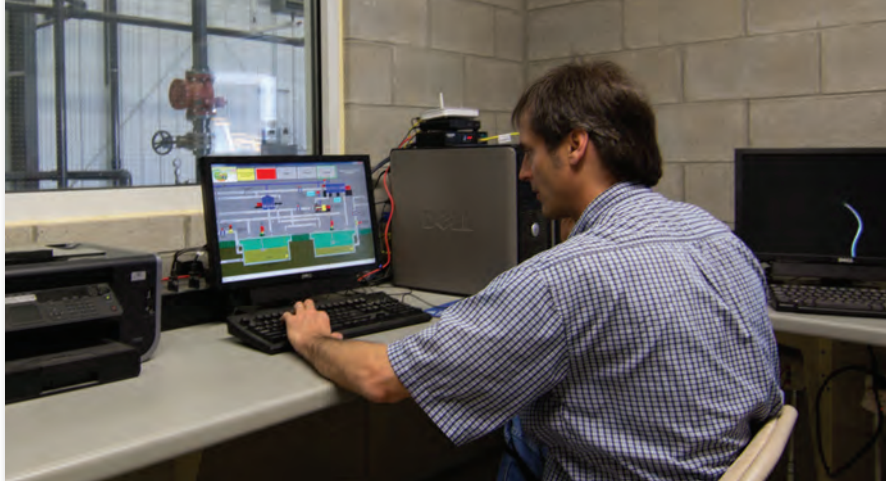
"We have an excellent dairy team here," says Beachler. "Our dairy management, as well as several of our technical guys, make it happen on a day-to-day basis. They've been involved since Day 1 and understand the system well."

The data control system also enables Bion to monitor the system remotely.

Although this project cost \$7.5 million and represents \$25 million in research and development, it's only Phase 1. Once the end product from Kreider's 1,200 (of 1,400) milk cows is tested and the EPA is satisfied, Bion and Kreider will move on to Phase 2, which includes using the manure from the farm's remaining animals, including the five million chickens.

"The machinery is already in place to handle everything," says Beachler. "When we're using all the manure, we will be creating enough biomass to power approximately 2,700 homes."

Rowland is looking forward to moving ahead. "I think once we show how you can



Today the farm has grown to a staff of 225 milking 1,400 cows plus handling more than five million laying hens. Kreider Farms is also known for being one of the most environmentally progressive farms in the state. Contributed photo

cost effectively reduce the flow of nitrogen into the Chesapeake Bay, without effective government subsidies or government payments, there will be a lot of interest."

The project was funded by a PENNVEST (Pennsylvania Infrastructure Investment Authority) loan Bion intends to pay back through credits sold to municipalities. Currently, municipal waste treatment plants need to make costly investments to improve effluent technology, which costs taxpayers money. With the nutrient credit system, municipal treatment plants could choose between \$40 million in new technology and spending \$10 million on credits to meet the same environmental standards.

"Ideally, it would be what is cheapest for the rate payer and best for the

environment," says Rowland. "It will be interesting to see if it works. I think that opens up a lot of opportunities for other technology companies."

For Kreider Farms, the benefits are turning out to be substantial too. Although they do need to hire a couple more individuals to monitor the new system, they are getting bedding from the separated solids, reducing the amount of commercial nitrogen fertilizer they purchase, and labeling themselves as a partner in sustainable farming.

Construction was completed this July and Kreider Farms felt it went smoothly considering it required building structures, installing new technology and rerouting manure flow. Beachler says credit goes to the excellent dairy team at Kreider Farms.

Composting

Some of the separated solids will be used in Kreider Farms' composting operation. The company sells a bagged product of manure — with a little chicken litter thrown in. It's becoming popular with customers and saw a 400 percent increase in sales this year.

"We compost year round," explains Tom Beachler, vice-president of operations at Kreider Farms. "We have bays with forced air into the pile. We turn it weekly and can compost in about three weeks, depending on weather.

What Kreider's is excited about is that the customers are seeing the connection between their dairy products and compost.

"Some stores that sell our milk and ice cream now have our bags of Kreider Cow Compost soil amendment," says Beachler. "That's real sustainability when the consumers buy a half-gallon of ice cream and also feel good about playing a part in environmental responsibility. It's really been a win-win for the retail stores that have been involved with that."

"They are an amazing group of people.

"There are always challenges along the way, like clearing the first-stage lagoon and refiguring the manure distribution," says Beachler. "But the whole process was well managed. Bion had the resources, and they even used some of the builders and electricians we've used in the past, which made it work very well."

One of the biggest accomplishments, says Beachler, wasn't the technology but Bion's ability to bring different entities together and work together.

"They brought industry, DEP, Chesapeake Bay and the EPA together for a common good and got them to move forward on something. That's no small feat. People want solutions; however, it seems they don't always agree. They can't move forward. This is "moving forward" and we're very happy to be part of it."

Now that it's complete, people can come see technology in action. Kreider Farms has been doing farm tours for more than a dozen years, and gets up to 20,000 people a year from the surrounding urban areas.

There has been a lot of interest from other farms in this kind of program. Rowland says future Bion systems may look a bit different from farm to farm. For example, Kreider's barns use misters, adding more

water to the treatment systems. Other farmers use different bedding — all factors that would have to be accounted for.

In the meantime, Kreider Farms and Bion are enjoying the support of the Pennsylvania Farm Bureau and organizations in this bold step forward. "It's voluntary and it's taking advantage of market principles to get investments on the farm."

As the trials continue, Bion and Kreider Farms are making all the information public. You can check on the progress by logging on to Bion's website — www.bionpa.com.

"A lot of people don't realize how much nitrogen is lost via ammonia volatilization," says Rowland. "At Kreider Farms, about half the nitrogen from the cows was lost via ammonia before land application. Ammonia loss is not regulated under the Clean Air Act so it's just not a fact or figure you see in the public. The project at Kreider Farms is going to shine a light on the significance of that nitrogen loss."

Bion's goal for the future is to help find answers towards treating the waste from large-scale livestock agriculture.

"Environmental groups are obviously up in arms saying there are too many animals here and you're polluting the

groundwater. We're showing how large-scale livestock agriculture can be sustainable, environmentally and economically." **MM**

Want to learn more about Kreider Farms? Check out these videos, available online, which outline some of the management processes and accomplishments of the operation.

Grand opening

http://www.youtube.com/watch?v=_Qex-_gjSx0&feature=relmfu

Tour of the farm by tram

<http://www.youtube.com/watch?v=91K8Zfc1g0M&feature=related>

About Kreider Farms, the operation's eggs and awards

http://www.youtube.com/watch?v=_Qex-_gjSx0&feature=relmfu

A 360-degree panoramic view of the farm

<http://www.youtube.com/watch?v=VJN-nGS7mBE&feature=relmfu>

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