New PNNL-developed technology treats dairy wastes, odors

A technology developed by Battelle and brought to the Northwest by researchers at the Department of Energy's Pacific Northwest National Laboratory is transforming a waste lagoon into a waste treatment facility at an Outlook dairy in Yakima County.

The InStreem technology, shown here at a Washington state dairy, cleans waste lagoons by enhancing naturally occurring biological activity.

Siince January, the George DeRuyter Dairy has been outfitted with InStreem, a technology that enhances naturally occurring biological activity to clean waste lagoons. Henry Pate of Battelle's Florida Marine Research Laboratory developed InStreem. Battelle also operates PNNL for DOE.

Lagoons traditionally have been used to store manure and liquid effluents from dairy herds. In the spring, wastes stored over the winter months are pumped onto fields where crops use the manure's nutrients. However, more nutrients such as nitrogen and phosphorous may be applied to crops than can be used effectively.

"InStreem is designed to use a dairy's existing infrastructure to convert lagoons from waste storage facilities to facilities that solve waste problems," said John Jaksch, PNNL program manager for the project in the Pacific Northwest. "In doing so, this technology addresses one of the dairy industry's most pressing issues."

Unlike conventional treatment methods, InStreem converts existing lagoons into extended aeration systems, establishing conditions favorable for both aerobic and anaerobic degradation of wastes. The aerobic process is designed to remove excess nitrogen and the anaerobic process is designed to remove other nutrient constituents, such as phosphorous. InStreem maintains an oxygen-deficit condition in the lagoon and does not over-aerate, while still allowing nutrient reduction to take place and bacteria to work on reducing the manure sediments. One InStreem unit treats a lagoon 1 to 1.5 acres in size.

To date, the demonstration is exceeding Jaksch's expectations. "In three months, the depth of solids dropped from 6 feet to 6 inches, and that was during the coldest part of the year," Jaksch said. "And since InStreem uses a small 5-horsepower engine to circulate the entire lagoon, it's energy-efficient."

In addition, InStreem has been successful tackling a problem common to all dairies — odor. "Within two weeks of operation we noticed a huge reduction in odor," said DeRuyter, owner of the dairy. "Odors on the lagoon banks now are barely detectable."

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Equipped with 10, 48-inch aeration discs powered by the 5-horsepower motor, the floating InStreem unit displaces water in adjustable horizontal and vertical planes around a barrier dividing the lagoon. In dairy applications, the technology replicates fixed-site municipal wastewater biological treatment technologies used at more than 400 community waste treatment plants across the United States and Canada.

The DeRuyter dairy is a large operation with about 2,600 head of cattle. DeRuyter uses a flush system in which the feed and loafing areas are flushed hourly with water. Manure is carried by water through a solids separator. The solids are turned into compost and the wastewater, laden with suspended manure solids, is returned to the lagoon where it is recycled back into the flush system after processing.

The DeRuyter demonstration will run for one year. Soil Search of Finley is assessing the demonstration by monitoring the site for nitrates, nitrites, ammonia, total phosphates, sulfates, chloride, biological oxygen demand, chemical oxygen demand, total and dissolved solids and fecal coliform bacteria. Soil Search provides nutrient management and precision farming services for the dairy industry in the Pacific Northwest.

“We chose DeRuyter’s because it enabled us to demonstrate the technology under difficult conditions,” said Jaksch. “Also, through an existing relationship with DeRuyter, Soil Search has more than four years of sampling data on the lagoon, providing invaluable background data for measuring InStreem’s performance.”

Soil Search has obtained the rights to sell InStreem in Washington, Oregon, California, Idaho, and in North and South Carolina, and began selling the units in eastern Washington this summer.

“Based on results to date — reduction in odors and bottom sediments — I didn’t see any reason to hold back,” said Larry Dickinson, chief executive officer and founder of Soil Search. “The industry is under tremendous pressure to control odors and InStreem repeatedly has demonstrated its effectiveness in doing so.”

Jaksch echoed Dickinson’s optimistic assessment based on early results, but cautions that this is a one-year scientific experiment. “We want to gather data for the entire seasonal life cycle, benchmark it against existing waste lagoon management practices and other alternative approaches and technologies, then nail down the technical and economic story for the dairy industry,” Jaksch said.

The Choctaw Manufacturing and Development Corp. in Hugo, Okla., manufactures the units, while Tierra Environmental Services, a New Mexico firm, is the national distributor. Originally, InStreem was tested at a hog farm and a polluted bay in North Carolina. ❖