

Dairy Waste Management Project Goals

This project is designed as a demonstration which will serve as both a learning tool as well as an educational tool. The project partners expect to gain insight in areas such as:

- optimum parameters for anaerobic digestion
- solids separation
- water recirculation and reuse
- economic viability of anaerobic digestion
- biological phosphorus removal capabilities, and
- how various agencies can pool resources in an efficient and effective manner.



The project will serve as a means of transferring technology and education through meetings, presentations, and on-site tours.

Funding Partners:



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ANAEROBIC DIGESTION

Dairy Waste Management/ Phosphorus Reduction Demonstration Project

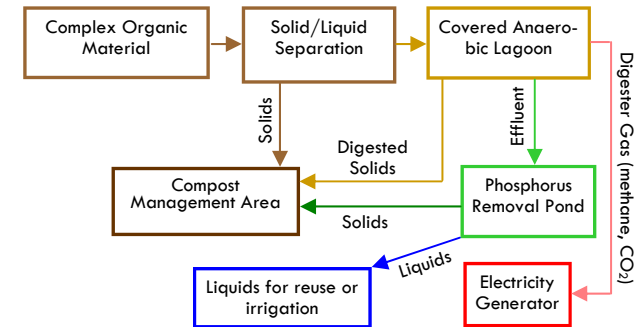
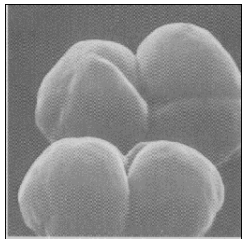


Diagram of proposed dairy waste management demonstration. The process will target an 80 percent reduction of phosphorus in the waste stream and produce methane gas that will be used to power an electricity generator.

The Anaerobic Digestion Process

Anaerobic digestion (AD) reduces odors and greenhouse gas emissions by capturing gases generated by the biological decay of organic material found in animal waste. AD alone does not reduce the nutrient content or the volume of solids that entered the system; however, the resulting digested solids are low in odor and pathogens and are biologically stable when stored under normal



Methane-Forming Bacteria

conditions. AD is a three step process that involves: 1) liquefying bacteria that transform complex organic matter into liquefied soluble organic compounds, followed by, 2) acid-forming bacteria that use these compounds as an energy source and leave a simple organic acid by-product, and 3) methane-forming bacteria that break down the acids into a biogas made up primarily of methane and carbon dioxide with traces of ammonia and hydrogen sulfide.

Use of Anaerobic Digestion in the North Bosque Watershed

A project currently underway in Hamilton County titled Dairy Waste Management-Phosphorus Demonstration Project utilizes anaerobic digestion as part of a multi-step process that ultimately will target an 80 percent reduction of phosphorus in the waste stream. As stated earlier, AD will not significantly reduce the nutrient content of the digester effluent. Therefore, an additional process called biological phosphorus removal is planned.

The anaerobic digester will consist of a sloped, lined, and covered lagoon. Incoming waste will pass through a solids separator before entering the digester. Biogas captured from the digester will be sent to an electricity generator. Through a cooperative agreement with the local electrical provider, the electricity generated on-site will be fed into the local grid and the equivalent amount will be credited to the dairy producer's account, effectively providing retail price for the electricity.

After digestion, the wastewater stream will then be fed to the biological phosphorus removal process where water will circulate between anoxic, anaerobic and aerobic zones to achieve bioaccumulation of phosphorus. The processed liquid will then be reused within the dairy operation or land applied in accordance with the producer's comprehensive nutrient management plan.

Solids from the separator, anaerobic lagoon, and phosphorus removal pond will be moved to a compost management area or hauled off-site to a local compost facility.

The project is funded by a number of agencies/entities that includes: the Environmental Protection Agency, Texas Farm Bureau, Texas Commission on Environmental Quality, Natural Resources Conservation Service, Texas State Soil and Water Conservation Board, US Department of Energy, Brazos River Authority, Altria, and United Cooperative Services.

Cascade Earth Sciences designed the facility. The Texas Institute for Applied Environmental Research will per-

form process monitoring, edge-of-field runoff monitoring, as well as providing on-site technical and coordination assistance as required. The Brazos River Authority is providing overall project management. TSSWCB has certified the comprehensive nutrient management plan for the dairy operation.

At present, the design has been completed, a construction contractor has been selected, and construction should begin in June, 2004.

Brief History of Anaerobic Digestion

In 1808, Sir Humphry Davy determined that methane is present in gases produced during the anaerobic digestion of cattle manure. Fifty-one years later, the first digestion plant for handling wastes was constructed in Bombay, India. By 1895, a sewage treatment plant was recovering biogas that was used to fuel street lamps in Exeter, England. It was not until the 1930's, however, that anaerobic bacteria and conditions that promote methane production were identified by scientists. This improved level of understanding, coupled with a need for new fuel sources, led to burgeoning interest in anaerobic digestion in Europe following World War II. Anaerobic digestion is well-suited to process manure associated with animal production, and, today, there are more than 600 farm-based digesters in Europe with more than 250 built in Germany in the last five years. In the United States, farm-based anaerobic digestion was first used on a swine farm in Mt. Pleasant, Iowa in the early 1970's. Most of the early digesters in the US were plagued by design problems and interest had waned by the late 1970's. There was a renewed interest in the process in the early 1980's, aided by government incentives and improved technology. Today, anaerobic digestion is being successfully applied on farms across the country and improvements continue to make the technology more efficient and, consequently, more economically viable.