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WHERE CHEMISTRY MAKES ALL THE DIFFERENCE

Case Study - COOLPRO® RPP biogas generator cover



Owners of the Matlink Dairy in western New York state are turning the wastes from 500 Holstein cows into electricity using a biogas generator.

The dairy, one of the largest in the area, had previously disposed of the animal wastes in a large, unlined lagoon. The partially-dried residue was then applied to the fields as fertilizer. However, odors were a recurring nuisance for residents of the downwind village of Clymer. Field application was restricted to the winter months in an attempt to reduce the odor complaints, but snow melt and rain runoff from the fields caused pollution concerns for the receiving streams.

The system

The project engineers devised a complete mix digester system, which uses gravity to convey bovine waste and dairy wash-down water to a drop gutter system and into a 20,000 gal. below grade concrete mixing tank. There, it is heated and mixed with small amounts of food waste material from local sources, which are held in a second adjacent tank.

After mixing, the resulting slurry is pumped into two adjoining, below-grade, concrete digestion chambers, each with an approximate 300,000 gal. capacity. The 80ft. (24m) long chambers are separated by a central concrete beam.

The covers

The digestion chambers are each covered by COOLPRO® 45 mil, scrim reinforced

geomembranes. The membranes are manufactured in an extrusion process that combines the woven fiber scrim with a reactor modified polypropylene resin. Polypropylene is preferred for this application because of its resistance to both ultraviolet radiation and the aggressive chemicals in the wastes and resulting gas. It can withstand the extremes of summer heat and winter freezes as well as the high temperatures caused by the anaerobic digestion. With a specific gravity of 0.9, polypropylene's light weight allows larger panels and fewer seams, a plus for a gas-containing application.

Using 78in. wide material, the project fabricator joined 12 panels to make each of the two covers for the digestion chambers, for a total of 24 panels. Panels were hot-wedge welded, with seams reinforced to ensure seam integrity and a gas-tight seal. Covers were fabricated with the light side out and dark side in, to avoid excessive summer heat absorption that could kill the anaerobic bacteria.

In order to maintain a gas-tight system, the polypropylene covers were attached to the concrete walls of the digestion chambers with a unique proprietary system that holds the cover edges securely against the gas pressure, normally measuring five inches of water column/0.18 psi, which causes the covers to inflate to a height several feet above the chambers. During a system upset at startup, gas pressure built up in the mixing chambers to such a degree that a buried pipeline leading from the digestion chambers to the generator literally ripped itself out of the ground. Yet, the

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covers, with a minimum breaking strength of 300 x 250lbs. (i.e., warp and fill directions), remained intact.

Starting the system

Samples of material were taken from the pre-existing waste lagoon and heated to 100°F. This process produced enough anaerobic bacteria to seed the newly built system and start the digestion process. The decomposing waste mixture produces methane gas.

The Matlink project is the only digester in the United States that incorporates food-based waste material, including whey from a local ice cream maker and waste from the production of grape juice. The inclusion of the food matter has more than tripled the amount of methane produced by manure alone.

Harvesting methane and by-products

The generated biogas, containing 60% methane, 40% carbon dioxide and a trace of hydrogen sulfide, is piped uphill from the digesters to the generator building. The gas is first compressed, then metered into a 1,905in.³ Waukesha electrical generator, originally designed to burn natural gas. The generator produces between 130 and 145 kW of electrical power, nearly twice what the farm requires for its own electrical needs. According to the dairy managers, the digester system is producing 25% more gas than originally anticipated. Excess gas has to be flared.

The generator provides enough heat to meet all of the facility's hot water needs, including washing and sanitizing of the milking parlor several times a day and heating the calf barn. Excess heat is also used to keep the mixing tanks and the digester at the proper temperature and to dry the food material prior to its introduction into the tank. Retention time in the digesters ranges from two to three weeks, long enough to allow the bacteria to utilize the majority of the available energy. Decomposed waste is continually pumped out of the digesters, separated with a screw press and dried (using heat from the generator) and stock piled in an adjacent building. A portion of the dry crumbly, now odor-free solid residue is used as bedding material for the cows, and plans are in process for bagging and selling the remainder as soil amendment. The digested liquid, also odor-free, is piped to a lagoon.



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