Ekokan Up-flow Biofilter

This project is located on Murphy-Brown Farm 93 near Bladenboro, North Carolina. The farm is a 16,000 head finishing facility. The Ekokan LLC process is designed to treat waste from 4,000 of the 16,000 animals at this farm. Alexandria Kantardjieff, president of Ekokan, is the technology provider.

The Ekokan LLC waste treatment system consists of solids/liquid separation and biofiltration of the liquid with upflow aerated biological filters. Five finishing barns (about 4,000 finishing pigs total) are connected to the waste treatment system, and the barn pits are emptied automatically in sequence. Wastewater from the barn pits is released to a solids separation unit. Coarse solids are separated from the wastewater using a screen separator (TR Separator). After the solids/liquid separation, the liquid is pumped to a 40,000-gallon equalization tank. Liquid flows from the equalization tank by gravity and passes through first-stage and second-stage aerated biofilters connected in series (two sets, or four biofilters in total). Plastic fixed media within the biofilters provides surface area for a biofilm of bacteria to perform biological degradation that reduces organics and odor and converts ammonia to nitrate nitrogen. Wastewater flows upward through the biofilters, and air is supplied at the bottom of each biofilter with blowers (two 60 hp blowers). The biofilter tanks are covered, and air and any excess foam from the aerated treatment are routed through PVC pipes to exit points over an anaerobic lagoon. Liquid flows through the two biofilters in less than 24 hours. The biofilters are backwashed periodically to remove excess biosolids. Treated effluent from the biofilters flows by gravity to a storage basin, with a portion of the treated effluent being recycled to the solids separation basin, from which it is pumped to the equalization tank. Water is pumped from the storage basin to the barns to refill the pits. Liquid recycled for flushing the barns should have lower ammonia content than typical anaerobic lagoon liquid normally used for flushing.

At this site, the anaerobic lagoon that receives manure from 10 barns was partitioned using plastic curtains into three sections, with one section much larger than the other two. The larger section receives manure from five barns not connected to the Ekokan treatment system. One of the smaller sections receives any overflow from the solids separation basin, the separated solids, and the backwashed biosolids that are removed from the biofilters. The other small section receives the treated effluent from the biofilters. Budget limitations resulted in partitioning of the anaerobic lagoon for storage of separated solids, backwashed biosolids and treated effluent. A proposed
alternative for handling the backwashed biosolids is to include another tank in the system for settling solids by gravity. Liquid from this settling tank could be recycled to the treatment system, while the biosolids could be applied to land or to a constructed drying bed in which reeds would be grown. The decanted liquid from the reed bed would be returned to the biofilter system. The separated solids from the liquid/solids separator could be land applied or composted. Because additional water is added in the barns from wells for pig drinking water and periodic cleaning and sanitizing of the barns between groups of pigs, there would likely be excess water that would need to be periodically irrigated to land.


**Technology Evaluation Team**

Philip W. Westerman  
Department of Biological and Agricultural Engineering  
North Carolina State University  
Raleigh, NC 27695-7625  
phone: (919) 515-6742  
e-mail: phil_westerman@ncsu.edu

Jactone Arogo Ogejo  
Department of Biological and Agricultural Engineering  
North Carolina State University  
Raleigh, NC 27695-7625  
phone: (919) 515-6806  
e-mail: jarogo@eos.ncsu.edu
Ekokan Up-flow Biofilter (continued)

Ekokan Material Flow Diagram

Regular Lagoon

Biosolids Reservoir

Polishing Reservoir

Treatment System Bypass

Barns

TR Separator

Lift Station

Equalization Tank

Primary Biofilter B1

Secondary Biofilter B2

Secondary Biofilter A2

Primary Biofilter A1

Treated Effluent

Recycled Flush Water

Overflow

Separated Solids

Biofilter Backwash

Air 1

Air 2