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# Innovation in Manure Management Technologies

## Status Report – NC Attorney General

## Agreements with Smithfield Foods, Premium Standard Farms, and Frontline Farmers

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# Agreements (3) Overview

- **Smithfield Foods - $15 million for development of "Environmentally Superior Technologies" (EST); $50 million for "environmental enhancement" activities**
- **Premium Standard Farms – $2.5 million ($2.3 for EST)**
- **Frontline Farmers - "..use its best efforts and influence to encourage its members to convert to economically feasible EST"**
- **NCSU responsible for Technology Determinations**
- **Install Environmentally Superior Technologies on each company owned farm in NC**

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## Environmentally Superior Technologies

- **"permittable by the appropriate governmental authority**
- **determined to be technically, operationally, and economically feasible for identified categories of farms**
- **meets the following performance standards…"**

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## Performance Standards

- **"Eliminate the discharge of animal waste to surface waters and groundwater through direct discharge, seepage, or runoff;**
- **Substantially eliminate atmospheric emissions of ammonia;**
- **Substantially eliminate the emission of odor that is detectable beyond the boundaries of the parcel of land on which the swine farm is located;**
- **Substantially eliminate the release of disease-transmitting vectors and airborne pathogens;**
- **Substantially eliminate nutrient and heavy metal contamination of soil and groundwater"**

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## Economic Feasibility Determination

- Projected 10 year annualized cost of the technology (including capital, operation and maintenance) per 1000 # steady state live weight for each category of farm system
- Compared to lagoon and spray-field system
- Projected revenues, including income from byproducts
- Available cost-share monies or other financial assistance from federal, state or other public sources
- Impact that the adoption of the technology may have on the competitiveness of the NC pork industry
- ID/quantification (if possible) of emissions to environmental media from each category of farm system implementing the technology as compared to lagoon and spray-field system
- Estimate of the economic benefits to NC households arising from the changes in emissions to environmental media resulting from implementation of the technology

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## General Overview of Progress October 2003

- 16 (+) candidate technologies
- 12 candidate EST operational (or concluded)
- 1 additional candidate EST scheduled to be operational by end of 2003 (construction in progress)
- Remaining candidate EST projected to be completed / operational in 2004 (design, permit and/or construction in progress for 2 of these)
- Performance data and economic analysis - work in progress for operational ESTs

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# LOCATION MAP

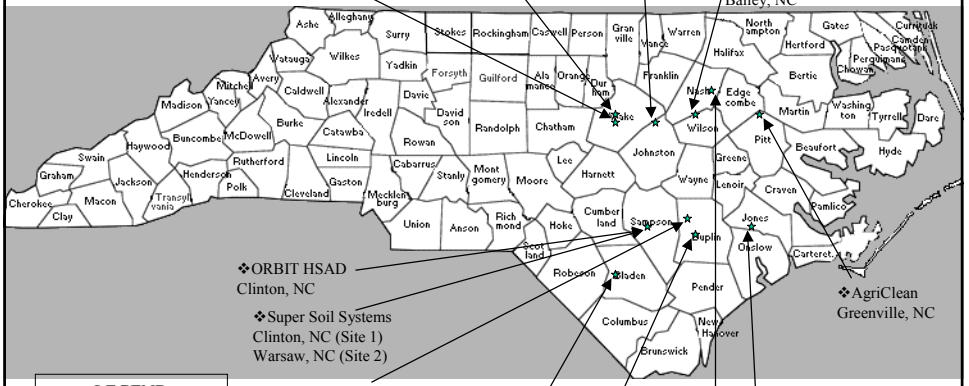
*Environmentally Superior Technology Demonstration Projects*

•Black Soldier Fly Larvae
•Belt Systems (2)
•Ultrasonic Plasma Resonator
•Desalinization System
NC State University
Lake Wheeler Road Field Laboratory

•Gasification / Belt System
NCSU Grinnells Labs

➢Ambient Digester
Clayton, NC

➢Sequencing Batch Reactor
Bailey, NC




❖ORBIT HSAD
Clinton, NC

❖Super Soil Systems
Clinton, NC (Site 1)
Warsaw, NC (Site 2)

❖ISSUES / IESS / Microturbine
Magnolia, NC (Site 1)
Kenansville, NC (Site 2)
Warsaw, NC (Site 3)

➢EKOKAN
Upflow-Biofilter
Bladenboro, NC

❖BEST / RECIP
Rose Hill, NC

➢Constructed Wetland
Richlands, NC

➢Thermophillic Anaerobic Digester
Rocky Mount, NC

❖AgriClean
Greenville, NC

LEGEND

- ★ Project Location
- ➢ First Round Technology
- ❖ Second Round Technology
- • On-Campus Project

Note: Projects are listed by name(s), then by location to nearest city.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Ambient Anaerobic Digestion Swine Waste Treatment System
Julian Barham Farm, Zebulon, North Carolina
4000 Head Farrow to Wean operation
July 3, 2002


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Ambient Digester

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## Nitrification Tanks – Barham Farm Project


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**Results reported (July 2003): In-ground ambient temperature digester / energy recovery / greenhouse vegetable production system**

- **Carbon loading reduced by 90%**
- **560 – 990 kWh electricity/d**
- **Tomato yield of 711 kg/d**


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Constructed Wetland Swine Waste Treatment System
Brandon Howard Farm, Onslow County, North Carolina
July 3, 2002


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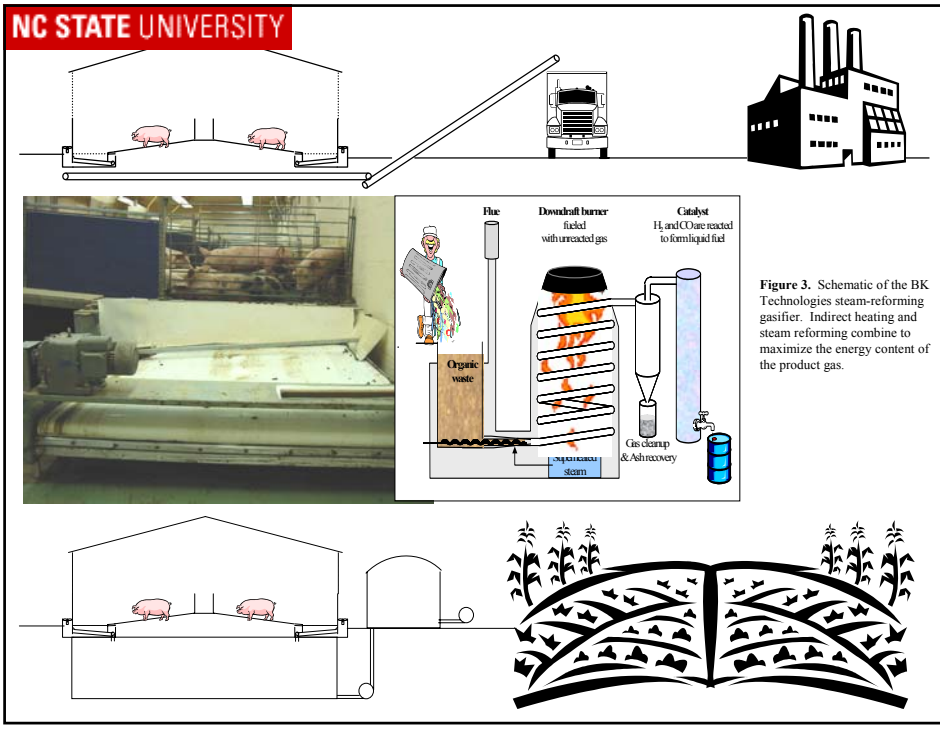


**Figure 3.** Schematic of the BK Technologies steam-reforming gasifier. Indirect heating and steam reforming combine to maximize the energy content of the product gas.

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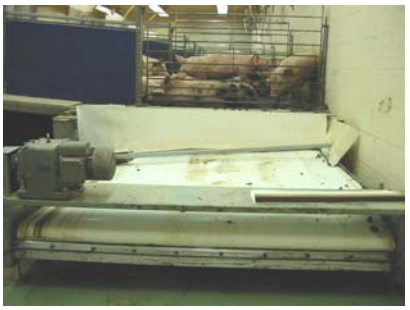
# Results reported (July 2003): Belt system (Van Kempen / Koger proj.)



- DM of belt collected manure fraction app. 50%
- NH3 emissions of app. 1.0 kg/pig space/yr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# Results reported (July 2003): Super Soils System

- **Solids, COD, metals, TKN reduced by 35-96% in solid separation module (TKN=35%, P=70%)**
- **TKN and NH3 reduced by 98-99% in nitrification module**

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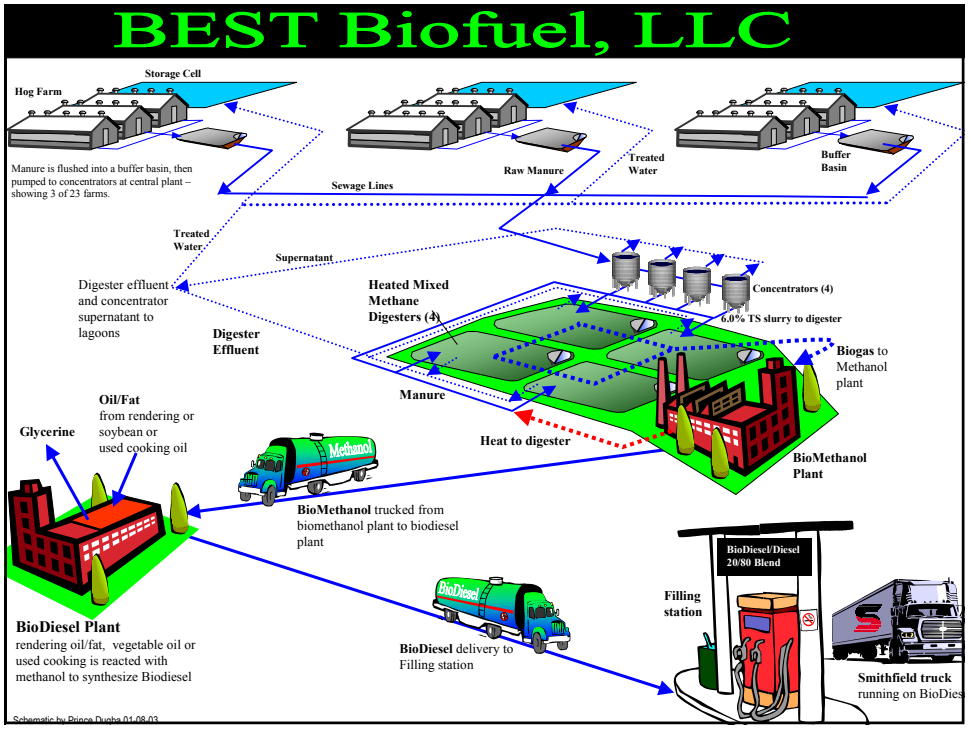
# Larval Basin

120 lbs of fresh manure

10,000 larvae/sq ft.

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# APWMC Web Address

- **www.cals.ncsu.edu/waste_mgt/**

- **(follow prompts that reference NC Attorney General Agreements - progress reports, descriptions, presentations, etc.)**