

## Animal and Poultry Waste Management Center

A candidate technology of the North Carolina Agreements Project:  
Development of Environmentally Superior Technologies per  
Agreements Between the Attorney General of North Carolina and  
Smithfield Foods, Premium Standard Farms and Frontline Farmers

# Belt Manure Removal and Gasification System to Convert Dry Manure Thermally to a Combustible Gas Stream for Liquid Fuel Recovery

This project employs a conveyor belt to separate the solid and liquid portions of the waste stream produced by pigs. The solids are then managed using a gasification process, while the liquid portion of the waste stream receives further treatment in a sequencing batch reactor. Gasification is the process of burning a substance in a low-oxygen environment to convert complex organic compounds to gases. When pig manure is gasified, gases such as methane, carbon monoxide and hydrogen are released. The gases will be collected and used to make fuel-grade ethanol. This system is being evaluated in Grinnells Laboratory on the North Carolina State University campus.

In addition to gases, gasification produces ash. The ash produced when pig manure is gasified contains the minerals that were in the manure. The ash should have value as either a fertilizer or a supplement in animal feeds. Indeed, the ash might end up going back to the hog farms from which it came, where it would become part of the pigs' diet. Ash from pig manure gasification should be completely safe to use as a feed supplement because any pathogens in the manure would be destroyed by the extreme temperatures (in excess of 1,100 degrees F) used to gasify the manure.



**Belt Manure Removal System**

The belt system used to separate the solid and liquid portions of the waste stream is one of two belt designs being evaluated as part of the Smithfield/Premium Standard Farms/Frontline Farmers agreements. In both systems a belt runs beneath the pens in which pigs are housed. The floor of the pens is slatted, and waste drops through the floor to the belt below. The belt is set at an angle, so liquid waste runs off and is captured. Solid waste remains on the belt, which carries the solid waste to the end of the pens, where it may be collected.

## Belt Manure Removal and Gasification System (continued)

### Why Separate Solid and Liquid Waste

The lagoon and spray field waste treatment technology used on most swine farms in North Carolina not only mixes solid and liquid wastes but dilutes the waste with water. The barns in which pigs are raised usually have concrete floors with slots in them. Swine waste drops through the slots to a pit below. From there, the waste is flushed with water into a lagoon.

That's an efficient way to deal with the waste if you don't want to move it very far. However, the weight and volume of the diluted waste makes movement difficult and costly. And being able to move waste is often necessary if the waste is to be processed to produce value-added products. That's why systems that separate the solid and liquid portions of the waste stream are part of many of the technologies being evaluated as part of the Smithfield/Premium Standard Farms/Frontline Farmers agreements. The solid portion of the waste stream particularly is a candidate for processing to produce value-added products.

Separating the solid and liquid portions of the waste stream may also help deal with odor and ammonia emission problems. Both odor and ammonia are produced by the action of fecal microbes on the manure constituents. If urine and solid waste are separated, and the feces dried, odor and ammonia emissions should be reduced dramatically.

#### Evaluation Team:

Dr. Jeanne B. Koger  
Department of Animal Science  
North Carolina State University  
Phone: (919) 515-4046  
E-mail: [jeanne\\_koger@ncsu.edu](mailto:jeanne_koger@ncsu.edu)

Dr. Theo van Kempen  
Department of Animal Science  
North Carolina State University  
Phone: (919) 515-4016  
E-mail: [t\\_vankempen@ncsu.edu](mailto:t_vankempen@ncsu.edu)

Dr. Grada A. Wossink  
Department of Agricultural and Resource Economics  
North Carolina State University  
Phone: (919) 515-6092  
E-mail: [ada\\_wossink@ncsu.edu](mailto:ada_wossink@ncsu.edu)