



## **WATER RESOURCES RESEARCH GRANT PROPOSAL**

**Title:** Development of a Simple Combustion Process for Disposal of Waste from Livestock Operations

**Focus Categories:** Treatment TRT Nonpoint Pollution NPP Agriculture AG

**Keywords:** Animal Waste Wastewater Agriculture Treatment Pollution Control

**Duration:** 02/01/99 - 01/31/01

**Federal Funds Requested:** \$22,000

**Non-Federal (matching) Funds Pledged:** \$46,004

**Principal Investigator(s):** Virgil Flanigan, University of Missouri-Rolla Shubhender Kapila, University of Missouri-Rolla

**Congressional District:** 8

### **Statement of Critical Regional or State Water Problems**

The recent statements emanating from Federal and State environmental agencies show a growing concern for the adverse effects of run-off from large livestock operations,[1] particularly in the midwestern states. There is ample data to show that unprotected waste from livestock operations washes into streams as non-point source (NPS) pollution. The United States Environmental Protection Agency (US EPA) estimates that 41 percent of the total NPS pollution results from agricultural sources, and a third of that is attributable to livestock operations.[2] In addition, water quality concerns such as noxious odors and the spread of pathogens and weeds are becoming serious. Clearly, alternative treatment technologies for livestock waste are required to:

- reduce the volume of the waste
- reduce the odor
- destroy pathogens and other undesired components

### **Statement of Results or Benefits**

According to Stephen Mahfood, the newly-appointed director of the Missouri Department of Natural Resources, the impact of swine production on the water and air quality is one of the most pressing environmental issues in the state.[3] The proposed drying and combustion system would provide an economical solution to the environmental problems faced by large swine and other livestock operations. A preliminary cost analysis shows that treatment with the proposed process will cost approximately \$3.80 per ton. This is competitive with treatments such as composting or oxidative and anaerobic digestion. The research will be carried out in laboratories affiliated with the Center for Environmental Science and Technology (CEST) on the UMR campus. It will involve both graduate and undergraduate students, affording them

an opportunity to work on and solve real world environmental problems. Furthermore, the close association between CEST and Missouri industry would enhance implementation probabilities for the technique. The proposed system is highly relevant to major swine producing regions such as southern Iowa and northwestern Missouri.

### **Nature, Scope and Objectives of Research**

An abundant supply of clean water is essential for sustaining human health and the environment.

Recent statements issued by the US Environmental Protection Agency (US EPA) state that rural and urban runoff accounts for more than one-half of all water pollution. Runoff from animal feeding operations in particular has been associated with threats to human health and the environment. In a draft plan issued March 5, 1996, by the US EPA, the EPA plans to regulate runoff from factory farms with large numbers of cattle, pigs, and chickens. The draft plan calls for an aggressive enforcement of the Clean Water Act permit requirements.

It is estimated that these requirements will affect approximately 450,000 animal feeding operations in the United States.[4] In Missouri alone, approximately 3.3 million head of swine are raised every year. The annual waste resulting from these operations is estimated to be 19,500 tons. It is anticipated that reduction in animal waste runoff would reduce or eliminate the excess nutrients which are contaminating lakes and streams in states with large livestock feed operations. This pollution has been blamed for drinking water contamination, fish kills, noxious odors, and a host of other deleterious environmental effects. In Missouri, the runoff situation is particularly acute with the swine feedlots. These operations are centered in northwestern Missouri, and similar situations exist in other states. The estimated volume of wet solid waste resulting from these operations is approximately 1 million tons. These wastes are rich in carbonaceous materials, urea, and related ammoniacal compounds and noxious sulfurous volatiles. Advanced combustion processes hold potential for rendering all these chemicals harmless.

The overall objective of the proposed research is to develop and evaluate a simple drying/combustion process to eliminate pollutant runoff from livestock production operations. The specific objectives are:

- Design and build a laboratory scale combustion system.
- Evaluate the combustion efficiency.
- Evaluate a modular configuration.
- Carry out a preliminary economic evaluation.

This study should provide scientific and engineering data to submit a proposal for construction of a pilot scale combustion system and evaluate the potential of an industrial scale operation.