

Development of Environmentally Superior Technologies

Phase I Environmentally Superior Technology Contingent Determinations

Second Generation Super Soils Technology

FINAL REPORT

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PREFACE

This report comprises a technology determination made by the Designee pursuant to Sections III.B.5 and III.B.6 of Agreements, dated July 25, 2000 and September 30, 2000 between the Attorney General of North Carolina and Smithfield Foods, Inc. and Premium Standard Farms, Inc., respectively.

The technology determination reported herein is based on environmental performance data and economic feasibility analysis. Research teams comprised of faculty and staff from North Carolina State University (NCSU) and the United States Department of Agriculture – Agricultural Research Service (USDA-ARS) conducted the studies and their reports are provided in the Appendices.

Members of an advisory panel appointed by the Designee and representing academic research scientists and economists, environmental and community interests groups, and agribusiness provided input and review to the process of this technology determination.

Summary

This report comprises a technology determination pursuant to agreements between the Attorney General of North Carolina and targeted pork production agribusinesses to identify “Environmentally Superior Technology” (EST) for the treatment of swine waste. The determination is based on environmental performance data and economic feasibility analysis. The study focus was on the Super Soil Systems “Second Generation” technology installed and operated on a commercial swine production facility in Sampson County, North Carolina. The swine farm houses an approximate animal capacity of 6,000 total finishing head.

Technical environmental performance standards for the determination included: discharge of animal waste to surface waters and groundwater; emission of ammonia; emission of odor; release of disease-transmitting vectors and airborne pathogens; and nutrient and heavy metal contamination of soil and groundwater. Economic feasibility determination variables included projected 10-year annualized costs and returns analysis and the impact that the adoption of the technology may have on the competitiveness of the North Carolina pork industry.

The results showed that the Super Soil Systems “Second Generation” technology achieved efficient technical (environmental) performance at reduced costs compared to a “First Generation” system previously evaluated. Overall, the technology is determined to be an unconditional EST component for new and expanding farm categories. However, the costs reductions were not sufficient to achieve unconditional EST status for existing farm categories per criteria previously established. It is noted that this determination (for existing farm categories) is specific to the agreements initiative; eligibility of the technology for existing farms through other initiatives (e.g., state or federal cost share initiatives) will be determined by requirements for those initiatives.

These findings show that organized efforts to reduce the costs of targeted EST are achievable and support previous recommendations to identify potential institutional incentives, public policies, and markets related to the sale of byproducts that will reward farmers for utilizing technologies that are shown to yield improvements and environmental benefits over the current lagoon spray field system. It is recommended that the optimal method of achieving continued cost reductions from alternative technologies is to install targeted technologies on a sufficient number of farms to facilitate continued engineering improvements, value-added product market development, and other cost reduction methods.

1.0 Introduction

Research efforts to identify and implement “Environmentally Superior Technologies” (EST) were initiated in 2000 by the Attorney General of North Carolina through Agreements with Smithfield Foods and its subsidiaries, Premium Standard Farms, and Frontline Farmers. Technology determinations mandated by those Agreements have been previously published in a series of three reports (July, 2004,¹ July 2005,² and March 2006³).

In Section 6.0 of the referenced Phase 3 Report (dated March 8, 2006), the “Super Soils” technology was determined to be an unconditional component EST for new and expanding swine farm sites. For existing farms, it was determined that this technology did not meet economic feasibility conditions required for unconditional EST to be implemented onto existing farms in North Carolina.

Based on recommendations made in the referenced Phase 1 and 3 Reports, a Super Soil Systems “Second Generation” technology was designed and developed with the primary objective to reduce its costs while maintaining its capability to meet technical (environmental) standards described in the referenced Phase 1 Report. The reports herein describe the “Second Generation” technology, its operational conditions, performance verification data, economic analysis data, and its analysis relative to EST determination requirements.

2.0 Technology Description

The Super Soil Systems “Second Generation” utilizes polymer-enhanced liquid-solid separation, nitrification/denitrification, and soluble phosphorus removal modules to treat swine manure. The specific system description, with comparison to the “First Generation” technology is provided in the Appendix A report.

3.0 Technical Performance and Economic Feasibility

The Super Soil Systems “Second Generation” system performance including environmental data is provided in the report by Vanotti and Szogi and included herein as Appendix A.

¹ Development of Environmentally Superior Technologies. 2004. Phase 1 Technology Determination Report, published by NCSU College of Agriculture and Life Sciences, 941 pgs, on file with NCSU Animal and Poultry Waste Management Center (July 26, 2004). Also available at www.cals.ncsu.edu/waste_mgt/

² Development of Environmentally Superior Technologies. 2005. Phase 2 Technology Determination Report, published by NCSU College of Agriculture and Life Sciences, 1,428 pgs, on file with NCSU Animal and Poultry Waste Management Center (July 25, 2005). Also available at www.cals.ncsu.edu/waste_mgt/

³ Development of Environmentally Superior Technologies. 2006. Phase 3 Technology Determination Report, published by NCSU College of Agriculture and Life Sciences, 716 pgs, on file with NCSU Animal and Poultry Waste Management Center (March 8, 2006). Also available at www.cals.ncsu.edu/waste_mgt/

Technical environmental performance standards defined in the Agreements mandate that successful EST address the discharge of animal waste to surface waters and groundwater; emission of ammonia; emission of odor; release of disease-transmitting vectors and airborne pathogens; and nutrient and heavy metal contamination of soil and groundwater. See Section 3.0 of the referenced Phase 3 Report for specific quantification descriptions of the technical performance standards.

The Super Soil Systems “Second Generation” economic assessment is provided in the report by Zering et al. and included herein as Appendix B. Economic feasibility for successful EST is mandated by the terms and conditions of the Agreements. Economic variables include projected 10-year annualized costs and returns analysis for the candidate technology; projected revenues from byproduct utilization; consideration of available cost-share monies; and the impact that the adoption of the EST may have on the competitiveness of the North Carolina pork industry as compared to the pork industry in other states (see Section 5.0 of the referenced Phase 3 Report).

4.0 Environmentally Superior Technology Determination

Based 1) on criteria previously established for EST determinations, 2) careful review of the project investigator’s reported system performance and economic data, and 3) external review input, the following technology determination is made at this time for the Super Soil Systems “Second Generation” technology.

New farm category

Designee concludes that the Super Soil Systems “Second Generation” technology, as described herein, meets unconditional EST status when combined with an unconditional EST for solids treatment. New farm category remains as described in Section 6.0 of the referenced Phase 3 Report.

Existing farm categories

Designee concludes that the Super Soil Systems “Second Generation” technology, as described herein, does not at the current time meet economic feasibility conditions as required for unconditional EST to be implemented onto existing farm categories in North Carolina.

5.0 Discussion

The results reported herein show that the Super Soil Systems “Second Generation” technology achieved efficient technical (environmental) performance at reduced costs compared to the “First Generation” system. The predicted standardized annualized incremental cost (\$/1,000 lbs. steady state live weight/year) of approximately \$400 for the “First Generation” system was reduced to approximately \$300 for the “Second Generation” system. Under conditions of the modified actual model (described in the

economic assessment report) this unit cost for the “Second Generation” technology is shown to be as low as approximately \$132. These results are significant, and the technology providers are to be commended for these accomplishments. However, unconditional EST relative to terms and conditions of the Agreements and economic feasibility (see Section 5.0 of the referenced Phase 3 Report) is approximately \$90 (or less)/1,000 lbs. steady state live weight/year.

It is noteworthy that a significant costs reducing component of the Super Soil Systems “Second Generation” technology is the striking reduction in total barn effluent volume treated as compared to the standardized model, which is based primarily on past lagoon spray field technology experience. The authors of the economic assessment note that the issue of how much effluent volume can be reduced and how this may affect animal productivity due to changes in the housing environment has been raised by some stakeholders. Comparatively, the authors of the technical environmental performance assessment note that animal health and productivity was shown to be enhanced during this study. These investigators (of both assessments) make valid observations. Defensible conclusions regarding these variables need to be statistically verified with adequate herd replications utilizing the reduced effluent volume. It is logical to conclude that unconditional EST will require significant modifications in effluent volume management as compared to traditional lagoon spray field technology experience.

Operational feasibility and operator training are discussed in the report included in Appendix A (Section 8.). While it is recognized and concluded that the “Second Generation” system is more efficient and easier to operate than the “First Generation” system, caution is urged regarding the statement relating to operator education and training. It will be necessary for the North Carolina Department of Environment and Natural Resources, Division of Water Quality to establish operator training/certification requirements for EST permitted.

The findings provided herein show that organized efforts to reduce the costs of targeted EST are achievable. This work supports previous recommendations to identify potential institutional incentives, public policies, and markets related to the sale of byproducts that will reward farmers for utilizing technologies identified by this process that are shown to yield improvements and environmental benefits over the current lagoon spray field system. The optimal method of achieving net cost reductions from alternative technologies is to install targeted technologies on a sufficient number of farms to facilitate engineering improvements, value-added product market development, and other cost reduction methods.

Acknowledgements

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