

NTRD Program Disclaimers

1. Disclaimer of Endorsement:

The posting herein of progress reports and final reports provided to TCEQ by its NTRD Grant Agreement recipients does not necessarily constitute or imply an endorsement, recommendation, or favoring by TCEQ or the State of Texas. The views and opinions expressed in said reports do not necessarily state or reflect those of TCEQ or the State of Texas, and shall not be used for advertising or product endorsement purposes.

2. Disclaimer of Liability:

The posting herein of progress reports and final reports provided to TCEQ by its NTRD Grant Agreement recipients does not constitute by TCEQ or the State of Texas the making of any warranty, express or implied, including the warranties of merchantability and fitness for a particular purpose, and such entities do not assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights.

NTRD Program Disclaimers

1. Disclaimer of Endorsement:

The posting herein of progress reports and final reports provided to TCEQ by its NTRD Grant Agreement recipients does not necessarily constitute or imply an endorsement, recommendation, or favoring by TCEQ or the State of Texas. The views and opinions expressed in said reports do not necessarily state or reflect those of TCEQ or the State of Texas, and shall not be used for advertising or product endorsement purposes.

2. Disclaimer of Liability:

The posting herein of progress reports and final reports provided to TCEQ by its NTRD Grant Agreement recipients does not constitute by TCEQ or the State of Texas the making of any warranty, express or implied, including the warranties of merchantability and fitness for a particular purpose, and such entities do not assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represent that its use would not infringe privately owned rights.

**Texas Commission on Environmental Quality
New Technology Research & Development (NTRD) Program
Monthly Project Status Report**

Title: FEEDLOT BIOMASS: A REBURN FUEL FOR "MAXIMUM NOX" REDUCTION IN
COAL-FIRED POWER PLANTS

Contract Number: _____ TCEQ Grant # 582-5-65591 0015

Grantee: _____ Texas Engineering Experiment Station, Texas A&M University

Date Submitted: _____ May 7, 2005

Report for the **Monthly** period:

Starting Date _____ March 31, 2005 _____ Ending Date _____ April 30, 2005 _____

Section I. Accomplishments (*Please provide a bulleted list of project accomplishments as well as a description of their importance to the project.*)

The overall objectives of the project are i) to develop a retrofit technology of using processed low-ash feedlot biomass (FB) as reburn fuel for potential reduction of the NOx in coal-fired power plants by 80-90% and ii) determine the possible capture of Hg for low rank coals, reduction of CO2 and other benefits of using animal wastes (alternately known as feedlot biomass, FB) as fuels.

1. The TEES contract # has been set up only around April 20, 2005 due to contacting required personnel for signatures and finalizing subcontract issues. The project is interdisciplinary in nature; as such the total TCEQ budget is \$341,933 has been split between TEES (Kalyan Annamalai(KA): \$276,963) and Texas Agricultural Experiment station (TAES, John Sweeten (JS) : \$64,970). Dr Sweeten is responsible for determining the fuel characteristics of lignite, sub-bituminous coal, raw manure (RM), and partially composted manure (PC) including fuel collection, processing (drying , grinding), proximate and ultimate analyses (Task 2.1.1.1) and a part of task 5 on the economic analysis for all four biomass fuels listed in Task 1.

2. Two graduate students (MS level) who have been at A&M for about a year have been recruited to work on the project as MS students: Mr. Brandon Martin and Paul Gofner. They will be officially on the project starting June 1, 2005. Mr. Soyuz Priyadarsan who has been a PhD student for more than 2 years will continue to work on the current TCEQ project. Another PhD student Mr. Madhu who has been working on Hg modeling as a PhD student for about 2 years has been recruited to work on the project. Since student workers are required for the combustor facility modification, they will join sometimes in summer 2005. These students are expected to work partly on sub task of task 1 (SOW: 2.1.1.2): Fundamental pyrolysis and ignition studies, Task 2: Small Scale Reburn Experiments for NOx reduction, Task 4: Reburn modeling to predict NOx capture by biomass fuels and Task 5: Perform the economics of the use of FB as reburn fuel in coal fired power plants and cost of NOx reduction compared to other technologies.

3. The following equipments are planned to be acquired: i) TGA analyzer ii) On Line Electro-Chemical Cl Analyzer, iii) Mercury Analyzer (Elemental HG only), iv) Mass Flow Regulator (required for above equipments v) Hg Generators and v) Computer required for data collection and interfacing. Specifications for these equipments have been obtained. Vortec Model M-1 Impact Mill, Vortec Industries, Long Beach CA will be acquired and used for final grinding of air-dry (<10% moisture) feedlot biomass

(FB) harvested from the TAES/USDA-ARS research feedlot at Bushland, to produce FB product (uncomposted and partially-composted) for reburn experiments in TEES Mechanical Engineering Dept.

4. Task 4 deals with zero dimensional reburn model for predicting the NO_x capture by biomass fuels. The model uses the concept of characteristic mixing time between reburn and main burner gases. During the period of wait on contract negotiations between TCEQ and TEES-TAMU (from Sep 2004 to March 2005), a few modifications have been made on the reburn model to include Hg chemistry. A brief overview is presented in Appendix A. Results are not yet available. The modeling formulation including homogeneous and heterogeneous reaction kinetics of reactions, pyrolysis kinetics, and evaporation model will be included in the next report.

5. Developed plans for harvesting, segregating (crushed-fly ash surfaced pens vs. unsurfaced soil pens), and pre-processing of feedlot biomass from completing cattle feeding trial in TAES/USDA-ARS research feedlot Bushland TX, preparatory to processing for reburn tests (JS)

Indicate which part of the Grant Activities as defined in the grant agreement, the above accomplishments are related to:

Task 1: Fuel characteristics

Task 2: Small Scale Reburn Experiments for NO_x reduction

Task 4: Reburn modeling to predict NO_x capture by biomass fuels

Section II: Problems/Solutions

| Problem(s) Identified | |
|--|---|
| <i>(Please report anticipated or unanticipated problem(s) encountered and its effect on the progress of the project)</i> | <ol style="list-style-type: none"><li>1. As opposed to industries, the universities operate in an academic environment of education and training engineers for state of Texas. Financial assistance is offered to graduate students only after contract is in place <i>and then only</i> the students take required courses relevant to project, read through relevant scientific literature but only after offer of financial assistance. Thus there is inherent time delay in getting the results from the project immediately after the start of contract<li>2. Since we are state university, the purchasing department must follow guidelines of state of Texas which require 2-3 months prior to purchase of required equipments<li>3. After we had received e-mail from TCEQ on selection of our proposal (Aug 2004) and while contract negotiations between TCEQ |

| | |
|---|--|
| | <p>and TAMU were in progress, we had received e-mail in Dec 2004 that a large grant (about \$ 1 million total) from DOE-NREL (National Renewable energy Laboratory) will be coming to Texas A&M and it will start sometime in June 2005. The DOE contract requires sharing of facilities between two projects and PIs' time between two projects.</p> |
| <p>Proposed Solution(s)</p> <p><i>(Please report any possible solution(s) to the problem(s) that were considered/encountered)</i></p> | <ol style="list-style-type: none">1. Typically the DOE (Department of Energy), NSF (National Science Foundation), USDA (US department of Agriculture) etc award contracts to the universities over a period of 2 – 3 years because of education and training nature of academic institutions and inherent delays in getting graduate students started on project; If possible, the future TCEQ awards to academic institutions should cover a period of not less than 2 years.2. To minimize problem # 2, we had started acquisition of certain equipments (e.g. vortec grinder) using funds from other related contracts prior to start of current TCEQ project. However acquisition of other equipments will follow stated guidelines of state of Texas.3. For resolving problem # 3, we have already had a verbal commitment from Program Manager (PM) of DOE-NREL for no cost extension to 2007. Further a request has been made to PM of TCEQ for no cost extension to Dec. 2006. |

Action(s) Conducted and Results

(Please describe the action(s) taken to resolve the problem(s) and its effect)

See section on proposed solutions

Section III. Goals and Issues for Succeeding Period: *(Please provide a brief description of the goal(s) you hope to realize in the coming period and identify any notable challenges that can be foreseen)*

Proposed activities for month 2 (5/01/2005 – 05/31/2005)

1. Get bidding process started on equipments: i) TGA analyzer ii) On Line Electro-Chemical Cl Analyzer, iii) Mercury Analyzer (Elemental HG only), iv) Mass Flow Regulator (required for above equipments v) Hg Generators and v) Computer required for data collection and interfacing.
2. The boiler burner facility is currently being used for ash fouling studies; it will be used in May in related DOE-Pittsburgh contract studies (but not related to new DOE-NREL project) on testing the newly developed laser based NOx sensors. Thus the facility is available for modification only in June. Hence the month of May will be used to generate more modeling results.
3. Prepare the FB fuels for analyses which include collection and composting over 45 days.

Authorized Project Representative's Signature

Date: _____