



FPPC

Farm Pilot Project Coordination, Inc.
"Technologies for Nutrient Management"

October 1st, 2006

To: Mr. William Boyd - Leader, Manure Management Team
East National Technical Support Center - NRCS

From: Bob Monley, General Manager, FPPC, Inc.

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Re: Quarterly Report for period from July 1st through September 30th, 2006

This report is intended to update the NRCS and the FPPC, Inc. Board of Directors on the status of the innovative technology pilot projects.

Executive Summary

Since the last report, FPPC has completed another request for proposal (RFP) cycle. A total of seventeen (17) proposals were submitted to the Professional Review Panel which met to evaluate and recommend pilot projects. A high percentage of proposals in this RFP round featured crossover technologies with successful track records in mining, pulp & paper and municipal waste industries. The Board of Directors took action toward funding three (3) new projects during their September 22nd, 2006 meeting. Due diligence and follow-up site visits are underway.

To date, FPPC has completed nine (9) pilot demonstrations and is currently pursuing another twenty-four (24) pilot projects in sixteen states.

OPERATIONS -----

1. **Disposition of Proposals:** A total of seventeen (17) proposals were received in the latest RFP round. In September, the Professional Review Panel met to technically evaluate and recommend proposals based on merit. The FPPC Board of Directors met September 22nd, 2006 to consider funding and approved three (3) projects while deferring consideration on four (4) other proposals until clarifying information was available and evaluated.

Approved projects funded or partially funded:

- \$493,000 to Crossroads RC&D and Wastewater Systems in Ohio. The Board approved funding for a package plant demonstration on both the Royer and Andreas Farm in Ohio. With the looming threat of winter spread prohibition, this proposal sets a new standard for effluent treatment and water reuse at either permitted discharge or 99% nutrient free level. The Board took note of the large cost share (\$804,000) provided by other sources.
- \$375,000 to North Florida Holstein (NFH) Dairy, White Technologies, Inc and U.S. Environmental Products, Inc in the Suwannee River basin. The Board approved funding toward the demonstration of a vacuum dewatering bed to be utilized for solids separation of dairy waste.
- \$100,000 to Skill Associates, Inc. near Green Bay, Wisconsin. The Board reviewed the requested funds for a new burner design but felt that a thorough impartial review of the combustion burner design as well as the immediate collection, presentation and review of all operational and technical data relevant to the burning of manure in the existing facility at the Weise Farm was needed. This data collection effort and review was funded.

Funding action and final project consideration was deferred on the following proposals pending clarifying information:

- “Biological Nutrient Management Technology for a Dairy Farm” submitted by Dr. Conly Hansen from the Center for Profitable Uses of Agriculture ByProducts - Utah State University and Wade Dairy
- “Manure Biodrying: an innovative manure treatment alternative” at Pioneer Farms – UW – Platteville, Wisconsin
- “Animal Waste Management Demonstration” submitted by NutraCycle for the 1000 cow Williams Dairy in Georgia
- “Technologies for Nutrient Management” submitted by Bella Holsteins, Inc., AGPROfessionals, LLC, and Alberts Water and Wastewater of Colorado

2. **Site Visits:** In September, FPPC hosted new members of the NRCS Manure management Team and conducted a visit to three sites to see the project work underway at Branford Dairy and Watson Dairy, and to become acquainted with operations and the pending proposal at North Florida Holsteins Dairy. The site visit allowed staff to become more familiar with projects in the north Florida area.

3. **Cultivating Interest:** Members of NRCS, FPPC, Connecticut state officials and dairy farmers, conducted a teleconference to discuss potential interest in the state of Connecticut for a pilot project. It was agreed to meet in Connecticut October 16-17th to visit the cow-pots project and to examine other potential nutrient reduction project ideas that could be sponsored by the dairy owners in the area and funded by FPPC.

4. **Second Generation Composting:** A follow-up discussion was conducted with Keith Warren, Mountain Organic Materials (MOM), Pete Hubbell, Water Resource Associates and Bill Boyd from NRCS was held on September 28th. Keith reports that the interest in on farm forced-air composting has begun to expand with increasing interest coming from the composting of mortalities. Keith believed there was a market beginning to develop for composting of mortalities because of the shortage of rendering plants and bio-security concern for movement of animals. FPPC was asked to consider helping MOM develop a second generation system as the scaling to larger and larger system was quite expensive.

5. **Nutrient Management Workshop:** A collaborative effort is underway to better define the nutrient management technologies available and methods to evaluate the effects on the waste stream. Dr. Robert Burns, on sabbatical from Iowa State University, is spearheading the effort - Evaluation of Alternative Manure Treatment Systems Workshop. This forum is aimed at an environmental engineering level and its technical agenda will feature arranging subject matter experts followed by case studies in breakout sessions. The technical session is being jointly planned and funded, by the NRCS and FPPC, to strengthen the network and the understanding of key professionals who will encourage and sponsor nutrient management ideas and proposals.

Progress at the active pilot demonstration sites is briefly summarized below:

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Dairy, Florida (#4.02) -----
QED Occtech
Branford–DPS Dairy in High Springs, Florida

The process includes:

- A system to capture nutrients from the waste stream of the 2050 dairy cows by combining QED’s tangential flow solids separator, nitrification, denitrification and composting solids.

Project Status:

This pilot project is in full operation and has begun treating effluent. Initial operation was hampered by electrical, pump and lime issues, but QED is beginning to see positive treatment results. Nitrogen reduction is meeting expectations. Meanwhile, farm personnel are currently being trained for the daily operation of the project and will be maintaining control of the system in the near future.

Dairy, Florida (#4.01) -----
Royal Consulting, Inc.
Butler Oaks in Lorida, Florida

The process includes:

- This dairy project seeks to capture nutrients in the phosphorus rich watershed next to Lake Okeechobee
- Solids are collected in a vat separator and is subsequently effluent is decanted and treated chemically.
- Solids are harvested and introduced into an in-vessel composter. This compost will be marketed as a peat substitute by South Dade Soil and Water Conservation District.

Project Status:

During August the system was 100 percent operational. Startup of the in-vessel composter was undertaken but some of the manure solids and sludge proved too wet for composting. Royal Consulting is currently investigating additional drying techniques in addition to the screw press.

Operation records and drying characteristics of sludge and manure solids are being tabulated and analyzed daily. A three prong approach is being evaluated - stacking on concrete, stacking on sand, and ventilation of the drum composter. Phosphorus reduction as a function of different chemical injection rates is also being studied.

Swine and Poultry, Iowa (#3.13)-----
Global Resource Recovery Organization (GRRO)
Next generation system

The process includes:

- System will incorporate dry manure transfer and or bolt on technologies that help to offset the cost of the tempest dryer removing the greatest share of moisture
- Pre-Separation Cyclone (liquid removal)
- Modular designed cyclonic drying system (Tempest dryer) on modular mobile platform
- Development of value added/commercial grade product - slow release fertilizer.

Project Status:

On September 19th, FPPC visited GRRO in Iowa to observe the second generation project. The system is being reconfigured into skidded modules to fit on a long low-bed trailer. The new system will have more space between components, enabling easier servicing and maintenance. The total system is being converted to electric motors and will have electricity generated by a diesel engine. However, the system will also be capable of operating on electric power without the diesel should fuel become cost prohibitive.

As the present time, three farm sites are being retargeted to allow the tempest dryer to be demonstrated in a more economically beneficial manner. GRRO is expanding its search for waste drying needs at swine, dairy and poultry operations in lieu of local Midwest swine demonstrations that have marginal returns.

Dairy, Utah (#4.04) -----
Utah State University, Center for Profitable Uses of Agricultural Byproducts
Blaine Wade Dairy near Ogden, Utah

The process includes:

- This system utilizes an existing induced blanket reactor (IBR) type of anaerobic digester converting organic carbon in the manure to methane and carbon dioxide.
- The (IBR) will be supplemented by a new electro-coagulation unit to concentrate nutrients from the effluent of the IBR.
- Individual contributions of nutrient reduction of the screw press, settling basin and the electro-coagulator units will be quantified.
- The observed treated water exiting from the installed IBR system is nearly odorless.

Project Status:

The operation of an electro-coagulation (EC) unit has been tested in the pilot demonstration. Field data indicates effective nutrient reduction from the waste stream utilizing the combination of digester, screw press and the EC unit. The total Nitrogen removed was 81% and the total Phosphorus was 94%. The nutrient reduction contribution of each subsystem has not been quantified yet, but it is believed that the EC unit is responsible for the greatest share.

The cost for electric power consumed was measured at \$2.00/1000 gallons of treated effluent from the digester which is approximately double the previous estimates reported last quarter. In addition maintenance is a concern because continuous operational experience required hourly back-flushing to prevent the EC from plugging or bridging. Estimates for maintenance cost will add another \$.50/1000 gallons of treated effluent. The EC manufacturer is receptive to improving maintenance and cost needed for animal agriculture.

The capital cost of an EC unit for this dairy (1000 cows) is \$ 70,000. Experimental work is now complete and the final report is expected by the end of November.

Swine, Kansas (#5.01) -----

QED Occtech

Springer Farms in Independence, Kansas

The process includes:

- A nutrient management system designed for a waste stream of 3700 finishing hogs
- Combines a tangential flow solids separator, nitrification and denitrification
- Treatment will allow cleanup of the existing lagoons
- Treated effluent water will allow recycling instead of use of fresh well water
- Clean water will favorably affect production by lowering mortality

Project Status:

All agreements have been signed and the project is moving forward. QED has conducted site engineering to assess the waste stream and to determine system and operation requirements. Detail plant design has commenced.

QED has prepared scopes of work for analysis of the QTFS and met with researchers to develop outcome criteria.

Dairy, Pennsylvania (#5.07) -----

Nutrient Control Systems

Mercer Vu Farms in Mercersburg, Pennsylvania

The process includes:

- Upgrading the existing treatment system, making waste treatment of manure more operationally friendly and cost effective.
- Fine sand removal, added solids separation capability and a conveyor, blower & controls, building expansion, windrow turner and curing pad to support a composting operation.

Status:

All agreements have been signed and the project is underway. Solid separation equipment has been ordered and installation is expected within a month.

Dairy, Vermont (#5.02)-----
BioProcess Technologies
North Williston Cattle Co.

The process includes:

- The existing system incorporates a solid separator, a digester, composting capability and effluent treatment.
- The proposed project will take the biological effluent treatment to a new level of effectiveness by upgrading pretreatment of fine suspended solids and optimizing organic treatment in the bio-filter towers

Project Status:

Technology provider and farm owner agreements are now in place and work has been authorized. A follow-up site visit is planned the week of October 16th, 2006.

Dairy, Colorado (#3.12)-----
Applied Chemical Magnesiums Corp. (ACM)
Bella Holsteins, Inc. in Platteville, Colorado

The original process included:

- Easily-assembled recovery system that utilizes the reaction capabilities of inexpensive, milled brucitic marble to extract between 75% - 90% of most nutrients
- Uses magnesium source to react with Nitrogen and Phosphorous to form a crystal precipitate.
- Uses a series of reaction tanks (sized for the anticipated flow) with simple mechanical (paddle) agitation, and a hydro-cyclone separator and drying screen for the recovery of the precipitate.
- Precipitated crystals and liquid are sent to the drying screen; crystals are separated from the liquid then stored for farmers to use as a slow release fertilizer. The remaining liquid flows to a lagoon for solids settling.

Note: The plan of work was modified to add technical expertise available from Colorado State University and Idaho State (Dr. Ron Sheffield) and to determine why the brucitic marble was not reacting in the prescribed manner:

- Determine if there was something unique about the dairy and or waste stream that may contribute to the poor results
- Determine why brucitic marble may behave differently than its close treatment cousin – struvite which is successfully utilized in Idaho.

Project status:

The third quarter of 2006 was marked by progress both in the field and in the laboratory. For one day in June, and five days in August, Dr. Ron Sheffield of the University of Idaho came to Colorado with a pilot-scale struvite crystallizer. The Colorado State University research team was trained in the operation of the crystallizer, and struvite was produced on two different Colorado dairies using two different methods. Samples of water from the treatment process, as well as samples of the product, were taken back to CSU for laboratory analysis.

Due to high concentrations of magnesium in the initial wastewater samples, it was determined that the use of brucite as a source for supplemental magnesium was not necessary at Bella Holsteins. In addition, brucite was tested for its potential as a base to raise the pH of the wastewater during the crystallization process. The pH response was not sufficient to raise the pH of the wastewater to the level necessary for the crystallization process. Therefore, for the new method of struvite production, acetic acid was chosen for the acidification step, and potassium hydroxide (caustic potash) was chosen to optimize crystallization.

For the final day of Dr. Sheffield's visit, the new method was attempted at a second dairy, with wastewater lower in organic solids. Operation at the new dairy was smooth, and the crystallizer was left at the dairy for the CSU research team to continue working with the new method. Initial results from crystallizer operation at this second dairy are summarized in Appendix 2.

Water samples were collected at intervals from the crystallization process input, output, and at an intermediate step during the process. These samples are currently being analyzed at the CSU Soil, Water, and Plant Testing Lab. Mean values of ortho-P results are given in Appendix 2.

In summary, the fieldwork phase of the project was completed on September 24, 2006. Initial results indicate that a supplemental magnesium source such as brucitic marble is not necessary at some dairies due to the high magnesium content in the wastewater. However, for waters deficient in magnesium, the use of brucite could be considered as a part of wastewater treatment through struvite production. Both the existing method and a new organic method for struvite crystallization were successfully tested at Bella Holsteins, and the new method was also used to treat water at a second site. Water samples and product samples are currently being analyzed, and preliminary results are given in Appendix 2.

Swine, North Carolina (#4.05) ----- Super Soil Systems Goshen Ridge Farms in North Carolina

The process includes:

- This technology system deploys a mobile platform with solid separation capability
- It can be deployed to serve multiple farm sites of different scales.
- The project goal is to demonstrate lower overall cost by spreading the capital investment across several site owners with operations that are significantly different in scale.

Project Status:

The design and engineering effort for the next generation system is now complete. The mobile unit (solid separator) has been started, tested and is working acceptably. The water tank, positioned to catch the effluent from the mobile solid separator is in place. Electrical connections are being completed, but at the moment site permits are on the critical path. With the permits, piping can begin to link the system together.

FPPC is requesting a review of expected financial benefits to be demonstrated in the project. Super Soil indicates that the grower will benefit from carbon credits, production improvements and reductions in the cost of mortality and antibiotics.

**Poultry, Wisconsin (#5.04) -----
R&J Partnership
Weiss Poultry Farm in Kewaskum, Wisconsin****The process includes:**

- Utilizes chicken manure and mortality carcasses, along with a carbon source for conversion into a stable, organic fertilizer.
- A bio-filter acts as a scrubbing mechanism to take out noxious odors associated with composting process.
- A key element in the process is the ammonia capture and the re-introduction of N into the final composting process.
- Leachate is collected in tanks and is re-used during the process. The net effect is that the Nitrogen value remains elevated.

This project scales up from last year's smaller prototypic demonstration effort to a farm scale - commercial size operation and will demonstrate stability, uniformity and consistency of higher grade compost for the fertilizer marketplace.

Project Status:

Prerequisite activity for this project has been intense. First, changes in the marketing relationship have now been firmed up, allowing the technology provider to concentrate on the project start. Modifications for the containers and financing for unfunded portion of the project has also been firmed. FPPC has reached contractual agreements and a Plan of Work will be finalized by the end of this week. The project is proceeding.

Dairy and Mixed Farm Waste at Inland Empire Muncipal Site (#5.06) -----
Agricultural Waste Solutions, Inc.
Chino, California

The process includes:

This project utilizes a regional model and a centralized location at the Inland Empire Utilities Agency site in Chino, California. Key elements of the pilot demonstration include the AWS centrifuge and gasification unit. The one-year testing program will test dairy, swine, beef, poultry, horse, digested sludge, food waste and mixes of wastes for their produced energy value. The demonstrations and tests will simulate a large range of farm waste systems, from high-volume flushes to dry-lot manure systems, in order to evaluate energy production, efficiency, costs, automation and maintainability. The improved centrifuge will remove moisture and is designed to uniformly condition the feed stock entering the gasifier.

The system consists of a skid-mounted centrifuge, a skid-mounted gasifier, an intermediate solids hopper, augers from the centrifuge to the hopper and from the hopper to the gasifier. All equipment sits on a 25 by 35 foot concrete pad, with a gas compressor and storage tank. Utilities are plumbed to the pad, and the gasifier can run on either natural gas or its produced gas from the storage tank.

Project Status:

On July 31, 2006, representatives from FPPC, NRCS and EPA visited the site at Inland Empire Utilities Agency (IEUA) in Chino, California.

With permits in hand and since the July 31st visit, the full system has run on 11 different occasions. As a result of these runs and of individual component trials, several modifications were performed in order to improve operational efficiency and automation. A Technology Owner Agreement between AWS and FPPC was written for this unique project, and it has been agreed and executed. AWS is submitting the Work Plan in early October and expects to begin the trials in mid - October and begin running the system in a continuous fashion before the end of year.

Dairy, Florida (#3.01) -----
AJT/Agrimond
Watson Dairy in Trenton, Florida

The process includes:

- Sand and foreign material removal.
- Solids separation.
- Primary anaerobic treatment and secondary aerobic treatment with enhanced aeration.
- Suspended solids precipitation using polymers.
- Anoxic treatment for de-nitrification prior to land application.

Project Status:

In order to accurately document the operational cost for the system it was decided to more closely and continuously monitor this pilot project in the final phase. Data extracted from a two week sample period could then be utilized as a validated data base to project ongoing operation and maintenance cost.

During the month of September, AJT-Agrimond conducted this strict surveillance and monitoring of the dairy's daily operation and system performance which included weekends. Any system component (i.e. motor, pump, volume container, and tank) consuming power, polymers, etc. was measured and documented. Laboratory samples were taken daily to correlate with operational data.

Upon completion of the two week study, a complete system service manual for operations and maintenance was compiled. Agrimond has presented the manual to the farm owner, Craig Watson and reviewed all operational data. The demonstration is now considered complete and the final report for the demonstration project is expected by mid-November.

Dairy, Florida (#3.04) -----
Chemical Lime Co.
Aprile Dairy in Riverview, Florida

Project Status:

The chemical treatment scope and testing using lime has been transferred to the QED project at the Branford Dairy-DPS site near Gainesville. Testing is scheduled in October with the final report expected in November.

The following proposals are not yet approved - pending action in the near term:

**Swine, Illinois (#4.03)-----
World-Wide Bio Energy
C&J Boorman Farm, Kinderhook, Illinois**

This project will combine a continuous thermo-chemical conversion technology (TCC) developed by the University of Illinois yielding bio-oil and an electro-coagulation process (EC) that will be incorporated to remove nutrients from the effluent waste stream.

Project Status:

Following the farm site visit in January, this proposed pilot project still awaits final funding commitments. The technology provider has re-applied for available funding at the state and local level, but firming up state and local cost share commitments as well as the development efforts still remain.

Current development efforts require Innoventor to scale up the engineering design from the University of Illinois working lab model to a 1,000 hog scale working prototype at the CJ Boorman farm. Once the 1 house/1000 hog prototype is functioning acceptably, the farm scale project sponsored by FPPC can be considered. Even though progress on this effort continues, a letter has been sent to the technology provider advising them FPPC is withdrawing its present support until the project scope and funding is fully defined and the prototype work is successfully completed. The technology provider is encouraged to resubmit his proposal during the next RFP cycle.

**Swine, North Carolina (#5.03) -----
North Carolina State University - Lake Wheeler**

A newly designed swine production facility is currently being constructed at NC State University at the Lake Wheeler Field Laboratory near Raleigh, North Carolina. This project will leverage the new construction investment with a new separation process that mechanically isolates feces from urine while reducing odor. The project will pilot cost effective ways to accomplish early separation of solids using a belt system and compare its performance to a scraper system.

Project Status:

A bid meeting with potential suppliers was hosted at Lake Wheeler in August to provide vendors familiarity with the new swine facility before a final bid is submitted. Initial interest from seven potential suppliers has narrowed to three (i.e. ADT Waste, Choretime and Hogslats.) The plan forward is threefold a) invite each supplier to work closely with NC State's researchers during the development phase and b) select the final supplier and c) to firm up an approach with implementation before the first of the year. Even though construction is running behind schedule, animals are committed at the beginning of the year.

Dairy, California (#4.06) -----
Coaltec Energy USA

This proposed project will utilize a gasification process to transform dairy waste into a more transportable waste form with byproducts of gas/heat available for energy purposes.

Project Status:

Coaltec Energy and their partner, Agrimass Enviro-Energy, requested evaluation of two dairy project sites in the Central Valley of California. Therefore, FPPC and NRCS conducted a field visit the week of August 1st and based on this evaluation, have determined that either site has the potential to be a candidate for an on-farm FPPC gasification demonstration.

Assuming there is a matching interest the next step is review/finalize project scope and execute agreements with the farm owner and the technology providers. Should no agreement be reached, funding for the Coaltec Energy project will no longer reserved.

Noblehurst Dairy farm, New York (#5.05) -----
Fluid Management of New England

This dairy has approximately 1200 milking cows and is located in Linwood, New York. This farm owner has made a sizable investment in digester facilities and waste to energy capability. The technology provider has proposed a bolt-on technology (i.e. singlet oxygen generation (SOG) and electro-coagulation (EC)) to be used to remove nutrients from the waste leaving the digester, freeing recycled water for wash-down and irrigation. Electro-coagulation and the singlet oxygen generator will be installed as prefabricated modular units.

Project Status:

Based on preliminary testing of the waste stream, sampled from the digester at Noblehurst, a pretreatment stage will be necessary to drop out the insoluble solids (very fine suspended solids below 10 microns) before the Electro-coagulation and the singlet oxygen generator can be expected to operate. The proposal is being modified to incorporate this pretreatment capability.

In search of a pretreatment, Fluid Management has evaluated the use of Bentonite, Ferric Chloride and Polymer mix, mechanical screens, ultrasonic cavitation and systems to dilute the supernate. A decision to opt for a pretreatment system using polymers is expected in mid-October. At that point, the proposal will be resubmitted and evaluated on its merit.

The final report status of nine completed pilot demonstration projects are listed below:

- =====
- A. Swine, North Carolina -----**
Super Soil Systems, USA (#3.09)
Goshen Ridge Farms, LLC - in Clinton, NC
“Solids Removal System to Reduce Environmental Impact of Swine Production”
Report Status: Demonstration project has been completed and final report submitted but awaiting final data from ARS.
 - B. Swine, North Carolina -----**
Air Diffusion Systems (#3.02)
Cavanaugh Farm No. 1 - swine farm in Wallace, NC
“Advanced Microbial Treatment System (AMTS) at Cavanaugh Farm No. 1”
Report Status: Demonstration project completed – final report has been reviewed and written review comments have been submitted to the technology provider on March 10th. A letter has been written to the technology provider suggesting that an independent third party be authorized to resolve/document review comments while the technology provider foregoes receipt of final payment.
 - C. Swine, Iowa -----**
Global Resource Recovery Organization (GRRO) (#3.05)
Burt Farm & Livestock Co. - swine farm in Marshalltown, IA
“Pork Nutrient Management Demonstration”
Report Status: Demonstration project completed and final report has been received. The final report will be revised to reflect the effects of wear and corrosion detected during operation.
 - D. Dairy, Florida -----**
Royal Consulting Services, Inc. (#3.08)
Posey Dairy in Lake Placid, FL
“Florida Dairy Nutrient Management Demonstration”
Report Status: The final report - reviewed, issued and is posted on the FPPC website.
 - E. Poultry, North Carolina -----**
McGill Environmental Systems (#3.06)
Farms in Sampson County, NC
“Nutrient Management Technology for Animal Feeding Operations”
Report Status: The final report - reviewed, issued and is posted on the FPPC website.
 - F. Poultry, North Carolina -----**
Cape Fear Resource Conservation (#3.03)
Central Processing Facility in Duplin County
“Demonstration Optimum Fertilizer of Ash from the BEST Solution for Swine and Poultry Manure Management”
Report Status: The final report - reviewed, issued and posted on the FPPC website.
 - G. Poultry, North Carolina -----**
Mountain Organic Materials (MOM) (#3.10)
Randy Johnson and David Parsons Farms, Wilkesboro, NC
“Demonstration of Poultry Manure and Mortality Forced Aeration Composting Bin Systems”
Report Status: The final report - reviewed, issued and posted on the FPPC website.

H. Poultry, Alabama-----
Renewable Oil, Inc. (ROI) (#3.07)
Mills Poultry Farm in Russellville, AL
“Demonstrating BioOil Technology for Poultry Litter Nutrient Management”
Report Status: The final report – reviewed, issued and posted on the FPPC website.

I. Poultry, Texas -----
RMG Strategies, Ltd and Microganics (#3.11)
Jacobs Ranch in Carmine, TX
Report Status: Demonstration project complete – final report is being prepared.

Appendix 2

Mean values for ortho-P test results on wastewater samples from the operation of the pilot-scale struvite crystallizer. “Lagoon” represents the concentration of ortho-P in the wastewater lagoon. “Acidified” is the wastewater plus an acid, which is meant to bring more ortho-P into solution. “Output” is the ortho-P concentration in the treated wastewater. The table shows that the process performs as expected for ortho-P, that is, on average acidified concentrations are higher than untreated concentrations, and output concentrations are lower than acidified concentrations. Concentrations are given in ppm, as phosphorus.

Location, Date	Lagoon (ppm)	Acidified (ppm)	Output (ppm)	% Reduction (Acidified vs. Out)
Bella, 8/14/2006, conventional method	8.84	25.5	4.77	81.3%
Bella, 8/17/2006, new method test	30.0	60.4	15.0	75.2%
Dairy 2, 8/18/2006, new method	38.2	61.3	28.5	52.8%
Dairy 2, 9/2/2006, new method	34.7	59.0	39.2	32.8%
Dairy 2, 9/3/2006, new method	46.5	61.3	27.1	55.4%

NOTES: Lagoon concentrations ranged from 1.2 ppm to 30.0 ppm at Bella, and 15.8 ppm to 63.1 ppm at dairy 2. This high variability could be due to actual variations in the wastewater, or variations in the sampling, storage, or analysis process. Mean values alone do not reflect this high variability. Similarly, percent reduction varied from a negative value, -5.8% (showing an increase in ortho-P) to as high as 91.9%. Mean values alone do not express this large variability.

While ortho-P results show that the individual components of the system perform as expected, total phosphorus reduction is a more accurate gauge of overall system performance. Total phosphorus results are forthcoming.