FPPC

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

April 16th, 2007

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 January 1st through March 31st, 2007

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 evaluation of submittals from another round of RFPs. A total of twenty (20) proposals were received from eleven (11) states. A Board of Directors meeting is scheduled in April to review and consider funding proposals recommended by the Professional Review Panel.

Final planning for the May Technology Summit in St. Petersburg continues. Registration to date would suggest that attendance will be slightly increased from last year. Information concerning registration is available on line at FPPC's webpage www.fppcinc.org.

OPERATIONS ----------

1. **Additional staffing:** In March, Dr. Robert Carnahan, FPPC Board member, assumed a more active role at FPPC. Dr. Carnahan who is now fully retired from his previous position at USF's engineering school has accepted the position of Managing Director and will help oversee the daily operations of FPPC's technology demonstrations. Meanwhile Bob Monley, FPPC's General Manager, will spearhead FPPC's initiative to find and develop integrated nutrient management systems that are more likely to be economically viable and that can be replicated commercially.

2. **Waste Solutions Forum**: In late February, FPPC staff participated in a regional symposium hosted by Virginia Tech, Virginia State University and the Virginia Cooperative Extension. The symposium, held in Harrisonburg, Virginia, was attended by approximately 200 concerned poultry farm owners as well as researchers from academia and key technology providers. FPPC made valuable contacts in the Shenandoah Valley region, Chesapeake Bay area and had the opportunity to visit a local poultry facility.

3. **Alternative Nutrient Waste Treatment Solutions:** The FPPC Board of Directors met in mid-February in Greensboro on the campus of North Carolina A&T University. The purpose of the mini-session was to orient Board members while providing an outreach for interested faculty and students. Dr. Robert Burns presented an abridged workshop version to approximately 30 participants to Board members, University faculty and students and NRCS.

4. **Economic viability:** FPPC has begun utilizing a "Tiger team" evaluation for the purpose of assessing the commercial readiness and viability of its second generation projects. The intent is to measure capital and operational costs to see if financial benefits are sufficient balanced to justify a replicated system investment in nutrient waste treatment. To date, the data that has been gathered indicates a need for better and more comprehensive performance measurements when treatment is in actual operation. Data comprised from projections, estimates and/or approximations is affecting credibility. While nutrient reductions and outcomes have been well documented, the current project demonstrations do not adequately track all performance factors that impact cost. Another inherent problem encountered thus far is the need to value engineer and better deploy specific equipment, configurations and unit processes in a way that optimizes financial performance of a waste stream that is not identical from site to site.

5. **Working Agreements:** In an attempt to simplify and update FPPC's contractual agreements on projects, efforts have been made to modify and rework language that is more appropriate for farm owners and technology providers.

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A. 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

Process description:

- The treatment system will capture nutrients (nitrates are limiting) from the waste stream of the 2500 dairy cows by combining solid separation, nitrification & denitrification and composting methodologies. The entire system is designed to accommodate new free stall barns with a flushed system
- Gravity - sand separator
- Double - slope screen solid separator
- Tangential flow separator with chemical/polymer addition
- Activated sludge biological treatment
- Removed solids processing in two in-vessel drum composters
- Effluent will be spray irrigated and/or recycled in the flush dairy

Project Status:
Waste treatment at the moment has progressed to the point that the tangential flow separator is now operating. The dairy waste stream is still being batched but the multi-faceted site construction is nearly complete. All animals are now in the new free stall barns, but the nitrification/de-nitrification pond will not be commissioned until the next 30 days and is projected to become stable over the next 60 days.

During a recent site visit, it was learned that the in-vessel composters (equipment funded by others) are experiencing significant mechanical problems. Field weld repairs are underway.

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

Process description:

- 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:

FPPC conducted a site visit to the farm in March to better define the moisture carryover problem to the drum composter and subsequently to the Vincent Corporation to define an action plan for improving moisture separation. Presently, the site has a 16 inch screw press and testing has just been reinitiated.

During the first quarter of 2007, the system was 100 percent operational but the in-vessel drum composter and portions of the manure solids and sludge were too wet to be directly added to the mix. Daily operation records are being collected in addition to the drying characteristics of the sludge and manure solids.

Royal Consulting and FPPC plan to test a more powerful screw press to speed up the processing speed of the soil amendment, even further. Also, improving the drainage system is planned to further facilitate the drying of the solids in the VAT separator. Both the screw press and the drying improvements are scheduled to be completed next month.

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

Process description:

- 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:

During the next month, the poultry waste stream from Foster Farms in Livingston California will be processed and evaluated. This application will test the tempest dryer's ability to handle the nutrient rich mixed waste and process it in a cost effective way. FPPC will review the testing protocol.

When the testing has been completed, the modular unit will be returned to Iowa for testing in a swine application.

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

Process description:

- 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) effluent will be treated by a new electro-coagulation unit.
- Individual contributions of nutrient reduction of the screw press, settling basin and the electro-coagulator units will also be quantified.
- Testing of the Houle 2 stage separator

Project Status:

FPPC has extended the Utah State University to September 2007 in order to continue studying the Houle two stages separators that now follow the induced blanket reactor (IBR)

anaerobic digester. Therefore, data on the two stage separator will be included in the final report.
The electro coagulation (EC) unit has proven to be very effective in removing both nitrogen and phosphorus. (See graphs in Attachment B)

Currently the cost to operate the EC is being evaluated as the process appears to be energy intensive and the cost effectiveness of the equipment is currently under review.

Swine, Kansas (#5.01) ----------
QED Occtech
Springer Farms in Independence, Kansas

Process description:

- A nutrient management system designed for a waste stream for total 3000 animals from sow to finish
- Combines a special designed tangential flow solids separator feeding a composting operation
- Treatment will have sufficient capacity to allow cleanup of the existing lagoons
- Treated effluent water will allow recycling of water instead of use of fresh well water
- Clean water will favorably affect production costs by lowering mortality and application of composted solids will displace commercial fertilizer purchase

Project Status:

The current project is being assessed for its economic appeal before full funding is committed. To date, the comparison of the QED dairy project appears to be sufficiently different that little overlapping knowledge is available for cost analysis.

Dairy, Pennsylvania (#5.07) ----------
Nutrient Control Systems
Mercer Vu Farms in Mercersburg, Pennsylvania

Process description:

- Upgrading the existing nutrient management 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:

From the site visit, FPPC learned that the screw press is now installed and is operational. The conveyor system has also been modified to the proper length to handle solids. For the collection of solids, the existing holding area has been modified for chemical addition and aeration. The composting windrow pad (1.25 acres) is now complete with berms.

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

Process description:

- 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
- Belt press will be installed as the primary solid separator

Project Status:

Site preparation and tests have been completed for each of the key components of the pilot project. Solid separation continues to be a key issue at this site. Negotiations have been completed with AWS, (formally NutraCycle), to provide a belt solid separation system that will hopefully achieved the desire suspended solid removal level. Construction of this belt system will begin in the second quarter.

Dairy/Mixed Waste, California (#5.06) ----------
Agricultural Waste Solutions, Inc.
Inland Empire Municipal Site, Chino

Process description:

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:

The full system processed flushed dairy wastes, dry-corral dairy wastes and horse wastes in the past quarter on a batch basis. The SRM (Solids Recovery Module), the on-farm nutrient recovery component, is fully de-bugged and is consistently producing results comparable to the NCSU trials. The SRM is ready to run on a continuous basis but the full system is not yet

running on a continuous basis because of gas production issues with the GPM (Gas Production Module), the centralized energy production component.

The GPM produces an average of about 3000 cu.ft./gas/hour and an old compressor was obtained from IEUA (our site host) is sized to handle that level of production (50 cu.ft./minute). Initial GPM trials in late 2006 were all with flushed/wet dairy wastes (50-70% moisture), and the compressor was able to handle the fairly even gas production rates. In the past quarter, very dry manure (15-30% moisture) was gasified on several occasions in order to test the system for corral-dried dairy manure and beef feed-lot manure feed stock conditions. These gasification cycles are much less even than with wet manure, with a larger but shorter duration production peak, and the production peaks are at levels substantially above 50 cu.ft./minute. Hence the gas compressor cannot handle the gas production during these peaks, which appear to be in the range of 80-90 cu.ft./minute.

When the gas production exceeds the compressor's capacity, the gas velocity slows and stops, building pressure in the vacuum system. The solid particles in the gas do not spin out in the cyclone and seek out the coldest part of the system, which is the heat exchanger. The result is a formation of tar plugs in the heat exchanger's 96 tubes, blocking the gas passage and trapping gas in the plugs. The gas contains about 1200 ppm of H2S, and the trapped gas in the heat exchanger tubes on a number of occasions eventually produced holes and leaks in the stainless steel tubes.

A number of remedies for this has been attempted; however, the only viable solution is to install a larger compressor that can handle the gas production peaks. A 100 cfm/minute rebuilt compressor has been ordered. With a rebuilt the heat exchanger with H2S resistant tubes another heat exchanger to be needed as a backup/exchange in the future. The GPM was down for 3 weeks for the rebuild. Until a larger compressor is installed, only wet manure will be gasified.

The total energy production of dry manure (gas btu times volume minus energy consumed) is higher than expected, producing up to 70% of the energy of freshly separated manure. Less energy is required in the pyrolysis process to gasify the material, as more energy is consumed in de-watering wetter material. No separation is required prior to gasification, so total production economics of feed-lot and corral-dried material should be very good.

The larger compressor will be installed and the full system is expected to be running on a continuous basis in May.

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

Process description and objectives:

- 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.
- 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:

During the first quarter of 2007, fertilizer trials were initiated at the Colorado State University greenhouse facility, allowing a comparison of P extracted from dairy waste. The greenhouse study officially began on March 2, 2007, and will continue through early July 2007. In preparation for this study, the various phosphorus treatments (including reactor product) were analyzed both chemically and using X-ray diffraction techniques. Recovered struvite and other magnesium phosphate materials were applied in addition to ground phosphate rock and conventional triple superphosphate fertilizer. This design enables the comparison of magnesium phosphates to a wide range of fertilizers in a natural soil, and will hopefully shed light on the relative performance of recovered magnesium phosphate as influenced by soil pH.

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

Process description:
- This 2nd generation technology system deploys a mobile solid separation capability
- It can be deployed to serve multiple farm sites of different scales; however three (3) 800 hog production sites are being interconnected to replicate the waste output of one large swine facility and to test the scalability of this concept.
- 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:

During his recent visit, Mr. Fetterman proposed further investment in his centralized composting and soil amendment facility. Specifically, Mr. Fetterman is attempting to build a large scale facility that will process solids from many swine farm within a 25 mile radius. The current proposal is being evaluated for its economic viability. Much of the data will require further analysis and scrutiny to determine its commercial potential.

Poultry, Wisconsin (#5.04) ----------
R&J Partnership
Creekwood Farms, near Madison
Weiss Poultry Farm in Kewaskum, Wisconsin

Process description:

- Utilizes chicken manure and mortality carcasses, along with a carbon source for conversion into a stable, organic fertilizer derived from laying hen facility
- 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 process is optimized so that Nitrogen values remain 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:

All necessary agreements have been fully executed and a revised Plan of Work has been approved. A site visit has confirmed the suitability of the Creekwood farm and the pilot project is underway.

Dairy, New York (#5.05) ----------
AWS (Animal Waste Systems) and
Fluid Management of New England
Noblehurst Dairy Farm

Project description:

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. A belt press from AWS will be utilized to remove the bulk of the suspended solids coming from the digester.

Project Status:

A technical evaluation has concluded that application of the EC process would be premature until a manageable level of fine solids can be achieved in tis waste stream. At this point all funding efforts are being redirected away from treating the effluent to allow a more thorough pilot test program for solids removal. A comparison of the existing screw press against the experimental belt press has now been authorized.

Dairy, Vermont & New York (#6.02) ----------
AWS (formerly Nutracycle LLC)
Belt press application

Project status:

AWS has visited two FPPC demonstration sites and has revised its proposed scope accordingly to provide a belt presses in both dairy applications.

The projected ship date for the first belt press and accessories is June 11, 2007 in Vermont. Fabrication drawings are nearly complete. In the interim, AWS performed the belt press simulation mid-March and have made the necessary adjustments to the fabric opening sizes and type for re-screening without polymer. Some polymer conditioning is required for re-screening. There is no benefit from re-screening scraped manure without polymer.

AWS and FPPC have agreed to a budget and scope for the second site at Noblehurst Farms in New York.

Dairy, Ohio (#4.07)----------
Crossroads RC&D / Wastewater Services, Inc.
Andreas Farm, Royer Farm

Process description:

- microbial enhancement
- dewatering and complete solid separation
- package plant to treat effluent
- able to achieve nutrient and water quality levels acceptable for discharge

Status:

All agreements have been finalized with the technology providers, RC&D and sent to the farm owners for their signature. The pilot project should be soon underway at the Andreas and Royer Farms.

Dairy, Florida (#5.09)----------
White Technologies Inc.
U.S. Environmental Products, Inc.
North Florida Holstein, Bell, Florida

Process description:

- solids removal via vacuum dewatering bed

Status:

All agreements have been fully executed and pilot project is underway. The technology supplier, White Technologies, Inc. has placed on order all long lead purchased items (steel and epoxy resins) needed for fabrication and site construction.

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

Process Description:

A newly designed swine production facility has been 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:

Developing commercial interest and a partnership with an agricultural supplier has been difficult. After seven suppliers indicated early interest, only one supplier responded with a proposal. This supplier was unwilling to risk any of his own investment for development and cost sharing. The latest status will be revisited with the Board for a final funding decision.

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

Process objective:

- Cost effectively remove nutrients with the lime addition and a metal salts.

Project Status:

QED has reported via testing of the Branford dairy waste stream that the lime additions to the dairy waste stream did not result in a cost effective solution for Phosphorus removal. The next step is to document the test results in a final report. The inability to overcome the pH and the highly buffered waste stream appears to be the key factor.

Attachment A

Final report status of eleven completed pilot demonstration projects is listed below:
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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.

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. An independent third party has been authorized to review the final report.

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: The final report has been reviewed, issued and is posted on the FPPC website.

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 has been 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 has been 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 has been 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 has been 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 has been 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: The final report has been reviewed, issued and posted on the FPPC website.

J. Dairy, Florida ----------

AJT/Agrimond (#3.01)

Watson Dairy in Trenton, FL

Report Status: Demonstration project complete – final report has been received and is currently being reviewed by a third party.

K. Dairy, Wisconsin ----------

Skill Associates – Phase I (#5.08)

Weise Farms in Greenleaf, WI

Report Status: Initial data gathering and testing of the manure combustion process has been completed and documented. A report has been submitted and funding for the next phase has been approved.

Attachment B

Graphs showing partial results of EC study in Utah

ICP analysis showed that the digested manure has 26% and 15% less nitrogen and phosphorus respectively than raw manure (Figures 3 and 4).

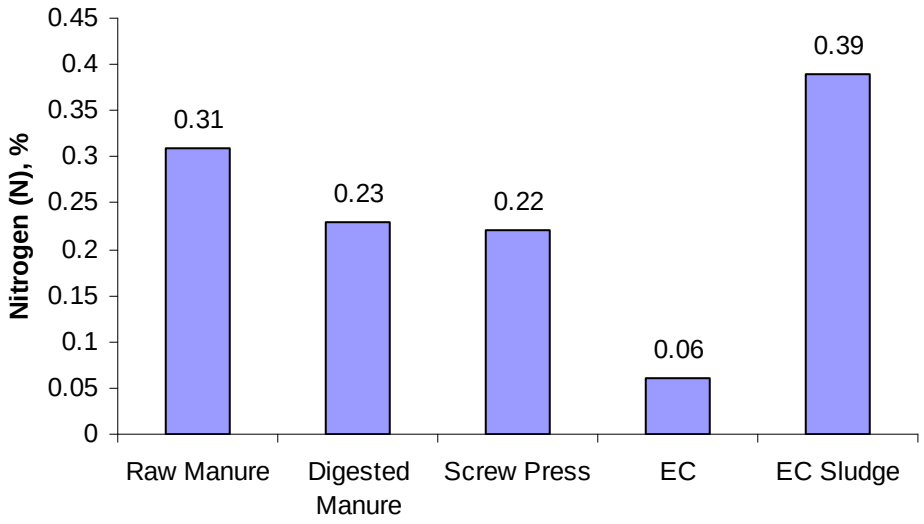

Figure 3. TKN concentrations of manure at different locations along the waste treatment system measured in the fall. Data acquired by ICP analysis.

The EC process was very effective at removing both nitrogen and phosphorus removing 74% and 93% respectively from the liquid waste and concentrating these nutrients in the sludge produced.

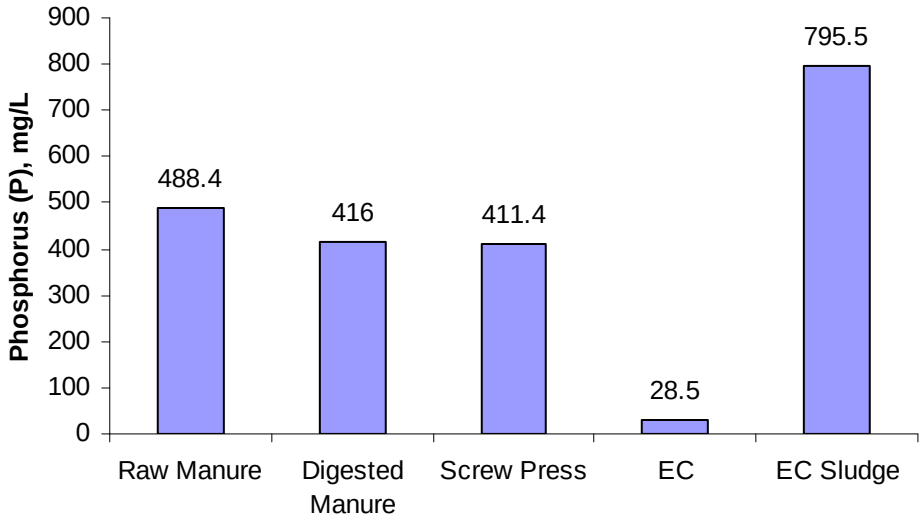

Figure 4. TP concentrations of manure at different locations along the waste treatment system measured in the fall. Data acquired by ICP analysis.