



Agricultural  
Research  
Service



# 2020 FLC EXCELLENCE IN TECHNOLOGY TRANSFER AWARD

## Odor and Ammonia Capping of Swine Lagoons Using High Performance Nitrifiers



Matias Vanotti  
USDA-ARS



Ariel Szogi  
USDA-ARS



Tom Ducey  
USDA-ARS



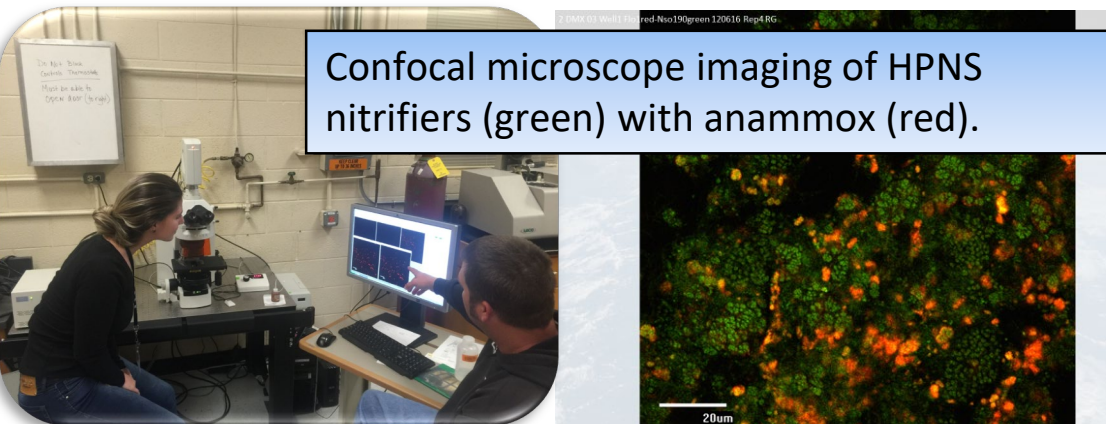
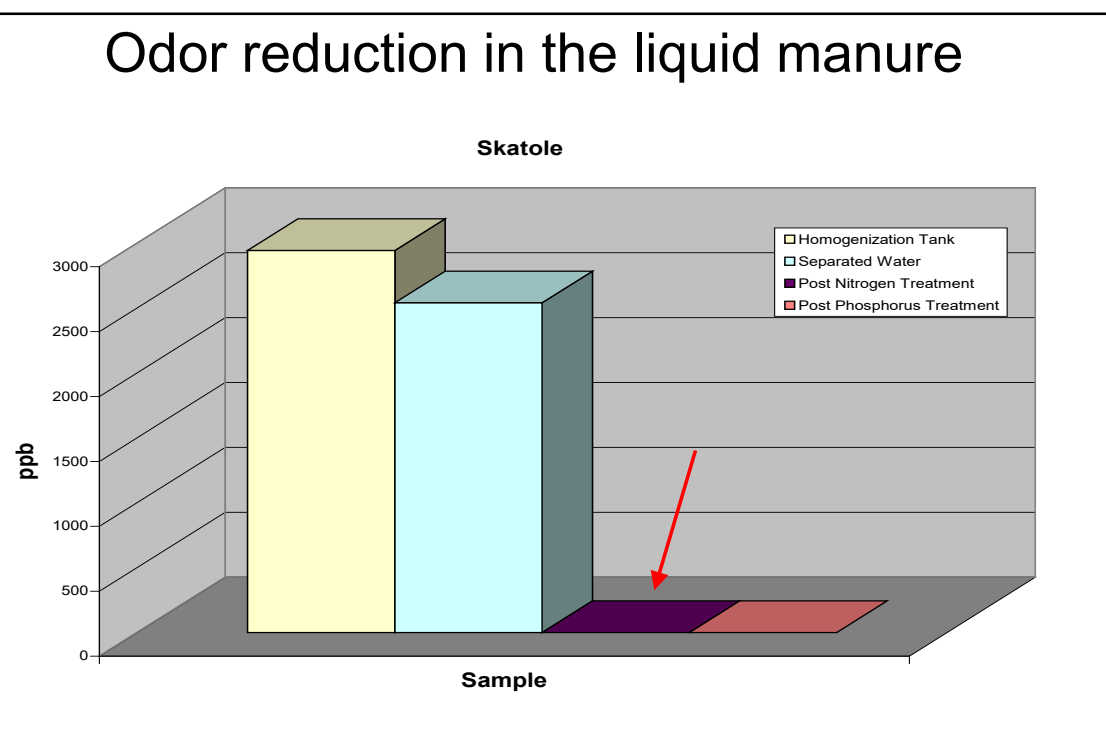
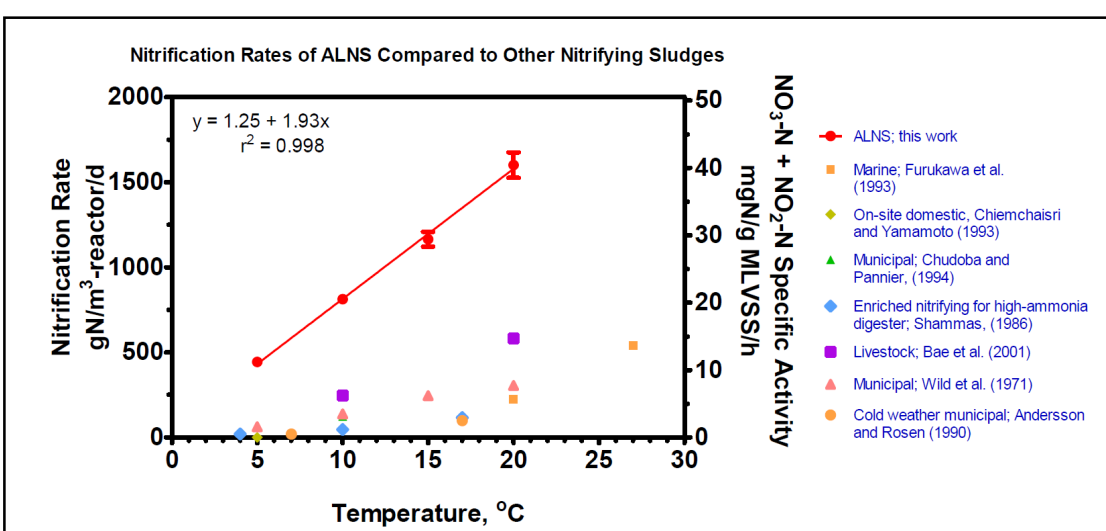
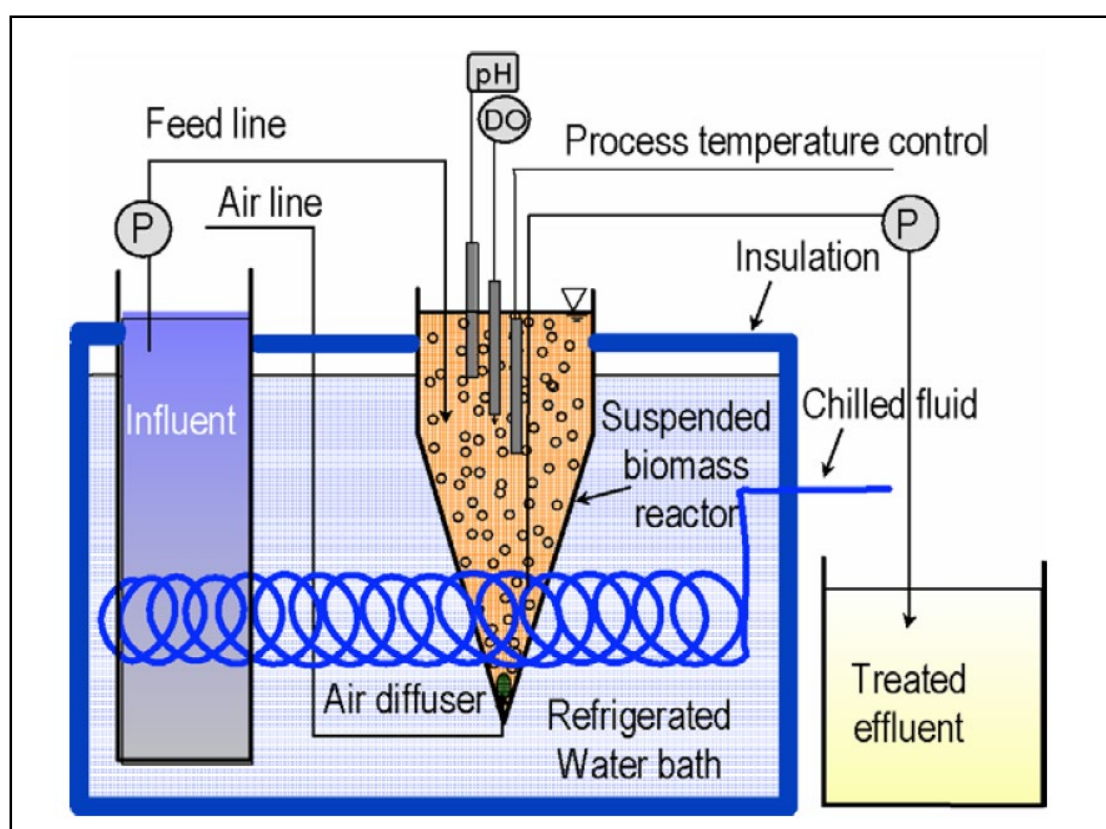
Gail Poulos  
USDA-ARS-OTT



Bill Cumbie  
PANCOPIA, Inc

### High Performance Nitrifying Bacteria (HPNS)

- The technology transferred is a high-performance nitrifying bacterial composition (HPNS) for the economical removal of ammonia and odor from livestock wastewater.
- In the past, both the high ammonia concentration typical in livestock wastewater and cold winter temperatures inhibited nitrification (biological oxidation of the ammonia) resulting in very low nitrification rate. Therefore, the treatment needed huge tanks and capital investment.
- To solve this problem, ARS scientists were successful in the isolation of a novel nitrification microbial community from manure sludges, the HPNS (NRRL B-50298), that provided:
  - rapid reactor start-up and steady performance at high ammonia levels (95% ammonia control), and
  - the highest rate of nitrification treatment found in the world at low temperatures.
  - an oxidized environment that substantially eliminates the odor causing compounds in manure.

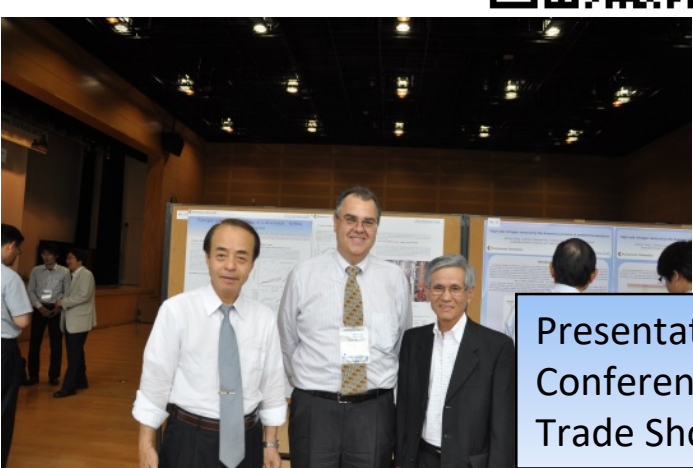


One liter of HPNS is needed for start-up of a 230,000-liter nitrification tank that will continuously remove 100 kg ammonia per day from liquid manure.

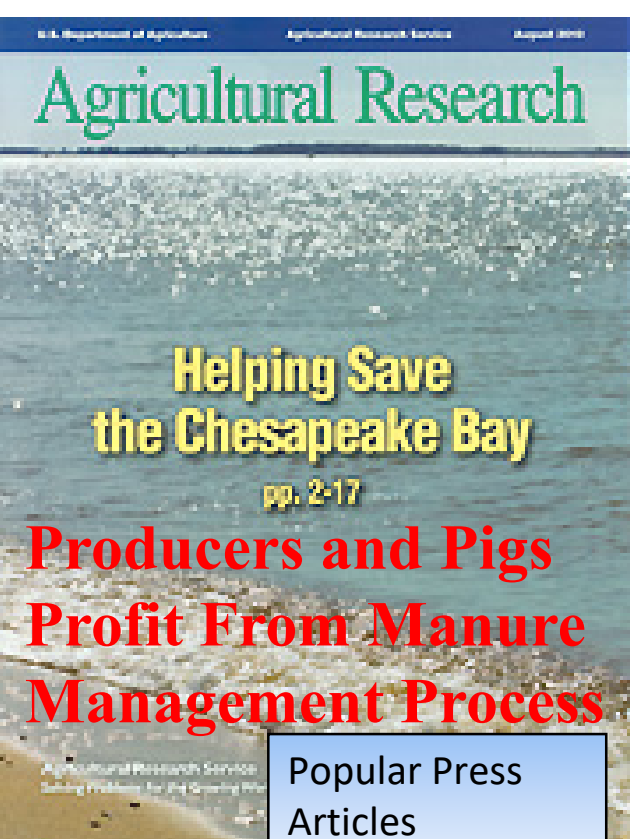
### Technology Transfer Activities

- US Patent No. 8,445,253, entitled, "High Performance Nitrifying Sludge for High Ammonium Concentration and Low Temperature Wastewater Treatment", was issued May 21, 2013
- A Technology Brief highlighted the unique properties of the HPNS and announced ARS' interest in finding business partners to commercialize the technology.
- Science update articles at ARS Agricultural Research Magazine.
- Meetings at the ARS laboratory with interested companies resulting in 3 Material Transfers Agreements (MTA) and 3 Confidentiality Agreements (CA). Two executed co-exclusive licenses were awarded.
- Six journal publications and 10 conference proceedings telling about the performance, usefulness, wastewater applications and value propositions. A Webcast transmitted to practitioners through eXtension.
- Participation at the 1st Symposium on Manure Technologies for Odor and Water Quality Enhancement.
- Numerous presentations at conferences and trade-shows.
- Demonstrations at cCustomer/Partner Workshops at ARS laboratory in Florence SC (70-100 participants).
- ARS laboratory cooperated with Industry in Demonstration and CRADA projects for further development.

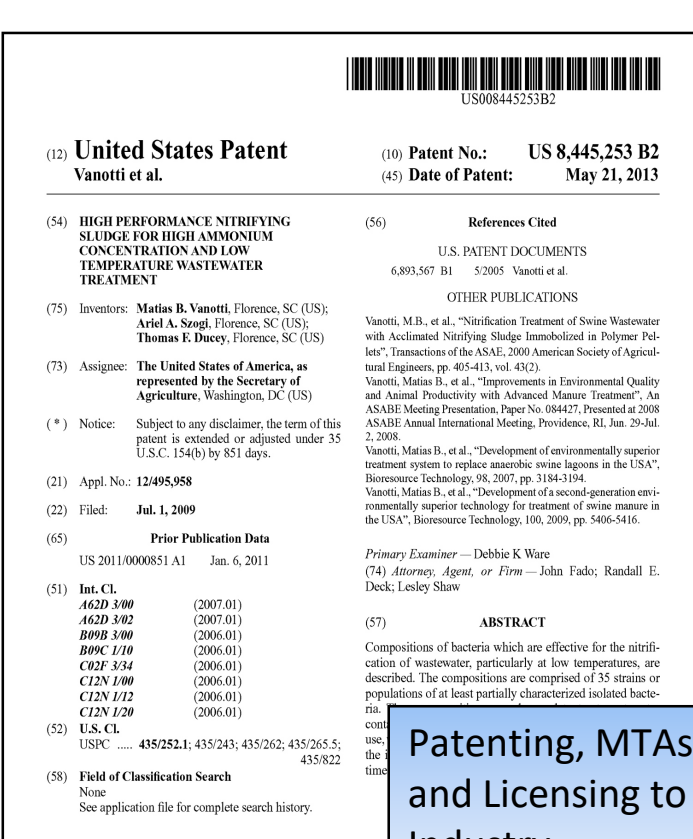
**FLC Success Story:**  
Treating wastewater  
gets cleaner and  
cheaper



Presentations at  
Conferences and  
Trade Shows



Popular Press  
Articles



Patenting, MTAs,  
and Licensing to  
Industry



Research and Demo  
Projects with Industry

DEMONSTRATION PROJECT  
Evaluation of generation 3 treatment  
technology for swine waste. (NC Clean  
Water Management Trust Fund)

CRADA  
Advanced Floating Treatment System  
for Swine Lagoons using  
Deammonification (USDA SBIR)

CRADA  
Removing Ammonia Contamination  
from Biogas Feedstock in Swine  
Farms (DOE SBIR)



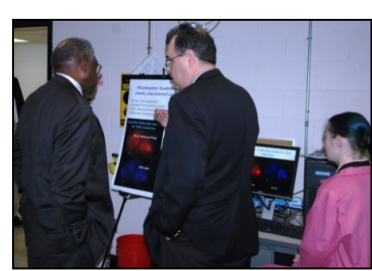
Technology Brief at  
Federal Laboratory  
Website



High Impact  
Publications



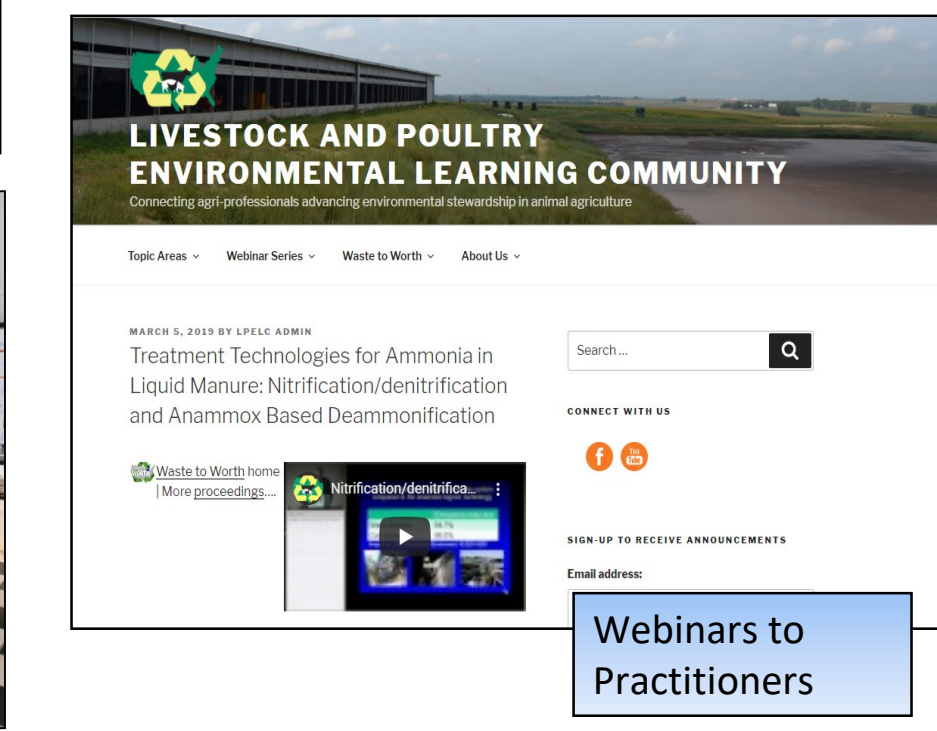
Customer/Partner  
Dialogue Workshops



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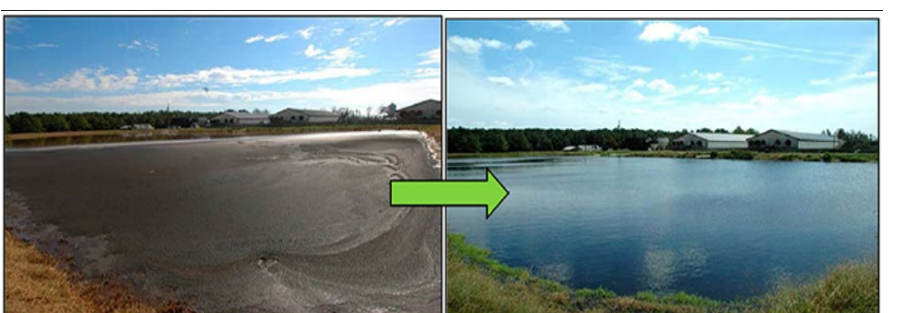
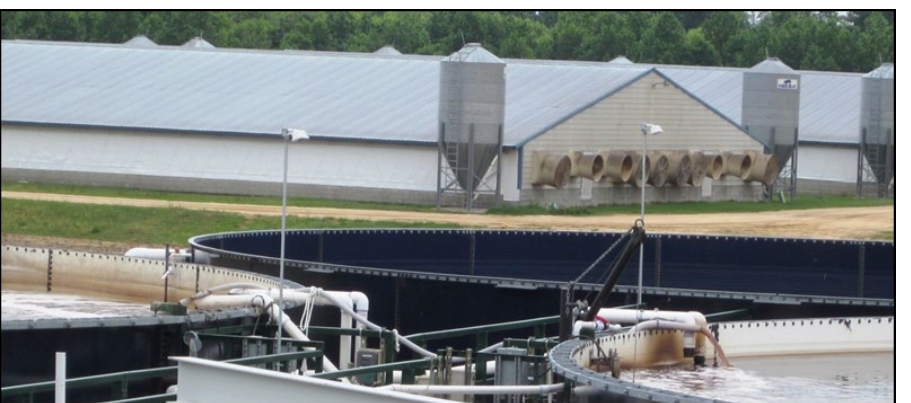
Webinars to  
Practitioners

### How it Benefits Users

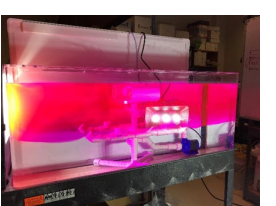
#### Improvements of air quality in farms, and animal health and productivity



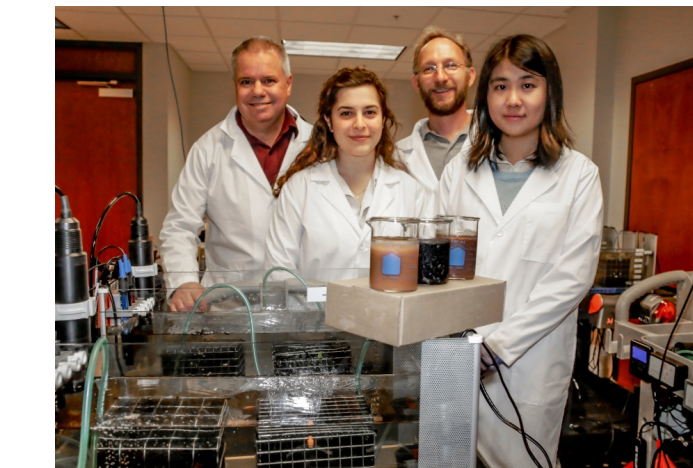
- The licensee Terra Blue Inc. of Clinton, NC, tested HPNS full-scale in 2<sup>nd</sup> and 3<sup>rd</sup> generation manure treatment systems in large swine farms, treating up to 75,000 gal of swine manure per day.
- The projects showed that, with the HPNS, both ammonia and odor emissions from swine facilities can be eliminated 100%.
- The swine lagoons were converted in clean water reservoirs (picture).
- By recycling HPNS treated water to the barns, ammonia inside the barns was reduced 75%. As a result, animal health and productivity were enhanced; the farmer sold 28,100 kg more hogs (a 5.8% increase) per growth cycle..



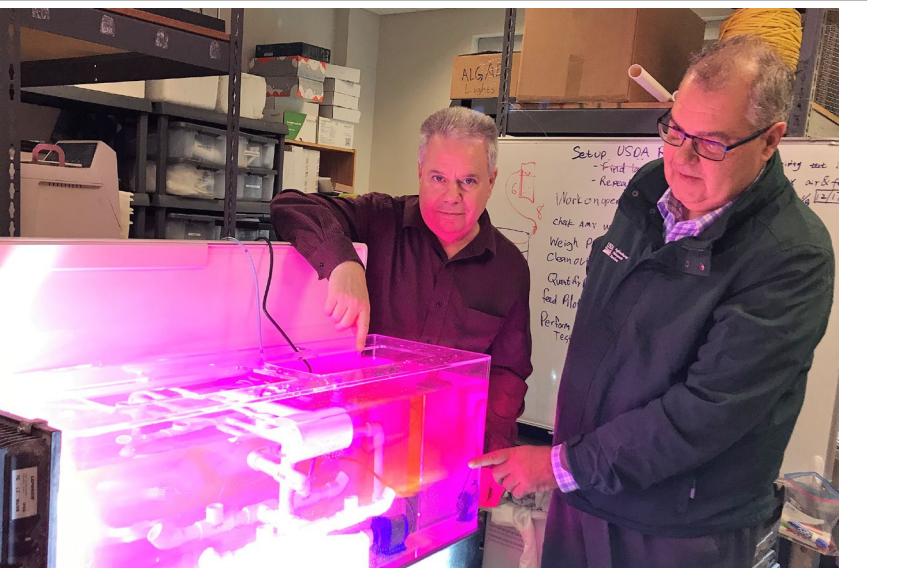
#### Greater system efficiency using strategically positioned nitrification units



- The licensee Pancopia Inc. of Hampton, VA, is using the HPNS for commercialization of the first low cost, effective odor and ammonia capping unit for swine lagoons.
- A significant advance was made in a USDA-SBIR project when the HPNS was placed in media scaffolds in floating units in lagoons.
- Using computational fluid dynamics (CFD), the floating units provided treatment to just an upper layer of the swine lagoon. As a result, cost to remediate odors and gaseous emissions in swine lagoons is significantly reduced by more than half.
- As biogas projects based on animal manure from industrial swine farming become a large-scale reality, unintended consequences arise from the high ammonia wastewater used as a feedstock. Pancopia Inc. was awarded a DOE-SBIR project for removing ammonia contamination from biogas feedstock using HPNS.
- Pancopia Inc. have developed space water purification for NASA using the HPNS and is using the new technology for upgrades in household septic tanks in the Chesapeake Bay watershed. The company is projecting by 2013 to support 15 direct employees and an additional 20 created jobs for fabrication and installation of units.



Pancopia's staff working in development of  
commercial prototypes at Reaktor Accelerator, a  
Business Technology Innovation Center in VA.



Alpha reactors developed using CFD to create a  
layering zone for economical control of harmful  
emissions from swine lagoons.