

**LIFT Scholarship Exchange Experience for Innovation & Technology (SEE IT)**  
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**TRIP REPORT**

**SCHOLARSHIP UTILITY:** *Pima County RWRD – Tucson, AZ*

**SCHOLARSHIP UTILITY CONTACT:** *Jeff Prevatt – Deputy Director, Treatment Division*  
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**ATTENDEES:** *Jeff Prevatt, Tom Berry*

**TRIP DATES:** *May 29-31, 2018 – July 14-20, 2018*

**UTILITIES/SITES VISITED:**

1. AlexRenew Water Resource Recovery Facility, Alexandria, Virginia, USA
2. Ejby Mølle Wastewater Treatment Plant, Odense, Denmark
3. Veolia Water Technologies, Malmo, Sweden
4. Pacques, Groningen, Netherlands

**TECHNOLOGIES/INNOVATIONS SEEN:**

1. Sidestream Anammox – Demon.
2. Mainstream Anammox – Pacques, Granular, Membrane Aerated Biofilm Reactor (MABR).  
Sidestream Anammox – Demon.
3. AnitaMox, Mixed Bed Biofilm Reactors, Integrated Fixed Film Activated Sludge, Anammox Farm.
4. Pacques Granular Anammox for Mainstream and Sidestream application.

**TRIP BACKGROUND and RATIONALE (250 WORDS):**

Anammox is an exciting new tool for biological nitrogen removal of side-stream loads resulting from the dewatering of biosolids with five side stream installations currently in operation and one mainstream installation operational in the United States. It is expected this number will increase dramatically as more utilities demand reductions in energy consumption and take advantage of this energy saving technology. The afore-mentioned side-stream loads can often account for up to 30% of a facility's daily ammonia load, therefore treatment of this waste stream is both necessary and potentially critical for ensuring continued regulatory compliance in addition to reducing aeration-associated energy costs.

Pima County Regional Wastewater Reclamation Department (PCRWRD) is in a unique position to dramatically expand utility exposure to this technology in an innovative and informative way that should assist in gaining acceptance on a much larger scale. PCRWRD, in conjunction with the University of Arizona and Oklahoma State University, recently received a \$350,000 grant from the National Science Foundation to construct, operate and model three variations of the Anammox process for both side stream ammonia removal and implications for main stream adaptation.

Our proposal involved on-site visits to AlexRenew, Ejby Mølle, Veolia, and Pacques facilities, most of which have successfully implemented both side and main-stream Anammox systems. Our aim was to gather

critical information, knowledge, and technical support that will not only benefit our installation next year, but prove critical to the construction of a functioning mobile demonstration facility for maximum impact and information acceleration for the adaptation of Anammox technology throughout the United States.

#### **TRIP SUMMARY:**

The facilities chosen are actively using Anammox for mainstream and/or sidestream ammonia treatment in wastewater treatment, or have developed an Anammox farm, where cultures are used as startup for Anammox treatment. Energy savings were required, and energy neutrality (energy use = energy production) was preferred. Our mission involved on-site visits to AlexRenew, Ejby Mølle, Veolia, and Pacques facilities, where they have successfully implemented both side and main-stream Anammox systems, to acquire critical information, institutional knowledge, and technical support that will not only benefit our installation in coming years, but prove critical to the construction of a functioning mobile demonstration facility for the adaptation of Anammox technology throughout the United States.

Our tour of the AlexRenew Water Resource Recovery Facility took place on May 30, 2018. The AlexRenew facility began operation of a sidestream Anammox treatment of digester centrate in May 2015 using granular Anammox. Their centrate contains as much nitrogen as 25% of the flow in to the facility, but are able to remove 85% of the nitrogen using this process. Anammox has dropped ammonia levels in centrate to approximately 100 mg/l. Evaluation of a mainstream Anammox process is underway. Our discussions here convinced us of the applicability of Anammox treatment in our treatment plants.

A tour of the Ejby Mølle Wastewater Treatment Plant was conducted on July 16, 2018. Granular Anammox is utilized for sidestream centrate and mainstream applications, and is in part responsible for this facility being energy neutral. Challenges using Anammox faced at Pacques include low temperatures, competition with nitrate-oxidizing bacteria, and slow growth. Slow growth and low temperature concerns will not be an issue at Pima County facilities, due to relatively stable waste temperatures throughout the year. The tour here and conversations with managers confirmed that Anammox would thrive in Arizona treatment plants, and the energy savings will be dramatic.

Our only tour of an Anammox farm was at Veolia Water Technologies in Malmo, Sweden. The intention here was to evaluate Anammox carrier technologies used in wastewater treatment mainstream and sidestream applications and potential for our mobile Anammox demonstration facility. The technologies utilized at Veolia were Anammox Carriers or ANITA Mox, and two alternative processes utilizing the carriers, Moving Bed Biofilm Reactors (MBBR) or Integrated Fixed Film Activated Sludge (IFAS). These methods dramatically reduce startup time, and the carrier offers a protective barrier to physical forces placed on the biofilm.

The last stop on this tour was at Pacques in Groningen, Netherlands. This facility was a wastewater treatment plant and Anammox production plant. Anammox technologies utilized were similar to Ejby Mølle, in that granular Anammox were utilized for mainstream and sidestream applications. Unfortunately, much of the information we were hoping to glean was proprietary, and photography was severely limited at this location. Challenges using Anammox faced at Pacques include low temperatures, competition with nitrate-oxidizing bacteria, and slow growth. Slow growth and low temperature concerns will not be an issue at Pima County facilities. Trouble shooting techniques in Anammox treatment were a huge part of our discussions here, as they were at all of our stops throughout our trips.



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All of the technologies we observed in Europe and Virginia have the potential to make a huge impact in Pima County treatment plants, and with the mobile Anammox laboratory we can bring the message to utilities throughout the United States. We expect Anammox treatment to change how wastewater treatment is conducted in the United States based on the facility tours we took on these trips, and we expect Pima County to be at the forefront of Anammox research and innovation for the next ten years.