

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

SCHOLARSHIP UTILITY: New York City Department of Environmental Protection (NYCDEP)

SCHOLARSHIP UTILITY CONTACT: Dr. Dimitrios Katehis, Ph.D., P.E., Executive Director, Wastewater Treatment and Resource Recovery Operation, dkatehis@dep.nyc.gov

ATTENDEES:

- NYCDEP - Aram Aslanian-Persico, Jayne Beckmann, Tony Harilall, Dimitrios Katehis, Natalia Perez, Malak Shafik, Irina Timokhina, Kelly Wu
- City College of New York - Alex Rosenthal, Krishnamurthy Ramalingam

TRIP DATES: December 6th – 7th, 2022

UTILITIES/SITES VISITED: Hampton Roads Sanitation District (HRSD)

- York River – 515 Back Creek Road, Seaford, VA
- James River – 111 City Farm Road, Newport News, VA
- Nansemond – 6909 Armstead Road, Suffolk, VA
- Headquarters – 1460 Air Rail Ave Virginia Beach, VA [*LOCATIONS*]

TECHNOLOGIES/INNOVATIONS SEEN:

Deammonification Technologies [DEMON Sequencing Batch Reactor & ANITA™ Mox Moving Bed Bioreactor], Integrated Fixed Film Activated Sludge, and Mainstream PdNA), SWIFT (Sustainable Water Initiative for Tomorrow) Potable Water Reuse Full Scale Demonstration, Ostara Pearl Struvite Recovery, Multiple Aeration Control Strategies (ABAC & AvN), Cambi Thermal Hydrolysis, Laboratory Information System, Utility/Academic Partnership Model

TRIP BACKGROUND and RATIONALE:

The NYCDEP Bureau of Wastewater Treatment's (BWT) mission is to safely convey and treat wastewater, manage stormwater, and recover valuable resources to protect public health and enhance the environment to sustain the economy and the quality of life for all who live, work and play in New York City. The Bureau's vision of becoming a leader in wastewater resource recovery can only be achieved through the development of a culture of continuous improvement that will be facilitated by the identification and implementation of best practices from across utility spectrum. Key among these is integration of research and technology development into the Bureau's core activities, so as to allow for rapid refinement and adoption of new technologies that will enable the Bureau's mission. The purpose of this trip was to access the lessons learned from a leading-edge utility, so that they can be utilized to meet NYC's future stringent environmental stewardship goals, whether driven by regulatory requirements or social imperatives. Due to the City's limited available land, growing population, climate goals, and environmental initiatives the Bureau anticipates employing methods already instituted at the HRSD facilities and forging a partnership for

implementation at our existing facilities and at potential future consolidated facilities. Some of these efforts have already started coming to fruition, such as the conversion of the existing SHARON facility to a Deammonification MBBR at NYC DEP's Wards Island Wastewater Resource Recovery Facility, which will eliminate the need for three quarters of a million gallons of glycerin, and almost half a million gallons of concentrated caustic solution, per year. HRSD's Dr. Charles Bott and Dr. Stephanie Klaus, were crucial to the streamlining of the deammonification process, allowing it to be simplified so that it could be upscaled and adapted to NYC's centralized dewatering network, where solids from facilities that total more than 500 MGD in operating capacity are routinely processed. Participants had focuses on deammonification as a more reliable nitrogen removal process, thermal hydrolysis and Fats Oils and Grease cleanup and digestion for the beneficial reuse of biosolids and biogas, phosphorus recovery to allow for reduced chemical use while preserving a limited resource, and aeration control strategies (Ammonia Based Aeration Control [ABAC] & Advanced Aeration Control [AvN]) for optimizing existing biological treatment.

TRIP SUMMARY:

On December 6, 2022, NYCDEP sent a team of eight staff, with representatives from Plant Operations, the Office of Energy & Resource Recovery, and the Regulatory Compliance, Strategy, and Technology Innovation directorate, to visit HRSD's York River and James River Facilities. At the York River Treatment Plant, the processes that were of special interest and differ from NYC's include: side stream DEMON Anammox SBR operations, intermittent aeration, and denite filters. The DEMON Anammox process for deammonification uses sensors for pH, conductivity, DO, and temperature to monitor process conditions for effective nitrogen removal. The intermittent aeration is controlled using programming logic to seamlessly transition aeration zones into anoxic on cycles. Denitrification filters are used to continue the reduction of Nitrite and Nitrate prior to discharging into receiving waters.

At the James River Treatment Plant, we toured the facility for ANITA™ Mox Moving Bed Biofilm Reactor (MBBR) for sidestream, deammonification MBBR implementation for mainstream, mainstream Integrated Fixed Film Activated Sludge (IFAS), hydrocyclones and gravity belt thickeners. At this facility, HRSD conducted pilots to test different types of media to determine the optimal size, shape, and surface area for the growth of Anammox bacteria. Comparing the growth of these microorganisms in mainstream versus sidestream treatment was informative. The use of hydrocyclones and gravity belt thickeners are used for improved solids separation. Both technologies have smaller footprints than the gravity thickeners typically used at NYCDEP and have the potential for cost savings from improved solids handling downstream.

On December 7, 2022, the NYCDEP team first visited the SWIFT research facility at Nansmond Treatment Plant before touring the plant. The SWIFT Program is utilized to recharge the aquifer and to prevent land subsidence and saltwater intrusion to create potable water. The additional steps to treat the wastewater, and laboratory analysis completed to ensure the effluent matches the existing groundwater, go above and beyond expectations, and all for the benefit of future generations. After this the team explored the Ostara-P, phosphorus recovery, system. This process allows the facility to precipitate struvite and generate fertilizer grade product for beneficial reuse on farms. Along the route, we toured the mainstream process of the facility, the secondary

treatment blower air is currently being operated using ABAC and will be transitioning to AvN. A similar pilot is being conducted at the Wards Island WRRF to introduce ABAC in one of the aeration tanks with future controls in AvN.

The Atlantic Treatment Plant's Thermal Hydrolysis Process (THP) Cambi was presented virtually due to maintenance. This process generates Class A Biosolids, is near energy neutral since it utilizes biogas, and greatly reduces sludge hauling volume, through a combination of increased volatile solids destruction (70+% volatile solids destruction versus the 50-55% volatile solids destruction typically encountered in mesophilic digestion) and enhanced dewaterability of the ensuing biosolid product, achieving a 5-10% increase in dryness versus conventional treatment.

Both the Atlantic and Nansemond facilities process fats, oil, and grease (FOG). Within the Atlantic facility, THP is utilized to process FOG thereby increasing biogas production, and at the Nansemond facility, FOG is turned into bunker fuel.

To conclude our trip, NYCDEP staff visited the main headquarters' laboratories where samples are analyzed, experimental pilots are tested, and source tracking of wastewater is completed. The microbial source tracking program, which originally used the associated sampling and molecular biology analytical tools to identify and track human fecal contamination, evolved during COVID to support the regional health department with COVID monitoring. It is currently working on surveillance of other pathogens in the wastewater including influenza, monkeypox and polio. At the headquarters, we learned more about HRSD's QA/QC procedures, certifications of laboratory staff, and their laboratory information management system (LIMS).

Why did you select the specific utility and technology for the visit?

This specific utility was chosen to learn from based on their success in not just the start-up of multiple innovative wastewater treatment processes, but also innovative business processes that allow HRSD to continuously identify and implement new technology to their treatment systems. These range from the deammonification facilities, to the instrumentation systems, the in-house SCADA support capabilities, the standardization of equipment, SCADA and treatment processes across multiple facilities. The continued use of these technologies over the years have assisted HRSD in finding optimization opportunities along the way.

NYCDEP further capitalized on the experience by learning more about other technologies that will aid in the bureau's environmental stewardship goals.

On your visit, do you think this technology/approach works for your utility?

Multiple technologies were assessed as part of this site visit to HRSD's facilities. The applicability of individual technologies ranged from immediately applicable to topic of future research. For example, the deammonification MBBR process will be deployed at the Wards Island WRRF for nitrogen removal from anaerobically digested biosolids' dewatering centrate. Similarly, the ABAC system is in the process of starting up at Wards Island for one battery in mainstream treatment, based on previous engagements with the HRSD and DC Water team. The application of these

technologies at Wards Island will be on a larger scale, however by visiting the site we hope the professional relationships developed will better prepare our team for the challenges ahead. Other technologies observed that are applicable to NYCDEP's future growth and environmental stewardship goals will be considered for further assessment in the future. These include the mainstream deammonification permutations and the SWIFT suite of technologies.

How useful was the trip in your decision-making process?

Gaining a stronger understanding of how HRSD transitioned into a leadership role within the industry, that allowed it to create what is now a decades long track record of technical and organizational innovation allowed the NYCDEP team to recognize that this transition is possible in large, multi-facility organizations. By demonstrating that developing and retaining the engineering, laboratory and operations staff that allow HRSD to operate at this heightened level of performance was possible, the DEP left HRSD energized and ready to take on new challenges in DEP's ongoing transition to a higher performing organization.

What were some of the trip highlights and takeaways?

- Seeing the different types of media tested by the HRSD team to determine the best shape and size to grow biofilm in the future MBBR.
- Successful use of the Emerson Ovation System for SCADA, with extensive in-house capabilities to support maintenance and optimization efforts.
- The expansion of the Microbial Source Tracking program and partnership with their local/state health department.
- The evolution of the SWIFT Program's technologies to recharge the Potomac Aquifer, including the development of a novel technology to treat dioxane in the water.
- The HRSD approach of planning ahead for a more complex future was educational and inspiring.
- Gathering with environmental professionals who are all working towards a better tomorrow should be done more often, a very special thank you to HRSD for hosting!



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