Thank you to our Patrons

We will begin our presentation in a few minutes...
The Delaware Solid Waste Authority (DSWA) was created in 1975 by the State of Delaware to manage solid waste for the entire state. Our mission is to “Define, develop and implement cost-effective plans and programs for solid waste management, which best serve Delaware and protect our public health and environment”. Currently we manage over 1 million tons per year of waste and recyclables at our facilities which include a single-stream Material Recovery Facility, a Construction and Demolition Processing Facility, a Household Hazardous Waste Program, a battery recycling program, three Transfer Stations, five rural waste drop-off stations and three state-of-the-art Landfills.
Innovative Membrane-Based Approach for High-Strength Industrial Wastewater Reuse

Samik Bagchi, Ph.D., BCES
Director of Innovation
Digested Organics
AAEES Board Certified Environmental Scientist with a specialty in Environmental Microbiology
Innovative membrane-based approach for high-strength industrial wastewater reuse

Samik Bagchi, Ph.D. BCES
Director of Innovation
Industrial Wastewater

- ~ 800,000 GPD
- 1.5% Total Solids (TS)
- ~30,000 mg/L of Chemical Oxygen Demand (COD)
- pH 4.5
Why Zero Liquid Discharge (ZLD)?
How to make it a ZLD?
Dewatering

Dissolved Air Floatation (DAF)

Centrifuge

- Need polymer
- Poor Dewatering
Pre-treatment

- Expensive!
Self-Cleaning Screens
Superfiltration (SF)!

<table>
<thead>
<tr>
<th>Particle Range</th>
<th>Particulate Range</th>
<th>Macro Molecular Range</th>
<th>Molecular Range</th>
<th>Ionic Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filtration or Membrane Type</td>
<td>Cartridge Filtration</td>
<td>Ultrafiltration</td>
<td>Nano-filtration</td>
<td>Reverse Osmosis</td>
</tr>
<tr>
<td>Approx. Microns</td>
<td>10</td>
<td>1</td>
<td>.1</td>
<td>.01</td>
</tr>
<tr>
<td>Approximate Molecular Weight</td>
<td>500,000</td>
<td>100,000</td>
<td>20,000</td>
<td>10,000</td>
</tr>
</tbody>
</table>

- 500-3,500 Daltons
- pore size 1.0 – 1.2 nm
A New Material Chemistry

- Zwitterionic co-polymer chemistry
- Low fouling
- Handle organic compound
SF Pilot Testing
SF Performance

Flux (LMH), Permeance (LMH/bar)

- Avg Flux
- Avg Permeance
- Perm Recovery

Cleaning

Permeate Recovery (%)
SF Concentrate
Sub-Induction Time Reverse Osmosis™ (SIT-RO)
SIT-RO Performance

Repeat batch RO processing reduces fouling and energy use
## SIT-RO Performance

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Units</th>
<th>SIT RO Permeate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total solids</td>
<td>%</td>
<td>0.01</td>
</tr>
<tr>
<td>Chemical oxygen demand (COD)</td>
<td>mg/L</td>
<td>880</td>
</tr>
<tr>
<td>Biochemical oxygen demand (BOD)</td>
<td>mg/L</td>
<td>426</td>
</tr>
<tr>
<td>Organic nitrogen</td>
<td>mg/L</td>
<td>10.3</td>
</tr>
<tr>
<td>pH</td>
<td>S.U.</td>
<td>3.16</td>
</tr>
</tbody>
</table>
Polishing RO
Evaporation
Process Flow

EQ Tank → Screen → SF → SIT-RO → pRO

Send for Analysis

Vacuum Evaporator → Animal Feed

Reuse Water

Raw Feed
Permeate
Concentrate
Take Home

• ~ 800,000 GPD of Industrial Wastewater

• > 80 % of it recovered as clean water for reuse

• Dry product would be sold as animal feed

• Skids under construction

• Would be operational in 2023
For more information, please contact:

**Bobby Levine | +1 847-707-8433**

robert.levine@digestedorganics.com

http://www.digestedorganics.com
Q and A

If you have a question, just click on the Q and A icon on the bottom of the screen and type it in there.
Getting Creative with Engineering Management

Rosaleen B. Nogle, P.E., BCEE, CFM
Principal Sanitary Engineer
Buffalo Sewer Authority

AAEES Board Certified Environmental Engineer with a specialty in Water Supply and Wastewater.
Getting Creative with Engineering Management:

Why change is needed in engineering management; questions to ask to challenge the way we have always done things; potential solutions.
Who Am I?

- Principal Sanitary Engineer
- Buffalo Sewer Authority
- PE, BCEE, etc...
The generations defined

**Millennials**
- Born: 1981 to 1996
- Age in 2019: 23 to 38

**Generation X**
- Born: 1965 to 1980
- Age in 2019: 39 to 54

**Baby Boomers**
- Born: 1946 to 1964
- Age in 2019: 55 to 73

**Silent Generation**
- Born: 1928 to 1945
- Age in 2019: 74 to 91

What do generational groups mean?
No one wants to work anymore

- Retirements
- Replacement
- COVID
- Experience

**Births underlying each generation**

*Number of U.S. births by year and generation*

Source: U.S. Department of Health and Human Services National Center for Health Statistics.

PEW RESEARCH CENTER
Need to diversify who gets hired

- Women and other under-represented genders
- Ethnic and racial minorities
- Foreign born
Old model

• Drafting
• Surveying
• Calculations
• Design
• Reports
Problem

- Not enough engineers to do it
- Engineers cost too much to do it
- We are not great at everything
Multi-disciplinary Team

- GIS Specialists
- Clerks
- Grant Management Specialists
- Planners
Lowering the Bar?

- Skills critical
- Grants and strings
  - BIL
  - ARP
  - IRA
- But engineers not best at them
Little kids playing soccer
Professional Soccer
What skills do we need?

What work do we actually need to get done?
Who do we have on our team?

- Skills
- Knowledge
- Abilities
- Hobbies?
- Other Background Info?
What skills are we missing?
How can we add them?

Contracts?

Job Titles?

Training?
How do we pass the ball?

• Taking the pressure off?
• Ensuring consistency?
• Keep moving?
Success?

2019
Five engineers, one LA 2019

2023
Two engineers; three GIS Specialists 2023
• Still gaps to fill
• Iterative process
• Need to look at job titles
GIS and Webpage being maintained

Stormwater permit work accelerated

Other tasks moving
My workload

- Engineering
- Management
- Web Design
- GIS App Development
- Grant Management?
Engineers

- Cost too much
- Are in too high demand
- Doing things that we are not good at

Solution

- Identify workload
- Lower paid supplemental titles
- Contract out to specialists
- Ensure transition
Q and A

If you have a question, just click on the Q and A icon on the bottom of the screen and type it in there.
Decade long water issues, spread of the COVID-19 pandemic, and the road forward

Abhishek RoyChowdhury, Ph.D.
Assistant Professor, Environmental Science & Natural Resources
Navajo Technical University
AAEES Member
Decade long water issues, spread of the COVID-19 pandemic, and the road forward: An untold story from the Navajo Nation

Abhishek RoyChowdhury, Ph.D.
Assistant Professor, Environmental Science & Natural Resources
Navajo Technical University
The Navajo Nation
Homes Without Water on the Navajo Nation

Legend:
- Economic Growth Centers
- Proposed Pipeline
- NTUA WaterMains
- Homes w/o Water

Source: The Salt Lake Tribune. July 25, 2020
Water scarcity on the Navajo Nation - Natural Causes

D0: Abnormally Dry; D1: Moderate Drought; D2: Severe Drought; D3: Extreme Drought; and D4: Exceptional Drought. (Source: The National Drought Mitigation Center, University of Nebraska-Lincoln, 2021)
Water scarcity on the Navajo Nation - Anthropogenic Causes
Navajo Nation COVID-19 map. Darkest areas have higher COVID-19 cases
Water Scarcity on Navajo Nation
Leading causes of death by cancer site among the Navajo, counts of deaths 2005-2013, all ages

Source: The Navajo Epidemiology Center

<table>
<thead>
<tr>
<th>Cancer Site</th>
<th>0</th>
<th>50</th>
<th>100</th>
<th>150</th>
<th>200</th>
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<tbody>
<tr>
<td>Colorectal</td>
<td></td>
<td></td>
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<tr>
<td>Stomach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>150</td>
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<tr>
<td>Pancreas</td>
<td></td>
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<td>138</td>
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<tr>
<td>Female Breast</td>
<td></td>
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<td>124</td>
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<tr>
<td>Liver</td>
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<tr>
<td>Prostate</td>
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<tr>
<td>Kidney</td>
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<td>110</td>
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<tr>
<td>Lung</td>
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<td></td>
<td>96</td>
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<tr>
<td>Ovary</td>
<td></td>
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<td>87</td>
</tr>
<tr>
<td>Gallbladder</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>43</td>
</tr>
</tbody>
</table>
NTU-NMT Navajo Nation Water Purification Project (N⁴WPP)

www.navajotech.edu/restore
Hollow fiber membrane-based direct contact membrane distillation (DCMD) process
Basic principle of DCMD processes.

Schematic drawing of Janus hollow fiber membrane (J-HFM) for DCMD.
Preliminary Results - Lab Study

- **Original**: 51,600 mg/L
- **Filtered water**: 17 mg/L
- **US EPA drinking water standard**: 500 mg/L

For trace metals:
- **Arsenic**, **Chromium**, **Lead**, **Selenium**, **Uranium**: 100% removal, with concentrations below the detection limit (1 mg/L).

**Note**: The charts illustrate the concentration of total dissolved solids (TDS) and the removal of trace metals compared to the US EPA drinking water standards.
Desalination performance of the Janus HFM DCMD process

<table>
<thead>
<tr>
<th></th>
<th>neat PVDF HFM</th>
<th>J-HFM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flux (kg/m²h)</td>
<td>22.1</td>
<td>26.11</td>
</tr>
<tr>
<td>Salt rejection (%)</td>
<td>99.99</td>
<td>99.99</td>
</tr>
<tr>
<td>EE (%)</td>
<td>55.64</td>
<td>72.45</td>
</tr>
</tbody>
</table>

![Graph showing water recovery and operating time for neat PVDF HFM and dual-layer Janus HFM.](image)
Water Filtration Unit Ready for Operational Testing
We are working with the communities
Questions?
aroychowdhury@navajotech.edu

Thank You
Please visit: http://www.navajotech.edu/restore/
Q and A

If you have a question, just click on the Q and A icon on the bottom of the screen and type it in there.
A Voice for Biosolids

Maile Lono-Batura, BCES, MNPL
Director of Sustainable Biosolids Programs
Water Environment Federation
AAEES Board Certified Environmental Scientist with a specialty in Sustainable Science.
A Voice for Biosolids: Telling Our Story

Maile Lono-Batura
Director of Sustainable Biosolids Programs
Water Environment Federation
Why Biosolids?

Image: Kitsap Sun

Image: Regional District of Nanaimo
Grand Challenge

Image: King County Wastewater
Enter the Clean Water Act

50 YEARS OF THE
CLEAN WATER ACT
1972-2022
Municipal biosolids — A resource for sustainable communities
Sally Brown¹, James A. Ippolito², Lakhwinder S. Hundal³ and Nicholas T. Basta⁴

The Clean Water Act and biosolids: A 45-year chronological review of biosolids land application research in Colorado
James A. Ippolito | Ken A. Barbarick
What We Know
What We Know
What We Know
What We ALSO Know

BYE-BYE
The Narrative - Internal
Biosolids Are Unique
Unique Approach
Engagement Examples

WEB PRESENCE
Bold initiatives invite engagement

HEADLINES
Market alignment with products & messaging
Engagement Examples

**FUN FECAL FACT**

**FATBERG AHEAD**

London is host to the Royal Family, Thames River, London Loo Tours, and a creature of gigantic proportions beneath the city - a 130-ton fatberg sloughed together from grease and wipes. Encountered in 2017 and estimated to possibly be the largest on record. A crew harnessing fatberg blasters, had to work around the clock to de-chunk it bit by bit.

**WHAT SECRET WEAPON WOULD YOU WIELD TO BLAST THE FATBERG?**

**FUN FECAL FACT**

**LET'S GET PERSONAL**

When you flush, computing your daily or annual contribution of the recovered poo pie is not likely on your radar. That is unless you are part of an elite audience seeking to lift the lid to understand the the power beyond the flush.

A few facts on annual production to stash in your back pocket:

- U.S. total = 5.823 million dry metric tons
- You = 37 lbs average per person
Flusher Engagement – Our Story

2022 YEAR OF POO

https://yearofpoo.org

https://www.viewpointproject.com/ptv-segments-biosolids/
New Challenge—Opportunity
Power Beyond the Flush

Thank you!

Maile Lono-Batura, BCES, MNPL
mlono-batura@wef.org
Q and A

If you have a question, just click on the Q and A icon on the bottom of the screen and type it in there.
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A recording of today’s event will be emailed to all attendees.

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Need a PDH Certificate?
You will be emailed a PDH Certificate for attending this webinar within the next week.

Questions?
Email Marisa Waterman at mwaterman@aaees.org with any questions you may have.