

# Northeast Digestion Roundtable 2019

Quarterly webinars to share technical operations experiences & advance best practices regarding anaerobic digestion in this region.

## NEDR # 14: Microbial Ecology of New England's Anaerobic Digesters



### INSTRUCTIONS

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The screenshot shows a webinar interface with several callouts:

- Ask questions / chat**: Points to a green speech bubble icon.
- Click to see list of participants**: Points to a grey icon with a list symbol.
- More controls & settings**: Points to a grey icon with a gear symbol.
- Leave meeting / Exit**: Points to a green icon with a red 'X' symbol.

An "Audio control & details" panel is visible, containing a "Waiting for the host..." message and a "Call by phone" pop-up window. The pop-up window includes a "Dial" dropdown menu set to "United States - Hartford", a phone number "+1.866.970.0010", and a "Conference ID: 236-940-048". A callout points to this pop-up with the text: "This box pops up when you click the audio control. Pick a phone number & dial in, entering the conference ID."

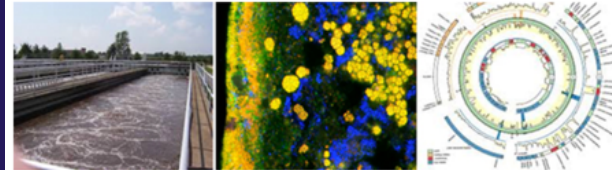
# Microbial Ecology of New England's Anaerobic Digesters

Caitlyn Butler and Nick Tooker  
University of Massachusetts, Amherst  
For  
The New England Biosolids RoundTable  
October 4, 2019

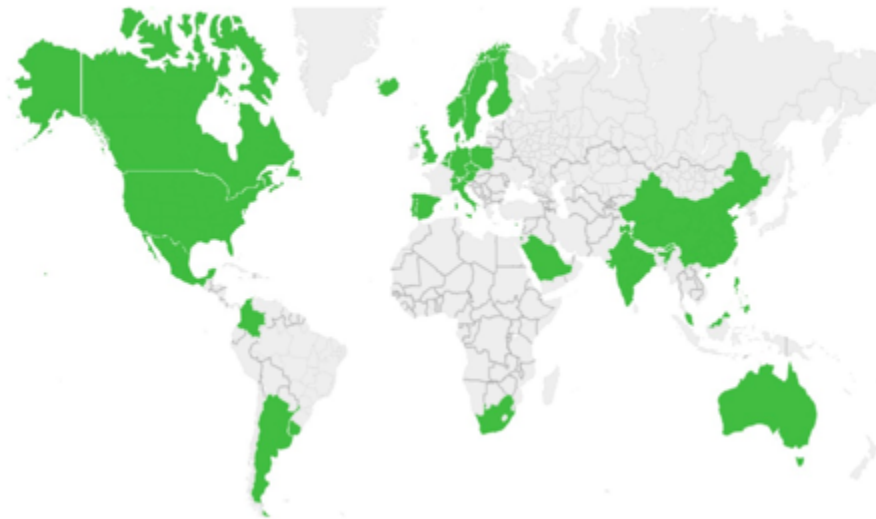
# Global Sampling Campaign of Ecology of Wastewater Treatment



**MIDAS: Field Guide to the Microbes of  
Activated Sludge and Anaerobic Digesters**



**Map and list of coordinators**



# First Sampling Campaign for Activated Sludge

Original article

## MiDAS: the field guide to the microbes of activated sludge

Simon Jon McIlroy<sup>†</sup>, Aaron Marc Saunders<sup>†</sup>, Mads Albertsen, Marta Nierychlo, Bianca McIlroy, Aviaja Anna Hansen, Søren Michael Karst, Jeppe Lund Nielsen and Per Halkjær Nielsen\*

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<sup>†</sup>These authors contributed equally to this work.

Citation details: McIlroy,S.J., Saunders,A.M., Albertsen,M., et al. MiDAS: the field guide to the microbes of activated sludge. *Database*, Vol. 2015, Article ID bav062; doi:10.1093/database/bav062

Received 25 February 2015; Revised 13 May 2015; Accepted 27 May 2015

(a) **Browse**

Search by: Metabolism  Fermentation in situ  **Browse**

Displaying 1-4 entries of 4 - Display data:  As table  Phylogenetically **Export table**

Canonical Name	Phylum	Filamentous	AOB	NOB	PAO	GAO	Nitrite reduction	Fermentation	Median
Comaetibacter	Proteobacteria	●	●	●	●	●	●	●	0.0
P2CN64	Chloroflexi	●	●	●	●	●	●	●	1.0
Propionilimonas	Actinobacteria	●	●	●	●	●	●	●	0.5
Tetrasphaera	Actinobacteria	●	●	●	●	●	●	●	8.7

● POS ● NEG ● Variable ● Not assessed

(b) **Browse**

Search by: Metabolism  Fermentation in situ  **Browse**

Displaying 1-4 entries of 4 - Display data:  As table  Phylogenetically **Export table**

- Bacteria
  - Proteobacteria
  - Chloroflexi
  - Actinobacteria
    - Actinobacteria
      - Propionibacteriales
        - Propionibacteriaceae
          - Propionilimonas
    - Micrococcales
      - Intrasporangiaceae
        - Tetrasphaera

<http://www.midasfieldguide.org/en/search/>

# First Sampling Campaign - Example Output

The 50 most abundant genera found in the sample set

	LIB-DNA-MD025-US2-14-A-1 -	LIB-DNA-MD025-US2-14-B-1 -	Country average	Global average	Global avg. of same WWTP type
Proteobacteria; Rhodocyclaceae; Ca_Accumulibacter	11.48	11.71	1.06	0.94	2.08
Proteobacteria; Polyangiaceae; midas_g_2635	7.75	8.49	0.96	0.95	0.1
Proteobacteria; Burkholderiaceae; Hydrogenophaga	0.79	0.77	0.31	0.63	0.29
Actinobacteria; Propionibacteriaceae; Propionibacterium	4.65	4.6	0.17	0.11	0.3
Bacteroidetes; Flavobacteriaceae; Flavobacterium	4.52	4.57	1.29	1.56	1.77
Proteobacteria; Rhodocyclaceae; Zoogloa	3.17	3.31	2.87	1.77	1.14
Proteobacteria; Burkholderiaceae; Burkholderia	3.02	2.88	0.95	1.32	1.6
Proteobacteria; Burkholderiaceae; Limosilobella	2.78	2.87	0.58	0.5	0.33
Proteobacteria; Actinobacteriaceae; Actinobacter	2.25	2.13	0.43	0.96	0.89
Proteobacteria; Burkholderiaceae; Legionella	1.49	1.49	0.23	0.42	0.4
Bacteroidetes; Chitinophagaceae; Parachanna	1.52	1.29	0.25	0.51	0.43
Proteobacteria; Burkholderiaceae; midas2_9929C	1.28	1.27	0.37	0.36	0.89
Proteobacteria; Burkholderiaceae; Acidithiobacillus	1.02	1.12	0.83	1.11	0.96
Proteobacteria; Rhodocyclaceae; Dechloromonas	1.12	1.2	2.01	2.06	3.1
Proteobacteria; Bifidobacteriaceae; midas_g_200	1.17	1.14	0.97	0.83	0.87
Firmicutes; Carnobacteriaceae; Thermococcus	1.13	0.99	0.2	0.63	0.51
Actinobacteria; Intrasporangiaceae; Tetrasphaera	1.23	0.95	1.59	2.13	4.75
Bacteroidetes; Saprospiraceae; midas_1_1084	0.99	0.98	0.25	0.42	0.44
Bacteroidetes; oryOPS_17; midas_g_4322	0.98	0.96	0.13	0.17	0.18
Actinobacteria; Actinomycesaceae; midas_g_353	1.09	0.78	0.96	0.95	0.99
Proteobacteria; Rhodocyclaceae; midas_g_24	0.85	0.9	0.37	0.33	0.92
Bacteroidetes; Saprospiraceae; midas2_CYCU-3231	0.62	0.52	0.49	0.42	0.53
Bacteroidetes; Sphingomonadaceae; Novosphingobium	0.79	0.77	0.26	0.34	0.44
Proteobacteria; Rhodocyclaceae; Rhodococcus	0.66	0.75	0.4	0.27	0.55
Proteobacteria; Rhodocyclaceae; Propionibacterium	0.68	0.57	0.14	0.34	0.48
Bacteroidetes; Saprospiraceae; Phaeoactinobacter	0.73	0.56	0.32	0.63	0.45
Proteobacteria; Rhodocyclaceae; Pseudorhodococcus	0.64	0.54	0.33	0.32	0.63
Bacteroidetes; Chitinophagaceae; Chitinophaga	0.64	0.59	0.22	0.24	0.35
Proteobacteria; Sphingomonadaceae; midas_g_52	0.65	0.54	0.39	0.27	0.34
Actinobacteria; midas_f_8_f_midas_1_5_ASV187381	0.5	0.58	0	0	0.65
Actinobacteria; Propionibacteriaceae; Propionimonas	0.55	0.59	0.81	0.63	0.69
Bacteroidetes; Saprospiraceae; midas_g_795	0.56	0.4	0.37	0.13	0.17
Bacteroidetes; h59_midas_group; midas2_PHC5-4628	0.63	0.5	0.15	0.25	0.2
Proteobacteria; Polyangiaceae; Polyangiobacter	0.52	0.58	0.39	0.64	0.94
Proteobacteria; Saprospiraceae; Kribobacter	0.42	0.57	0.39	0.33	0.14
Bacteroidetes; Saprospiraceae; midas_g_1259	0.53	0.54	0.35	0.23	0.05
Proteobacteria; Rhodocyclaceae; Rhodocyclaceae_ASV187525	0.48	0.57	0	0	0
Proteobacteria; Rhodocyclaceae; Rhodocyclaceae_ASV187727	0.53	0.44	0	0	0
Proteobacteria; Burkholderiaceae; midas2_1189p	0.42	0.52	0.45	0.37	0.74
Hydrogenisporales; Hydrogenisporaceae; midas_g_1192	0.45	0.46	0.33	0.69	0.36
Proteobacteria; Burkholderiaceae; Burkholderiaceae_ASV214	0.43	0.43	0.23	0.27	0.31
Proteobacteria; Saprospiraceae; midas_g_1988	0.46	0.41	0.36	0.13	0.42
Proteobacteria; Hallangiaceae; Hallangium	0.39	0.48	0.27	0.3	0.34
Proteobacteria; P008-42; midas_g_1576	0.43	0.43	0.36	0.18	0.16
Chloroflexi; A10; midas_g_3253	0.42	0.43	0.31	0.63	0.54
Proteobacteria; Burkholderiaceae; Sphingobium	0.42	0.4	1.37	0.5	0.15
Bacteroidetes; Saprospiraceae; Ruminella	0.26	0.45	0.34	0.43	0.82
Bacteroidetes; Chitinophagaceae; Lechevalieria	0.43	0.35	0.32	0.05	0.09
Bacteroidetes; AKVH10; midas_g_430	0.38	0.39	0.11	0.22	0.33
Proteobacteria; Hydrogenisporaceae; Hydrogenisporium	0.23	0.43	0.13	0.36	0.18

## Known PAOs

	LIB-DNA-MD025-US2-14-A-1 -	LIB-DNA-MD025-US2-14-B-1 -	Country average	Global average	Global avg. of same WWTP type
Proteobacteria; Rhodocyclaceae; Ca_Accumulibacter	11.48	11.71	1.06	0.94	2.08
Proteobacteria; Rhodocyclaceae; Dechloromonas	1.12	1.2	2.01	2.06	3.1
Actinobacteria; Intrasporangiaceae; Tetrasphaera	1.19	0.86	1.58	2.13	4.75
Actinobacteria; Propionibacteriaceae; Tetracosarcus	0.23	0.2	0.02	0.07	0.13
Gemmatimonadetes; Gemmatimonadaceae; Gemmatimonas	0.01	0.02	0.07	0.07	0.06
Cyanobacteria; midas_f_1485; Ca_Obscuribacter	0	0.01	0.15	0.13	0.19
Actinobacteria; Propionibacteriaceae; Microtholus	0	0	0	0.02	0.02
Proteobacteria; Burkholderiaceae; Malikia	0	0	0	0.02	0
Proteobacteria; Rhodocyclaceae; Quatrionococcus	0	0	0	0	0.01
Proteobacteria; Pseudomonadaceae; Pseudomonas	0	0	0.21	0.09	0.13

## Known Nitrifiers

	LIB-DNA-MD025-US2-14-A-1 -	LIB-DNA-MD025-US2-14-B-1 -	Country average	Global average	Global avg. of same WWTP type
Proteobacteria; Nitrosomonadaceae; Nitrosomonas	0.34	0.33	0.48	0.62	0.49
Nitrospirae; Nitrospiraceae; Nitrospira	0.27	0.2	1.73	1.61	1.59
Proteobacteria; Gallionellaceae; Nitrotoga	0.04	0.03	0.13	0.24	0.24
Proteobacteria; Nitrosomonadaceae; Nitrospira	0	0	0	0.01	0
Proteobacteria; Xanthobacteraceae; Nitrobarium	0	0	0	0.01	0

# Second Campaign for Anaerobic Digesters

Map and list of coordinators (anaerobic digesters)



**North America**

**Canada**  
Associate Professor Brandon Gilroyed, School of Environmental Sciences, University of Guelph Ridgetown Campus, Ontario.

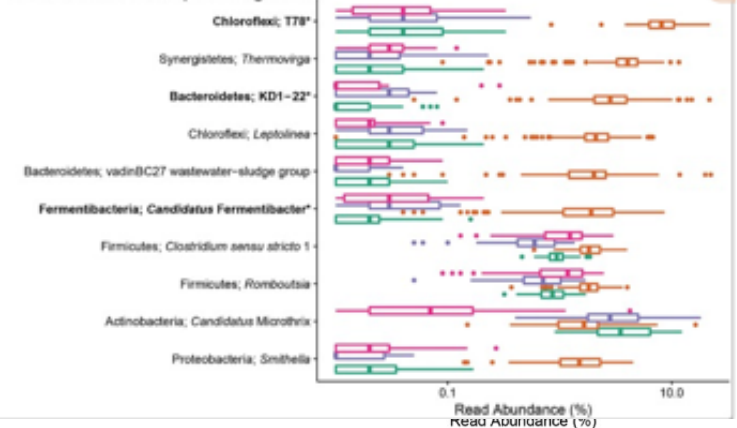
**USA**  
Aloke Vaid, Operations Manager Veolia (California), San Diego, CA.

Professor of practice Nick Tooker, Department of Civil and Environmental Engineering, University of Massachusetts Amherst, Amherst, MA.

**MiDAS 2.0: an ecosystem-specific taxonomy and online database for the organisms of wastewater treatment systems expanded for anaerobic digester groups**

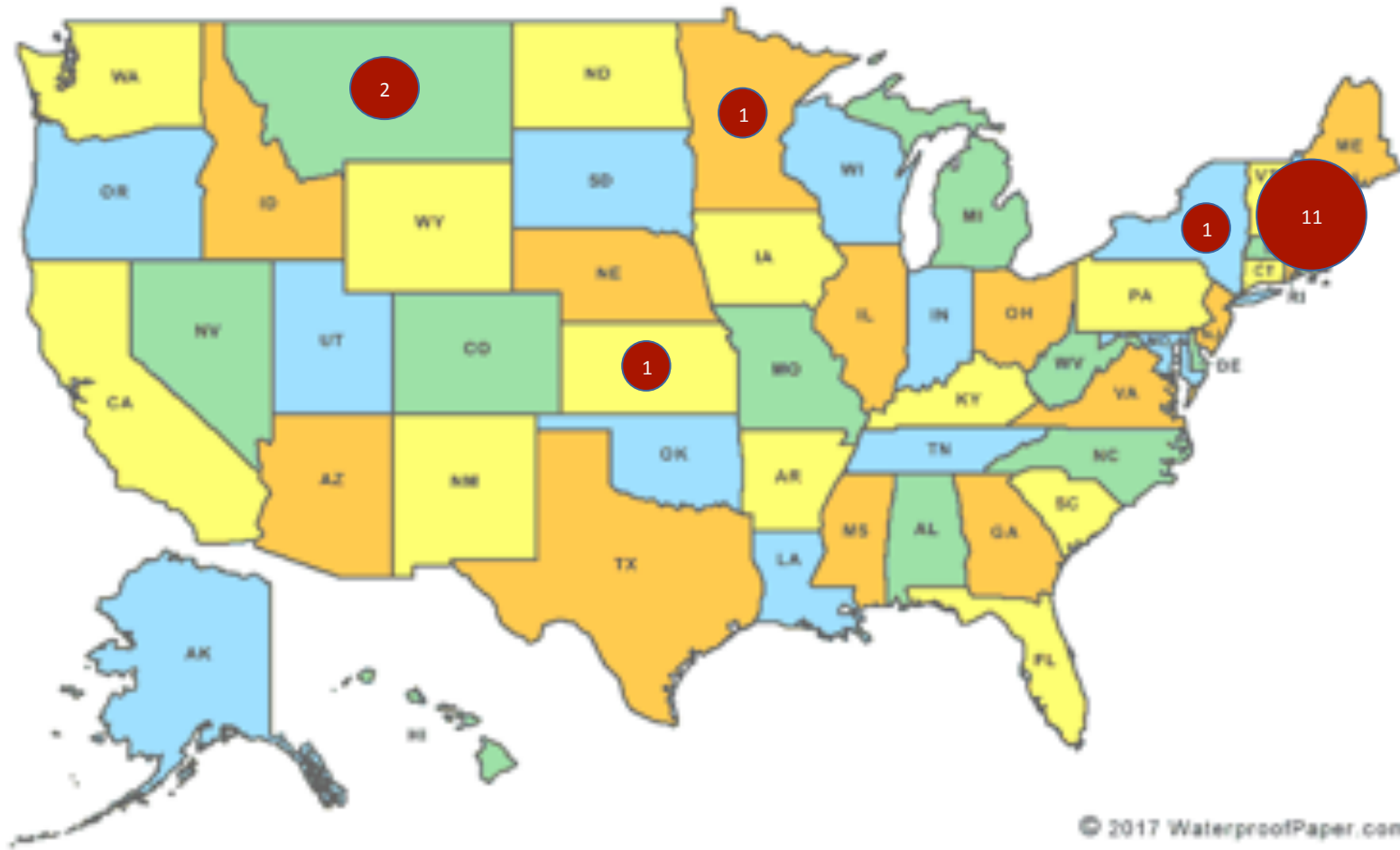
Simon Jon McIlroy, Rasmus Hansen Kirkegaard, Bianca McIlroy, Marta Nierychlo, Jannie Munk Kristensen, Søren Michael Karst, Mads Albertsen and Per Halkjær Nielsen\*

**A. Bacteria in mesophilic digesters**

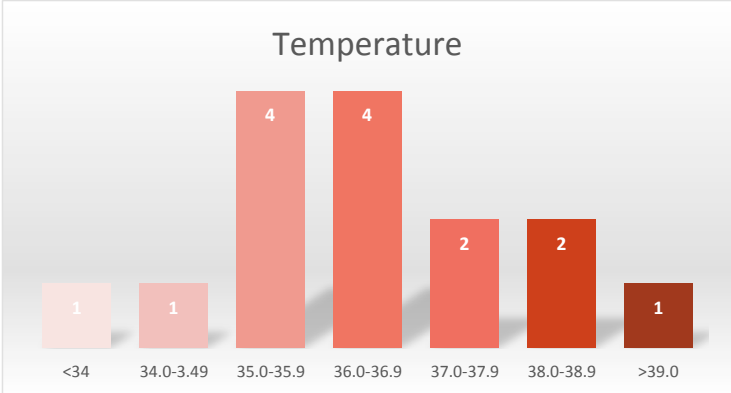


**Figure Key**

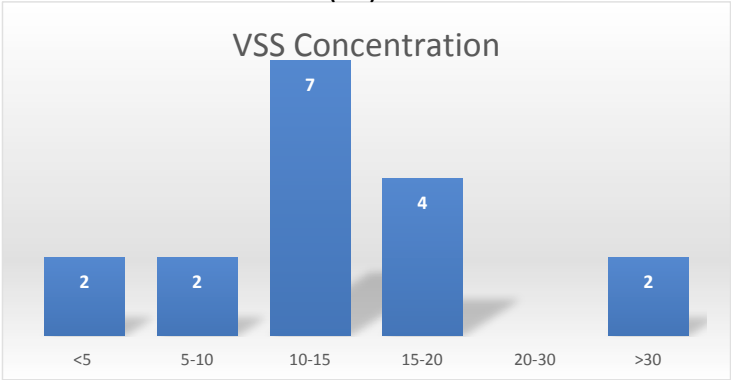
▭ Influent wastewater  
 ▭ Activated sludge  
 ▭ Mesophilic AD  
 ▭ Thermophilic AD



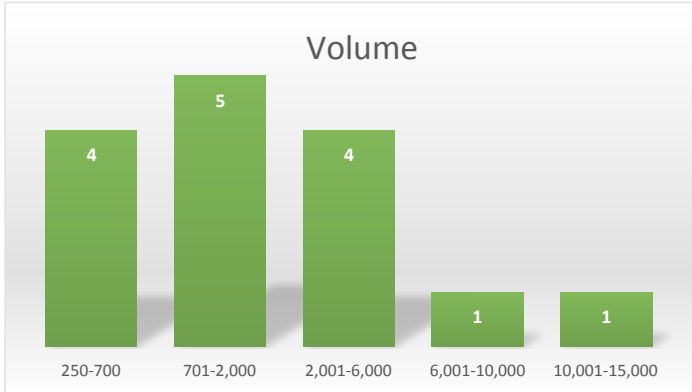
# Generalized AD profiles



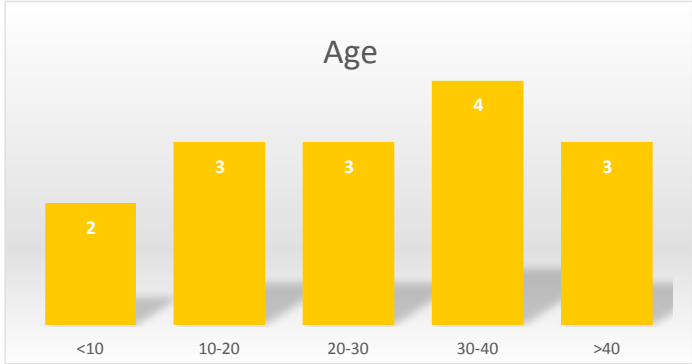
(°C)



(g/L)



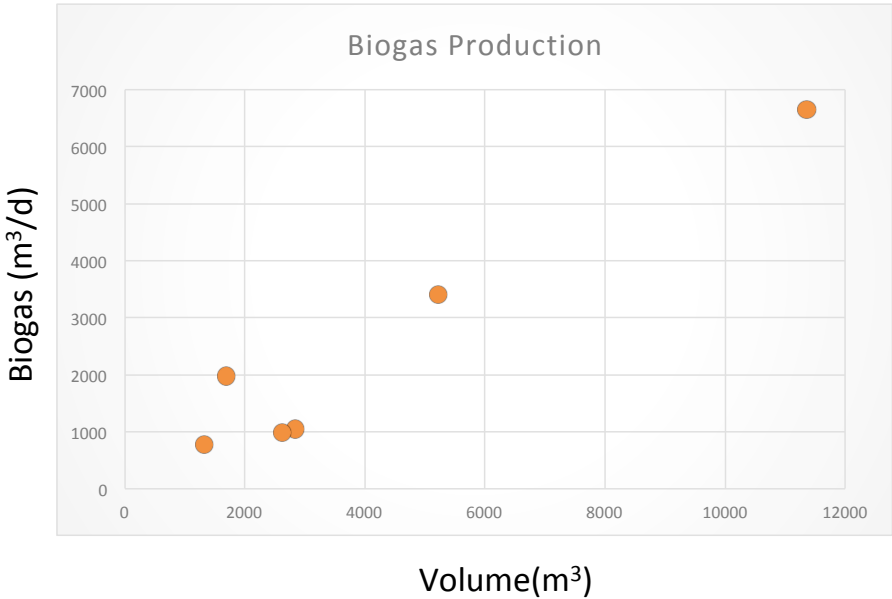
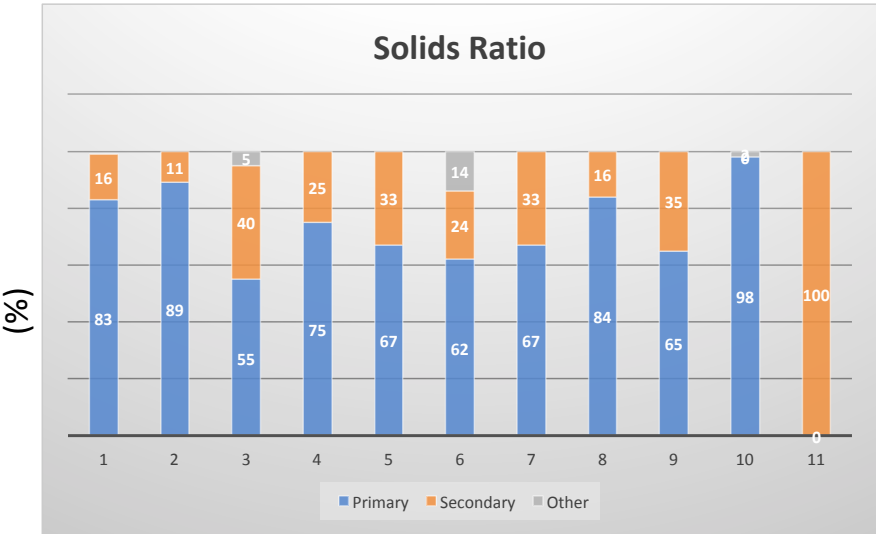
(m³)



(years)



# Generalized Operational Data






## Questions for this data set

Who are the communities in these digesters?

Is there a geographic correlation to the microbial ecology?

Does a single operational parameter strongly correlate with community structure?

Are there community structures that correlate strongly with biogas production?



How can we use  
this data set to  
answer your  
questions?

- Are there questions/curiosities/needs that we can support with the analysis of this data set?
- We welcome ideas that would be useful to the broader community
- Are there other data needs that are not currently met?
- Things to keep in mind:
  - This is a single sampling time point
  - This will primarily cover the bacterial (and some archaeal) populations



SEPARATION

# SUSTAINABLE BIOSOLIDS SOLUTIONS

GLOBAL PERSPECTIVES  
FROM YOUR MOST EXPERIENCED PARTNER

OCTOBER 4, 2019

**ANDRTZ**

ENGINEERED SUCCESS

# WHO IS ANDRITZ?



World leader in high performance process equipment

## PULP & PAPER



% order intake\*

### PRODUCT OFFERING

Equipment for production of all types of pulp, paper, tissue, and board; energy boilers

## METALS



% order intake\*

### PRODUCT OFFERING

Presses/press lines for metal forming (Schuler); systems for production of stainless steel, carbon steel, and non-ferrous metal strip; industrial furnace plants

## HYDRO



% order intake\*

### PRODUCT OFFERING

Electromechanical equipment for hydropower plants (turbines, generators), pumps, turbo generators

## SEPARATION



% order intake\*

### PRODUCT OFFERING

Equipment for solid/liquid separation for municipalities and various industries; equipment for production of animal feed and biomass pellets

\* Share of total Group order intake 2018

**HQ in Austria with 280 locations in over 40 countries**  
**SALES**

- > USD 7 Billion/year

**EMPLOYEES**

- > 29,600 globally



# SEPARATION – PRODUCT OVERVIEW

OUR STRENGTH IS PROVIDING SOLUTIONS – WE HELP EVALUATE THE OPTIONS  
SCREENING, THICKENING, DEWATERING, DRYING (all the top technology choices)

## MECHANICAL SEPARATION

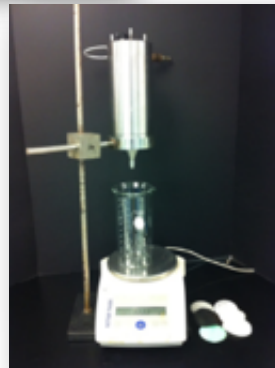
## THERMAL SEPARATION

## SERVICE AND AUTOMATION

MECHANICAL SEPARATION			THERMAL SEPARATION		SERVICE AND AUTOMATION				
<b>Decanter Centrifuges</b>	<b>Filter Centrifuges</b>	<b>Separators</b>	<b>Disc and Drum Filters</b>	<b>Filter Presses</b>	<b>Screens, Drains, Presses</b>	<b>Thickener and Flocculant Plants</b>	<b>Contact and Paddle Dryers</b>	<b>Belt, Drum, and Fluid Bed Dryers</b>	<b>Process Monitoring, Improvement, and Training</b>
							<b>OTHER EQUIPMENT</b>		

# SEPARATION NORTH AMERICA

THE KEY TO MAKING THE BEST SELECTION – DATA – SEPARATION LAB - TEXAS



# SEPARATION NORTH AMERICA



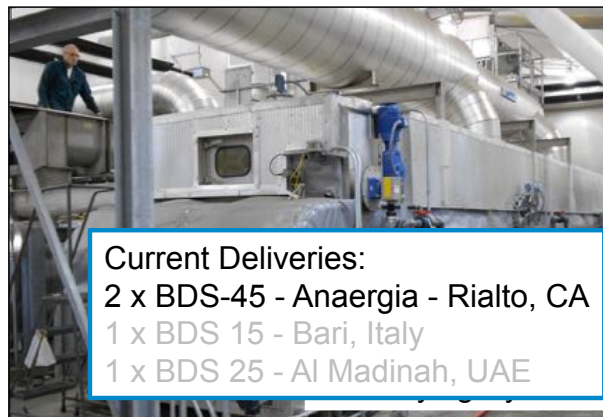
FULL SERVICE SHOP IN TEXAS - LAB, EQUIPMENT AND PLANT DESIGN AND LONG TERM SERVICE



Current Deliveries:  
1 x DDS-70 - City Of Hamilton, ON  
1 x DDS60 – Irvine Ranch, CA  
1 x DDS-180 - Almerdingen, DE



Current Deliveries:  
**FDS-60 – CRD Victoria, BC**  
2 x FDS 60 - Istanbul, Turkey  
9 x FDS 100 - Shanghai, China



Current Deliveries:  
2 x BDS-45 - Anaergia - Rialto, CA  
1 x BDS 15 - Bari, Italy  
1 x BDS 25 - Al Madinah, UAE



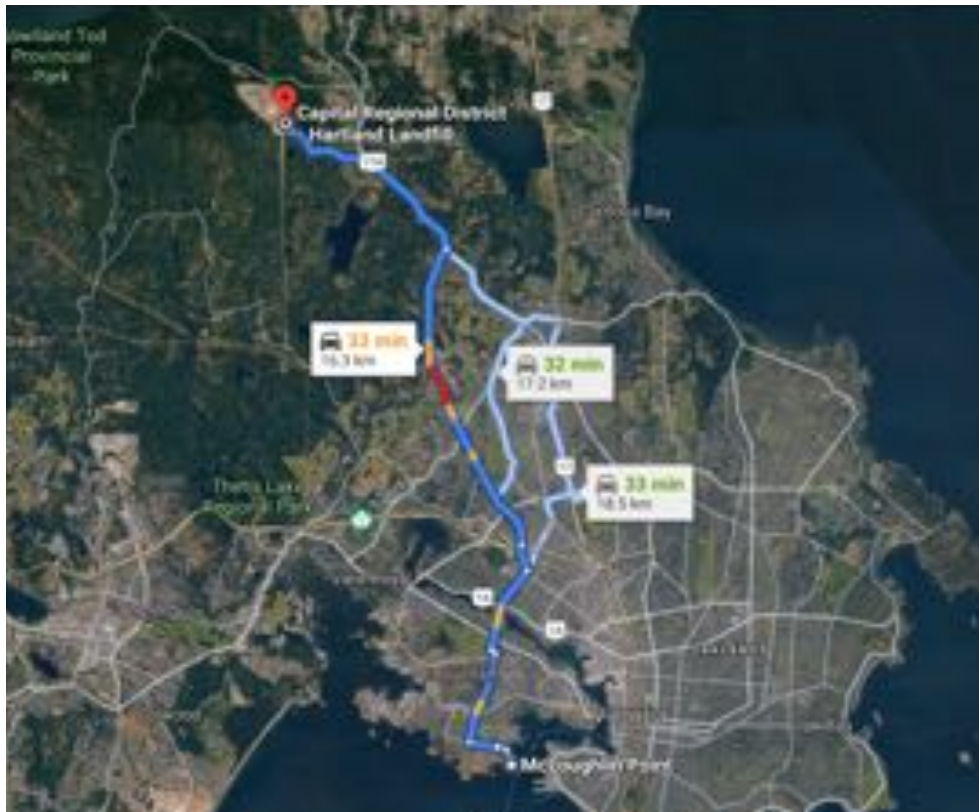
Current Deliveries:  
1 x 10W80 Stephens Point, WI  
3 x 14W190 - Zhengzhou China  
3 x 17W300 - Jebel Ali, Dubai



# OVERVIEW – FLUID BED DRYING SYSTEM (FDS)



CAPITAL REGIONAL DISTRICT, VICTORIA BC



## KEY POINTS

Design Build Operate for 20 years (Synagro)

Landfill location 18km pipeline from new WWTP  
(landfill gas dedicated to engine generators)

Mesophilic digestion after gravity table  
thickening to ~6% DS – anticipated VSD of  
45-50% - digester gas for use in dryer

High solids Centrifuge dewatering to estimated  
22% DS dewatered cake

Fluid Bed Drying 24/7 to produce Class A  
Biosolids at 94% DS – granular form for use in  
agriculture or as fuel at cement plant

Heat recovery from dryer - ~75% of input

**Plant will run without use of natural gas/propane**

# OVERVIEW – FLUID BED DRYING SYSTEM (FDS)



CAPITAL REGIONAL DISTRICT, VICTORIA BC

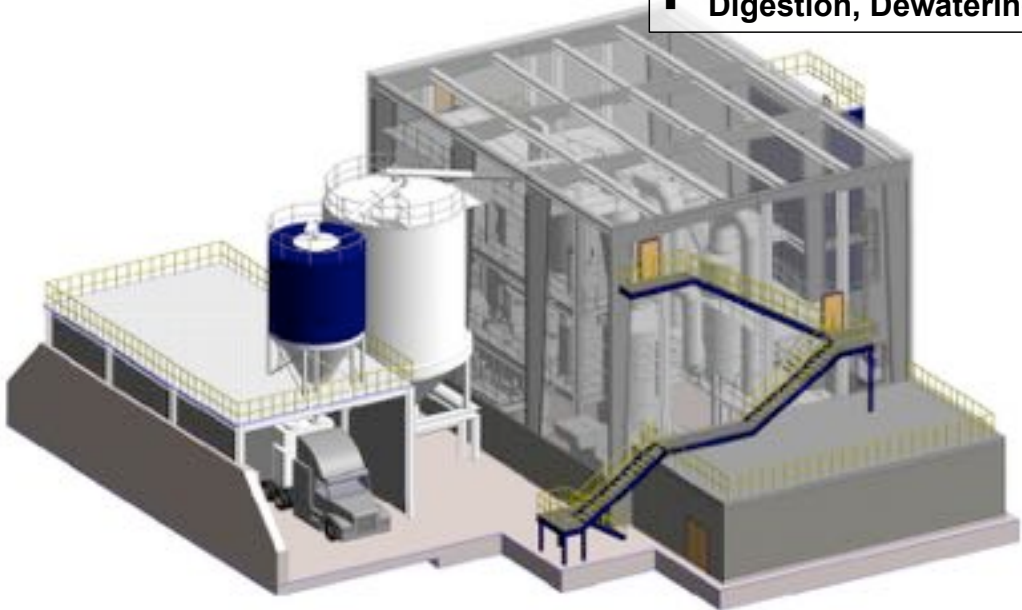


# SYNAGRO AT VICTORIA, BC



**Single Andritz Dryer Train**

- 10,000 dry tons per year
- Digestion, Dewatering & Drying



© 2014 Andritz AG

# CONSTRUCTION UPDATE

CAPITAL REGIONAL DISTRICT, VICTORIA BC – AUGUST, 2019





SEPARATION

OCTOBER 16-18 IN SPRINGFIELD

STEVE MACOMBER  
817-235-6577  
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OCTOBER 4, 2019

**ANDRITZ**

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