

# NEWgenerator™: Field Tests of an Off-grid Non-Sewered Sanitation System for Developing Countries and Remote Locations

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## Disclaimer:

The materials being presented represent the speaker's own opinions and do NOT reflect the opinions of NOWRA.

# Informal Housing Settlements

- Approx. 1 billion people
- High density and land value
- Low infrastructure coverage



# Informal Settlement Sanitation

- Dependence on communal toilets
- High failure rates of traditional sanitation technologies
  - Septic tanks, pit latrines

## The Need

- Compact & high efficiency treatment is needed
- Ability to recycle water
- Off-grid operation



# Technology Selection

## Anaerobic digestion:

- **Pros:**

- Low energy requirements

- Provides energy source

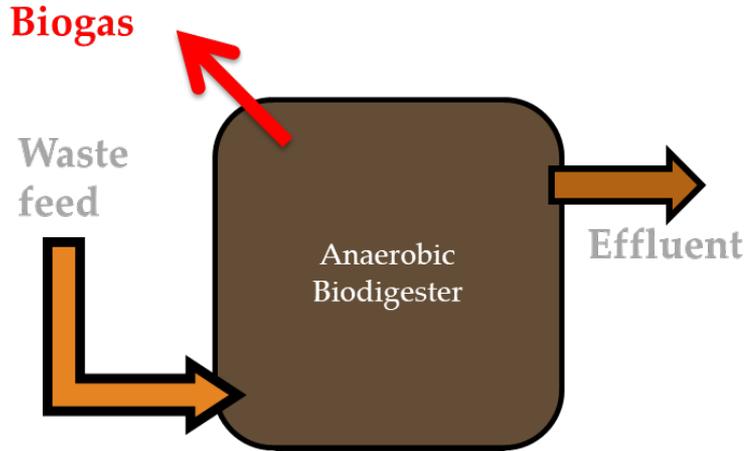
- Can treat high COD conc.

- **Cons:**

- Large reactor size

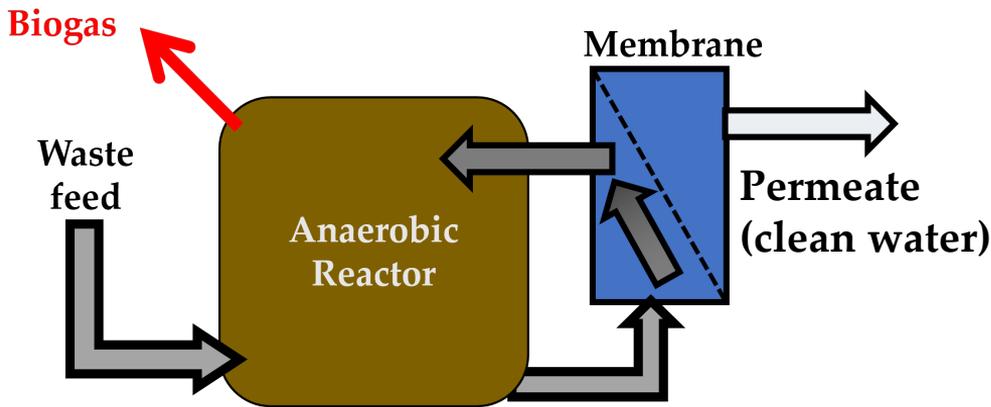
- Susceptible to microbial washout

- Poor effluent quality



# Anaerobic membrane bioreactor (AnMBR)

## Hybrid Process: Anaerobic Digestion + Membrane Filtration



### Benefits

- Smaller AD systems
- Safely removes pathogens
- Consistent effluent quality
- No microbial washout

# Nutrient Capture & Polishing

- AD is good at releasing nutrients not removing them
- IX can passively remove  $\text{NH}_4^+$
- Independent of loading rate
- High removal rates
- GAC for final polishing



# Disinfection

- Chlorine residual in treated water
- Limit the amount of chlorine stored onsite
- Onsite chlorine generation
- Electrolytic cell = electricity + salt



# The NEWgenerator

Anaerobic  
Digestion

Membrane  
Filtration

Nutrient  
Capture

Disinfection

Containerized

Off-grid Operation

Autonomous



# NEWgenerator History

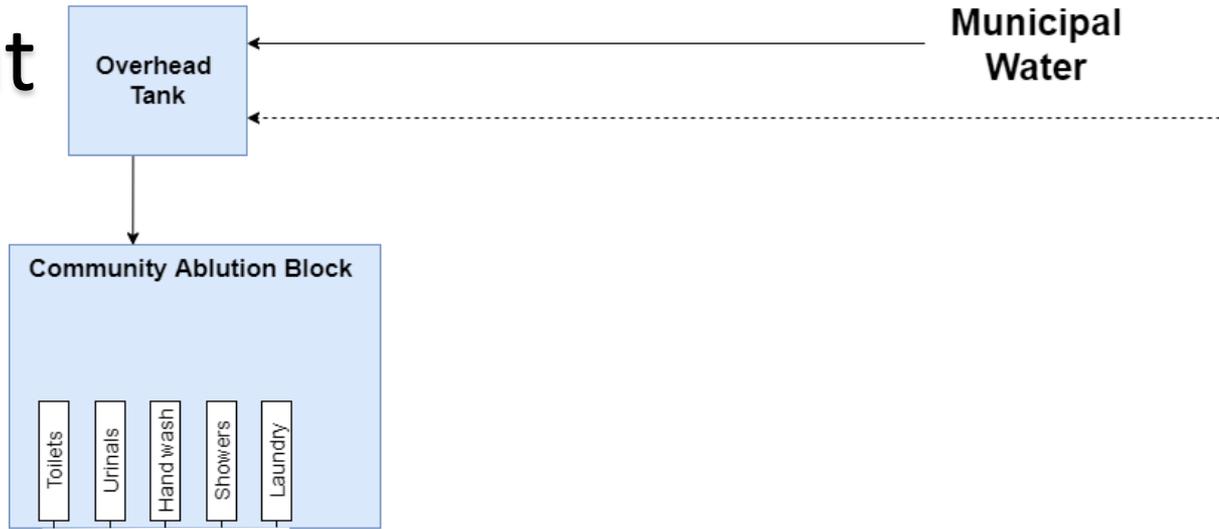


**Field Validation – Southern India – 1 Year**



**Community Ablution Blocks**  
(sanitation + hygiene facilities)

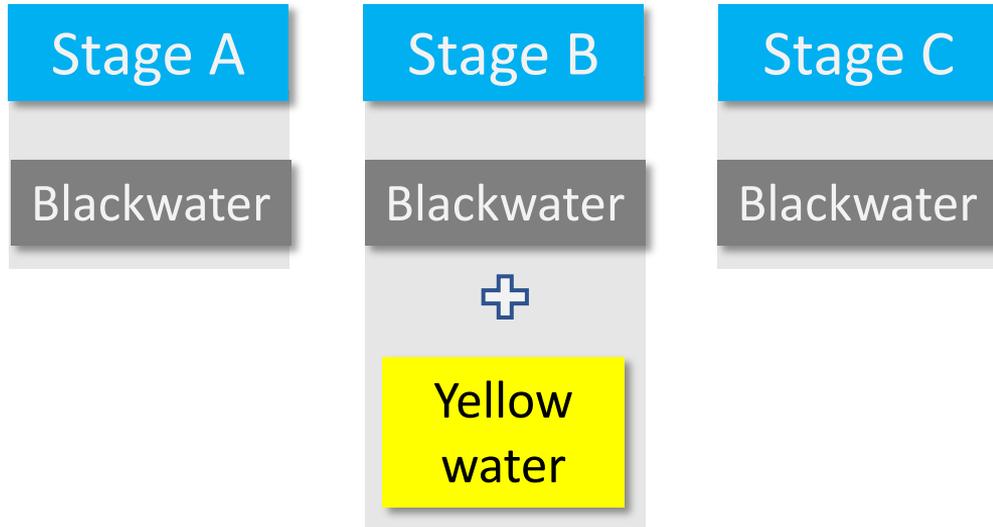
# Site Layout



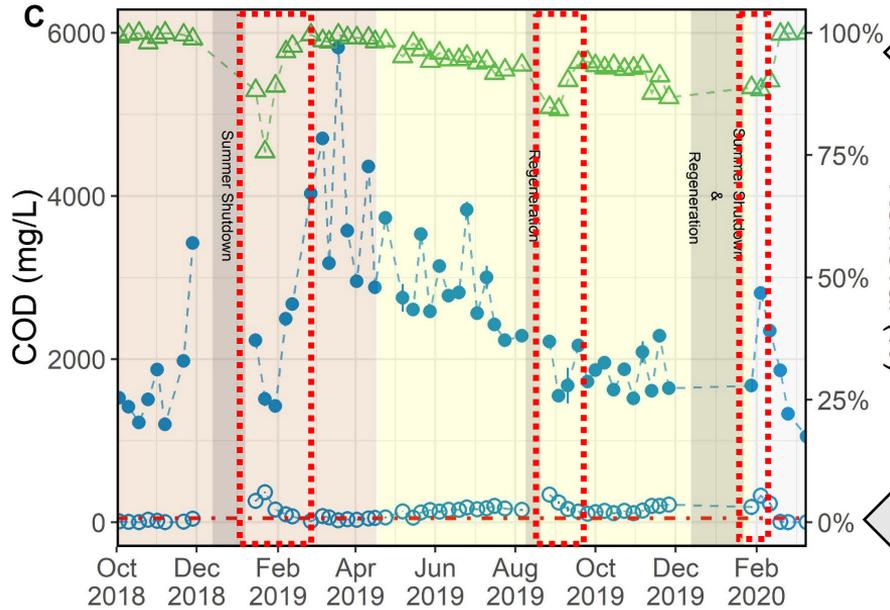


# Durban Field Trial: Test Plan

Total 534 Days



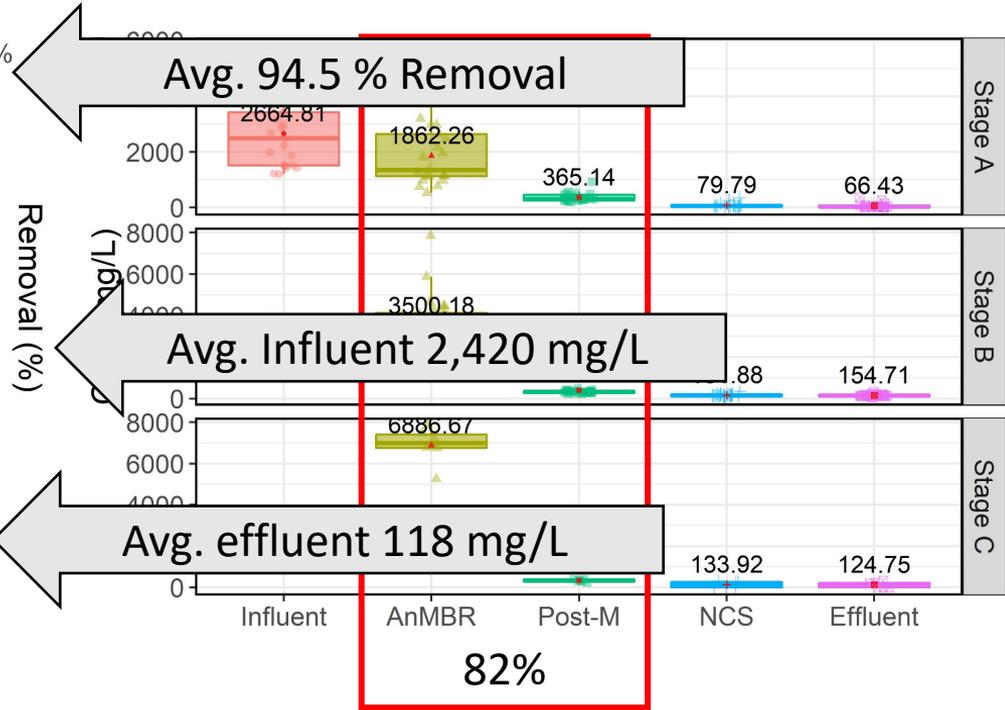
# Results: Chemical Oxygen Demand



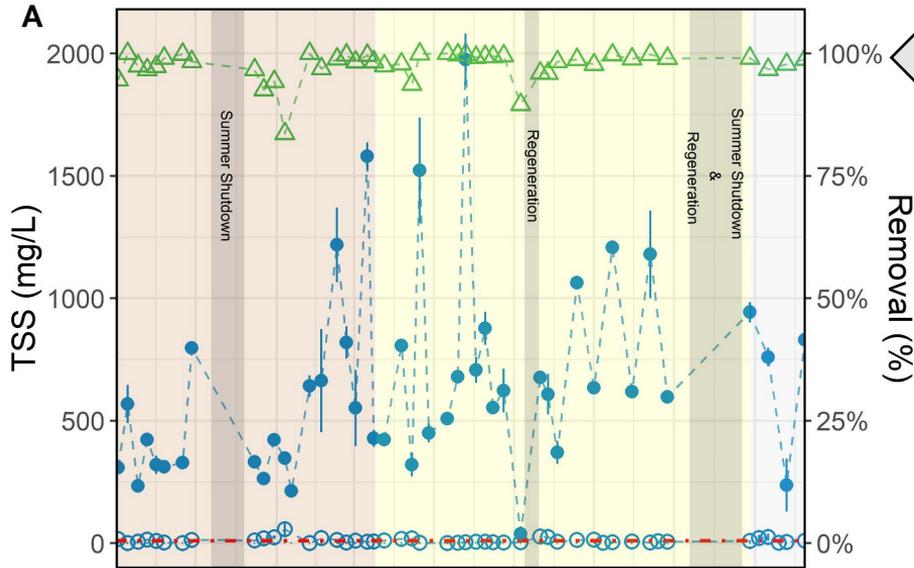
● Influent ○ Effluent ▲ Removal

■ Stage A ■ Stage B ■ Stage C

- - ISO30500 Category A



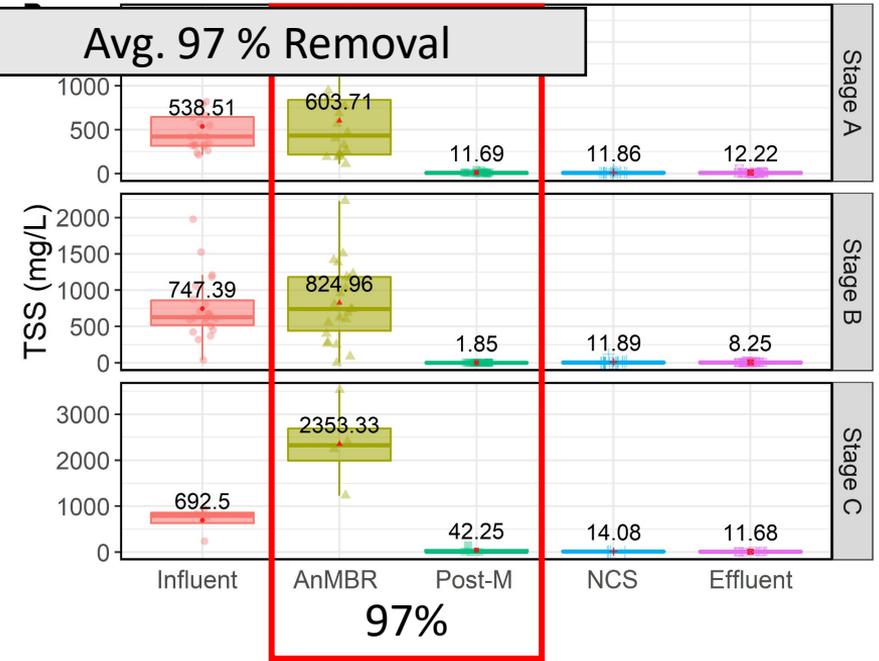
# Results: TSS



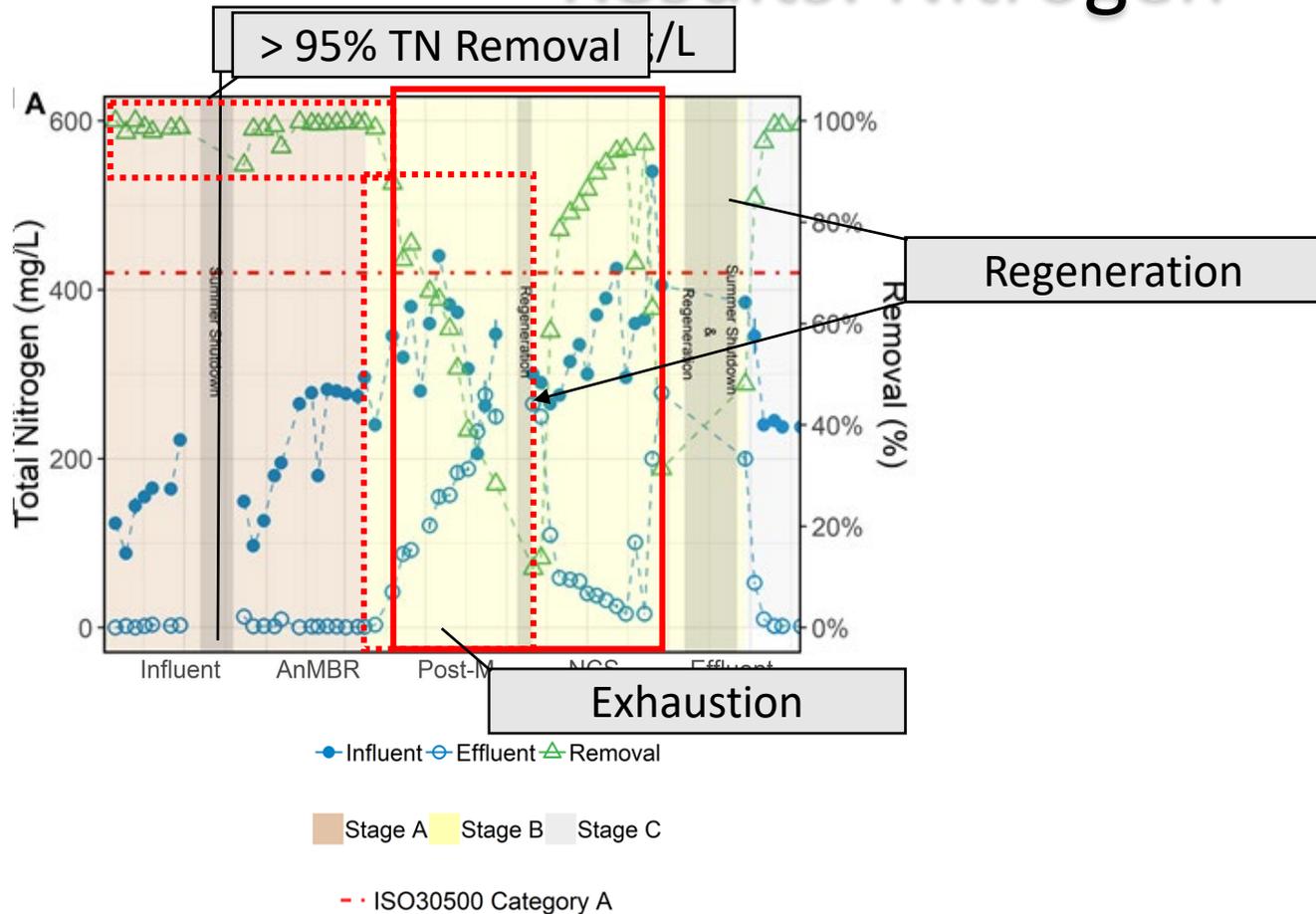
● Influent ○ Effluent ▲ Removal

■ Stage A ■ Stage B ■ Stage C

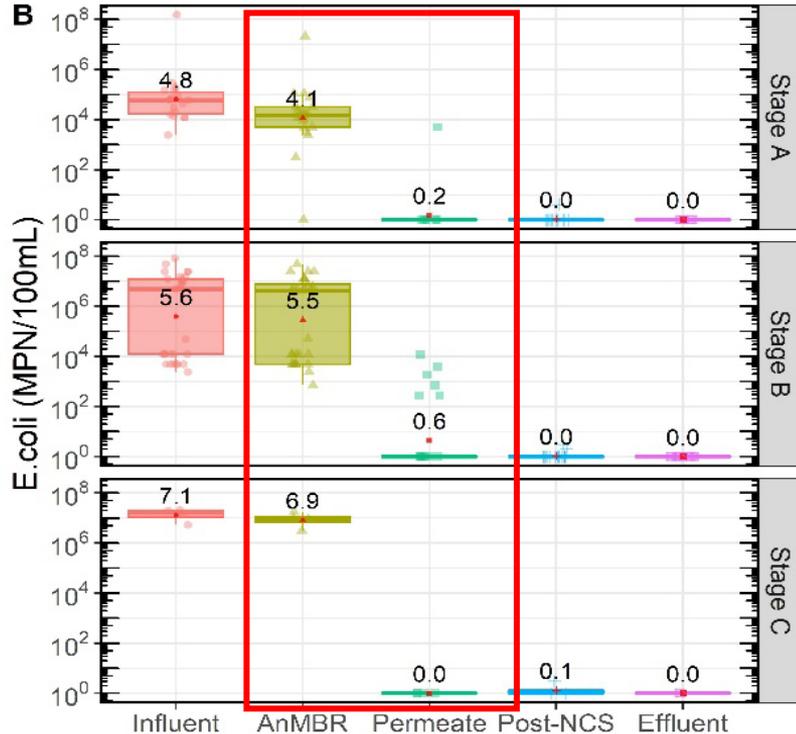
- - - ISO30500 Category A



# Results: Nitrogen



# Results: Pathogens & Indicator Species



- E.coli always below detection limits in final water
- No helminths detected in final effluent
- Membrane filtration primary mechanism for pathogen rejection



## ISO 30500: Liquid Effluent Criteria

Parameter	Criteria	Meet?
TSS	< 30 mg/L	YES
COD	< 150 mg/L	YES
pH	6-9	YES
TN	>70% removal	YES (current R&D to reduce OPEX)
TP	>80% removal	Partial (removing 40%, current R&D underway to meet)
Pathogen: Bacterial	<100/L (>6LRV)	YES
Pathogen: Helminth	<1/L (>4LRV)	YES
Pathogen: Virus	<10/L (>7LRV)	Anticipate yes (not yet tested, requires surrogate spiking)
Pathogen: Protozoan	<1/L (>6LRV)	Anticipate yes (not yet tested, requires surrogate spiking)

# Conclusions

- AnMBRs can successfully be implemented in informal settlements
- NCS is able to passively remove TN – High removal rates
- Field regeneration of the NCS was able to restore its sorption capacity
- NEWgenerator can meet most of the ISO 30500 NSSS requirements







# **NEW**generator™

*nutrients · energy · water*

