STeP Sanitation Technology Platform

Testing Of Onsite Wastewater Treatment Technologies With 100% Pathogen Removal

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RTI INTERNATIONAL

KOHLER

PSG IMS&R

Transformative technologies with potential to radically improve sanitation are being developed

Since 2011, the Gates Foundation has awarded 16 "Re-invent the toilet" grants to leading research organizations.

"Re-invent the toilet" aims to create toilets that:

- Achieve 100% pathogen removal
- Recover valuable energy, clean water, and nutrients.
- Promote sustainable and financially profitable sanitation services and businesses
- Aspirational next-generation products that everyone will want to use

The Sanitation Technology Platform helps move transformative sanitation technology from prototype to product.

STeP helps transformative technologies reach the 2.5 billion people worldwide who don't have access to safe, affordable sanitation. STeP provides a full range of services through a collaboration of global experts and organizations that removes risk and streamlines the path to market, fostering greater success for its partners.

STEP Partner Support

- The Closed Loop Advanced Sanitation System (CLASS) developed by Kohler is one of the transformative sanitation technologies tested by STeP
- A collaboration between industry and academia

Caltech

- Field testing in Coimbatore, TN

PSG IMS&R

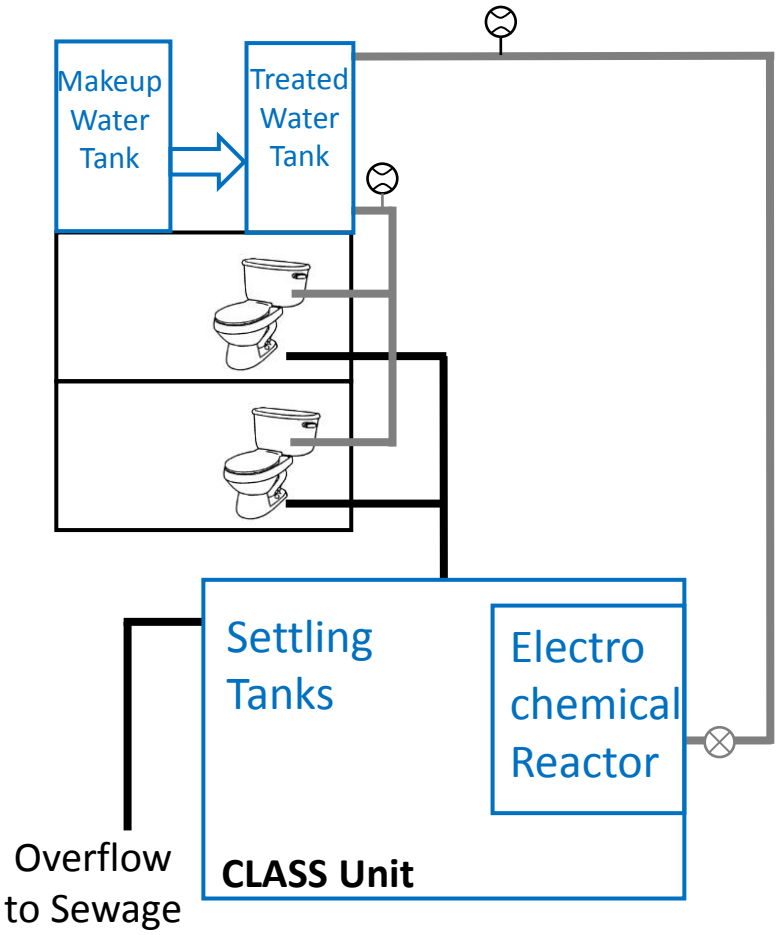
serene Senior Living

University of KwaZulu-Natal

T.STANES & COMPANY LIMITED

Closed Loop Advanced Sanitation System

KOHLER



Three prototypes were built by Kohler in Pune, India

- Multi-family, blackwater processing unit
- Anaerobic settling tank pretreats waste
- Electrochemical oxidation converts chloride to produce chlorine, a pathogen killing disinfectant
- Water re-used for toilet flushing
- Additive: NaCl (kitchen salt)
- Unit connected externally to 3-5 apartments, ~ 20 users

Test Site Descriptions

1 Unit 1: PSG

2 Unit 2: PSG

3 Unit 3: Serene

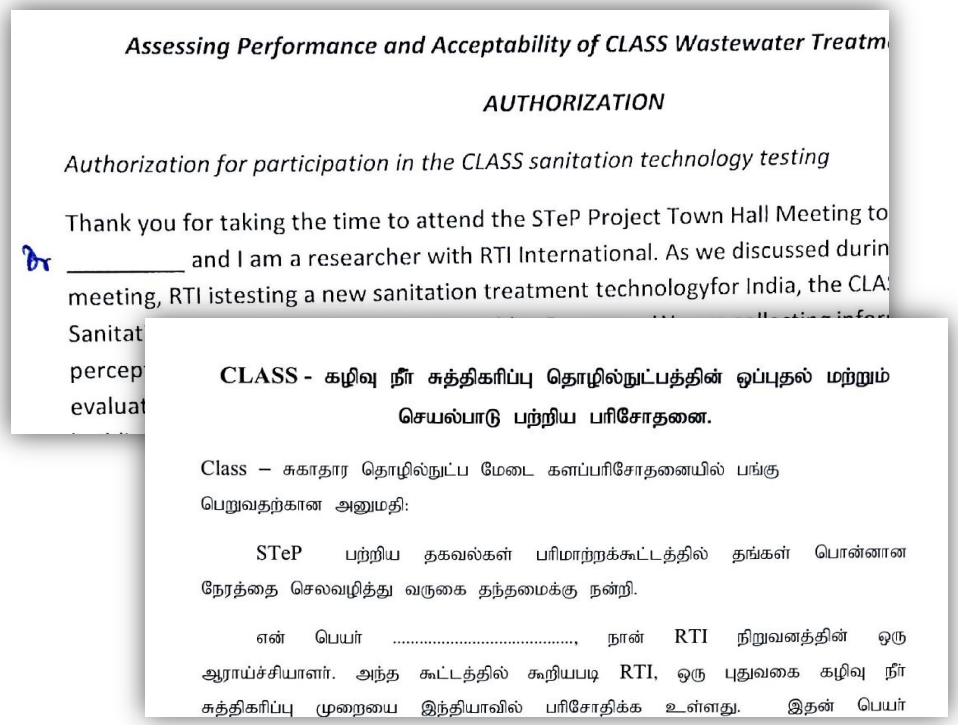
Features of Testing Sites:

- Domestic toilet use
- Sewage connection to system to ensure *no* disruption in water or wastewater services to the residents

	Unit 1	Unit 2	Unit 3
Hours of operation to date	3743	2653	6292
Volume of waste water treated (L)	81,860	56,320	103,070

Operational, safety, and user testing of multiple units

- Gained permissions and informed consent
- Operation of systems in “open loop”, e.g. treated water goes to sewage until the disinfection criteria are satisfied
- Evaluation in “closed loop” for 6 months
- User surveys at multiple time points



Assessing Performance and Acceptability of CLASS Wastewater Treatm

AUTHORIZATION

Authorization for participation in the CLASS sanitation technology testing

Thank you for taking the time to attend the STeP Project Town Hall Meeting to
_____ and I am a researcher with RTI International. As we discussed durin
meeting, RTI istesting a new sanitation treatment technologyfor India, the CLA
Sanitat
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CLASS - கழிவு நீர் சுத்திகரிப்பு தொழில்நுட்பத்தின் ஒப்புதல் மற்றும் செயல்பாடு பற்றிய பரிசோதனை.

Class – சுகாதார தொழில்நுட்ப மேடை களப்பரிசோதனையில் பங்கு பெறுவதற்கான அனுமதி:

STeP பற்றிய தகவல்கள் பரிமாற்றக்கூட்டத்தில் தங்கள் பொன்னான நேரத்தை செலவழித்து வருகை தந்தமைக்கு நன்றி.

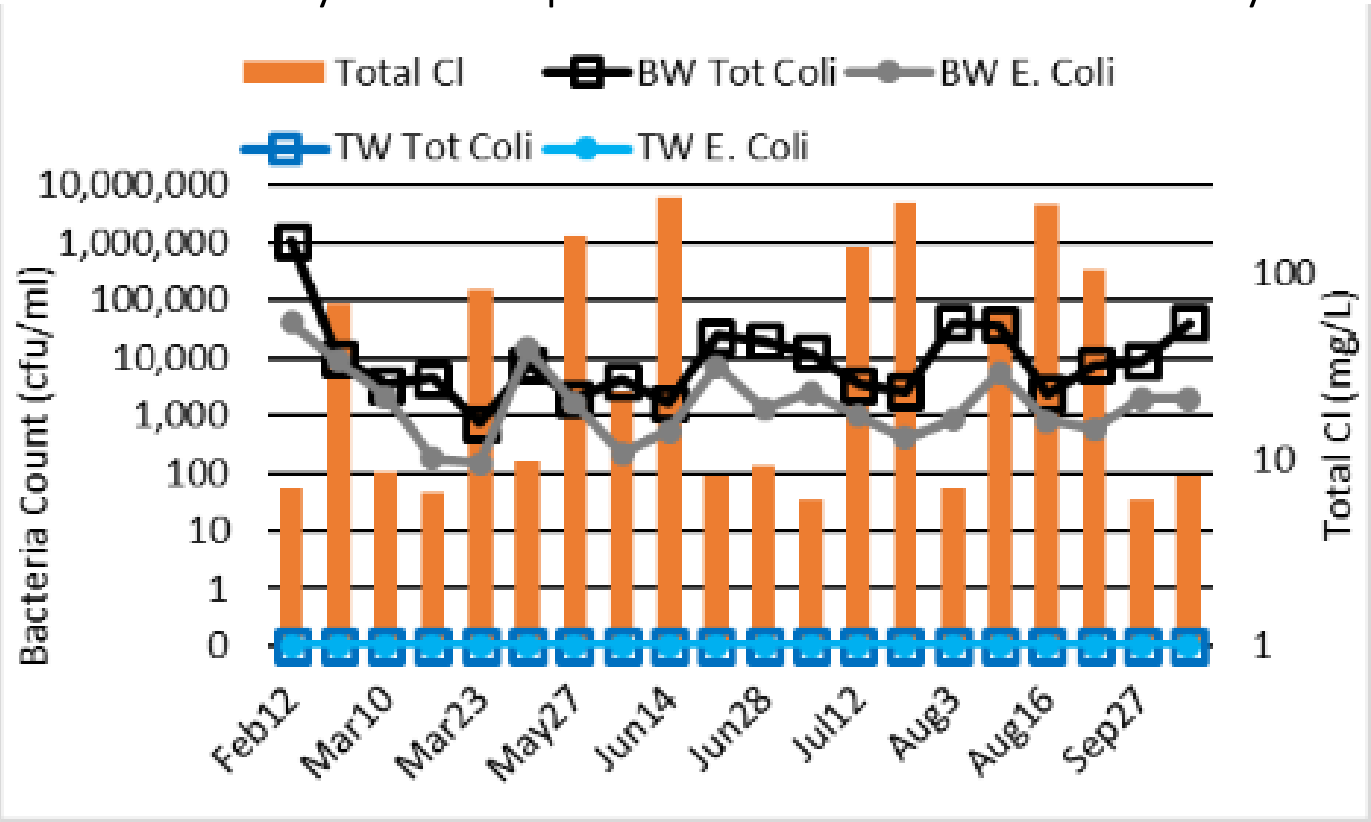
என் பெயர் ....., நான் RTI நிறுவனத்தின் ஒரு ஆராய்ச்சியாளர். அந்த கூட்டத்தில் கூறியபடி RTI, ஒரு புதுவகை கழிவு நீர் சுத்திகரிப்பு முறையை இந்தியாவில் பரிசோதிக்க உள்ளது. இதன் பெயர்

Criteria for “closed loop” operation:

1. E. Coli & Total Coliform: Not detected
2. Helminth eggs: Not detected

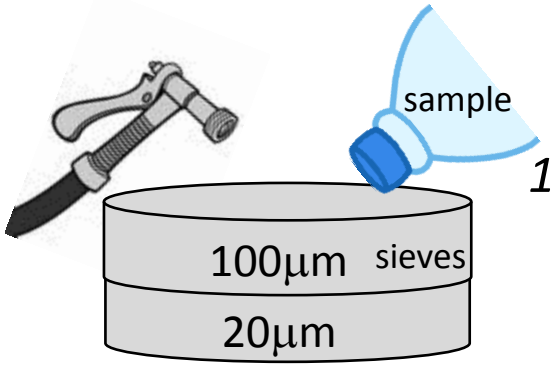
Bacteriological Analysis

- Treated water (TW): Consistent bacterial disinfection confirmed by an independent certified laboratory



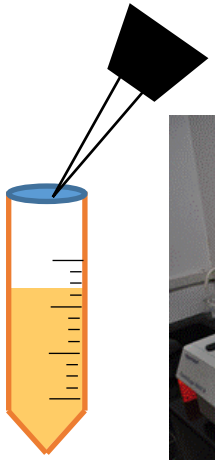
	Detection limits	
E. Coli	<1 cfu/ml (IS 5887: 1976)	<2 MPN/100mL (IS 1622: 1981)
Total Coliform	< 1 cfu/ml (IS 5401: 2002)	<2 MPN/100mL (IS 1622: 1981)

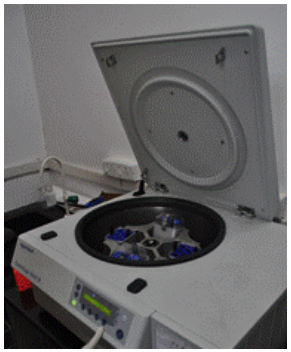
Helminth egg assessment is conducted in a laboratory at PSG IMS&R



1. *Pour sample over the sieve and rinse sieve with water*

2. *Collect sample from 20µm, sieve and centrifuge at 3000rpm for 15min*





3. *Discard the supernatant*

Note: TSS< 100mg/L, so flotation step is not needed

4. *Place the pellet on the microscope slide with coverslip*

5. *Imaging and analysis*

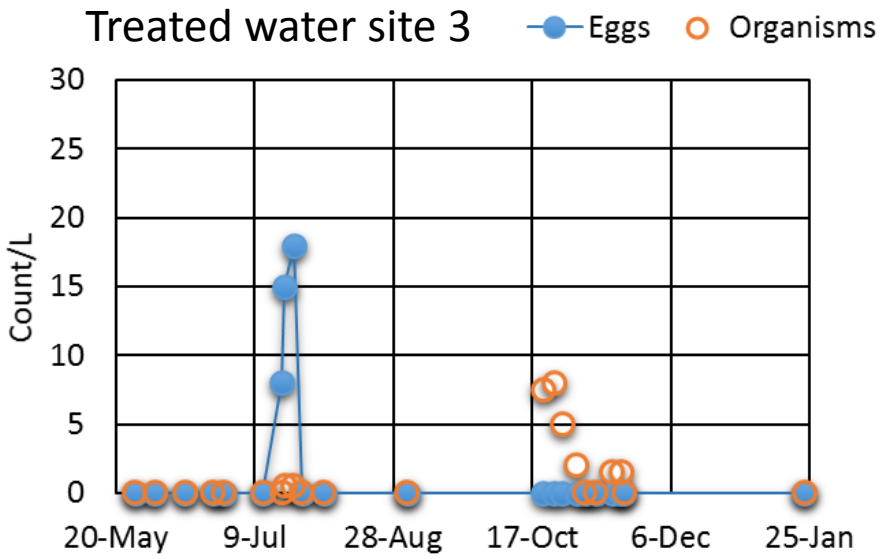
Protocol and training by Colleen Archer, UKZ-N

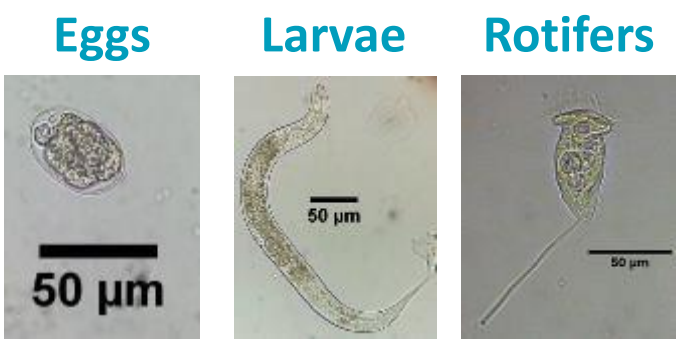
Method: Pebsworth et al American Journal of Primatology 74:940–947 (2012)

Soil Transmitted Helminth egg

Helminth egg enumeration has been rigorously implemented and tracked.

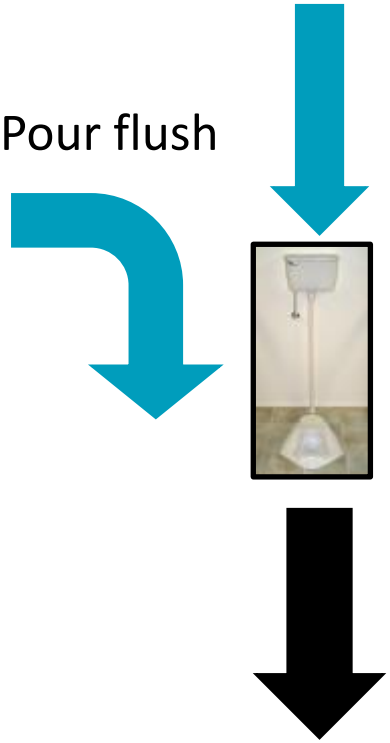
- In 100+ tests of untreated water samples in 3 sites.
  - Free-living (non-pathogenic) helminths range 3-100 eggs/L
  - In a handful of cases, low level pathogenic species (hookworm, 1-5 egg/liter) have been observed
- In treated water: Not detected (<0.5/L), unless a malfunction



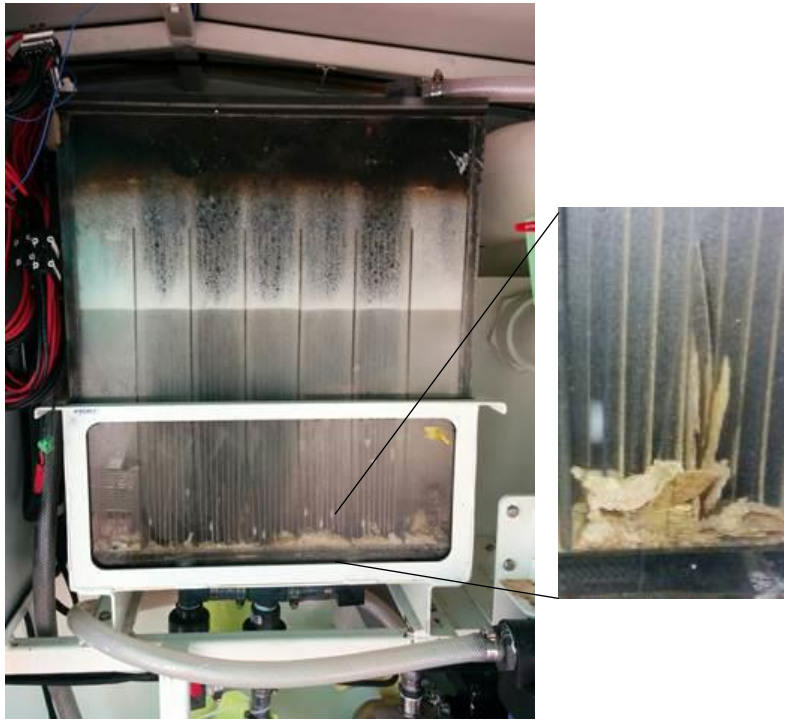


Lessons Learned

Pour flush water addition to toilets is significant.



Water hardness causes significant mineral deposits



<u>Next Steps:</u> Upgrade CLASS system to version 2.0 based on many lessons learned

Companion user insights were recorded; suggest positive acceptance, including use of water for flushing.

Approach: qualitative insights draw on structured interview, role-play, and calendar notes from a dozen residents.

Treated water connected to flush

Pre-baseline: 3-4 months before system installation

Baseline: 2-3 months after first connection

Endline: 6 months after connection

Pre-intervention behaviors/attitudes/ beliefs

Initial adoption behaviors/attitudes/ beliefs

Sustained use behaviors/attitudes/ beliefs

Findings

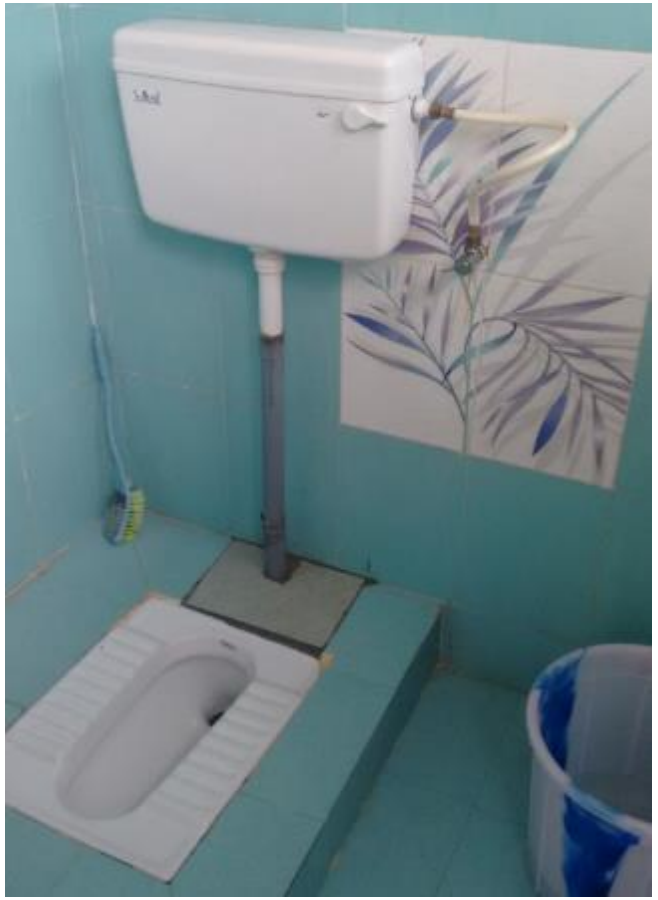
Users see system as a wholly positive addition to their households and community.

No attrition occurred during the field test.

No concerns on health effects.

"I haven't seen like this anywhere outside, this is new, this is nice."

"As far as we are concerned, we are much satisfied with this, even if guests come to our home means we take them to it and show how it is getting cleaned…"



Acknowledgements

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BILL & MELINDA GATES foundation

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PSG IMS&R

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- Tamil Nadu government officials and stakeholders
- The residents of the Coimbatore apartments who agreed to be part of this study.

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