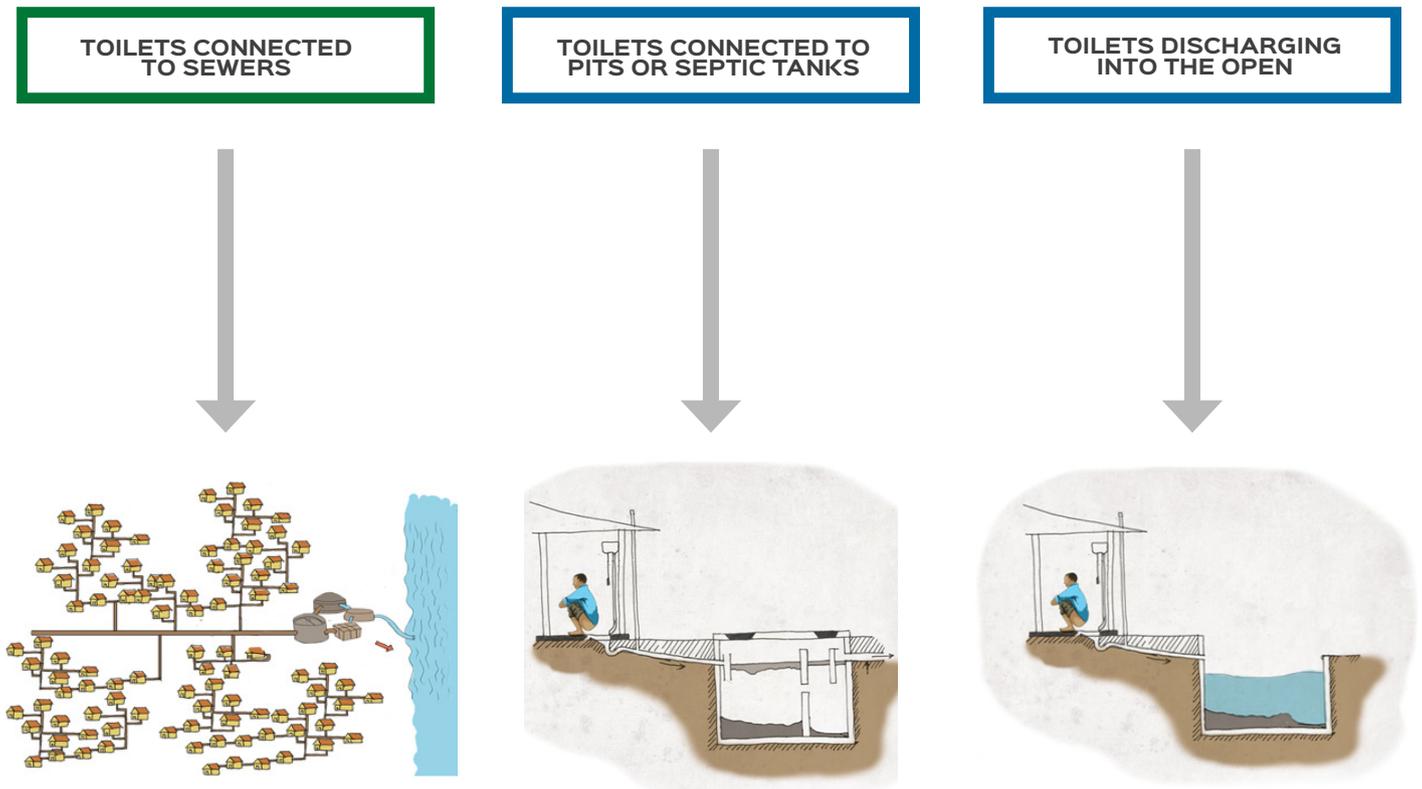




Toilet Ke Baad Kya?

What happens after you
flush your toilet?

Did you know that the waste you flush down your toilet does not always go into a sewer? Instead, it typically moves in one of three ways...



Source: DEWATS Training Material for ATVI, by CDD Society and BORDA, 2013.

An underground **sewer pipe** network collects human waste that is flushed down connected toilets, and disposes the waste in a designated place, such as a Sewage Treatment Plant (STP).

A decentralized system of collection, wherein human waste is collected in **on-site containment** systems such as pits or septic tanks. These systems accumulate solid and semi-solid waste (sludge), which need to be emptied periodically and transported to treatment plants.

Toilets **unconnected** to either a functional sewer or an on-site containment system; solid and liquid waste flows into the open, either into the soil or a water body.

DO YOU KNOW...

What your home toilet is connected to?

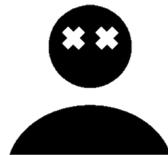
Check with your resident welfare association, local government... or ask your neighbors!

Why should I care what happens after I flush my toilet?

Simply flushing your waste down a toilet is not enough. If the waste is not treated and disposed safely, it is a health hazard not just for you, but for everyone!



70% of urban India's sewage is untreated¹; most of the untreated sewage flows into water bodies, posing a direct health risk to you.



The public health consequences of untreated sewage are immense; for example, diarrheal diseases contribute to 20% of deaths in children under the age of 5.²



The health and environmental impacts of inadequate sanitation in India add up to Rs. 2.44 trillion (US\$53.8 billion) a year —this was the equivalent of 6.4 percent of India's GDP in 2006.³

India has seen unprecedented growth in urban populations; it is predicted that 50% of India's population will live in cities by 2030. Considering the current state of our sewerage systems, expansion and improvement to safely treat the increased amount of human waste will be an enormous challenge.

1. Central Pollution Control Board. (2015). Inventorization of Sewage Treatment Plants.

2. USAID. (2010). A Rapid Assessment of Septage Management in Asia : Policies and Practices in India, Indonesia, Malaysia, the Philippines, Sri Lanka, Thailand and Vietnam.

3. Water and Sanitation Program. (2011). Economic Impacts of Inadequate Sanitation in India.

THE BASICS

Sewage consists of urine, faeces and flush-water, mixed with water from our bathrooms and kitchens. It is channeled from toilets through underground piped systems (sewerage systems) to Sewage Treatment Plants (STPs) or into the open.

ONLY

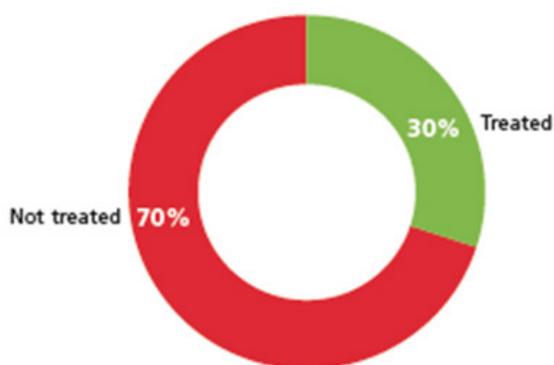
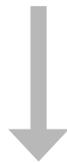
32.7%

of urban toilets in India are connected to piped sewer networks.¹

HOWEVER

45%

of urban toilets are connected to on-site containment systems.¹



Source: Inventorization of Sewage Treatment Plants, CPCB, 2015.

DID YOU KNOW?

Effective sewerage systems are connected to STPs, where sewage is adequately treated. However, only about 30% of India's urban sewage is currently treated, due to a number of factors including high costs and complexity of maintenance.

A majority of the toilets in urban India are connected to on-site containment systems. In order for these systems to be an alternative to sewerage systems, it is important to properly manage the faecal sludge and septage they accumulate.

Faecal Sludge and Septage Management (FSSM)

Includes the safe storage, collection, transport, treatment and end-use or disposal of faecal sludge and septage.

The rest of this document serves as a basic guide to FSSM.

TERMINOLOGY USED

Blackwater:

The mixture of urine, faeces and flushwater along with toilet paper and anal cleansing water.

Greywater:

Water from the kitchen, laundry and bathing (but not toilets).

Sewage:

Waste matter that is transported through the sewer. Normally a combination of blackwater and greywater.

Faecal Sludge:

Is the raw or partially digested combinations of excreta and blackwater, in a slurry or semi-solid form, with or without greywater. It is the solid or settled contents of pit latrines and septic tanks.

Septage:

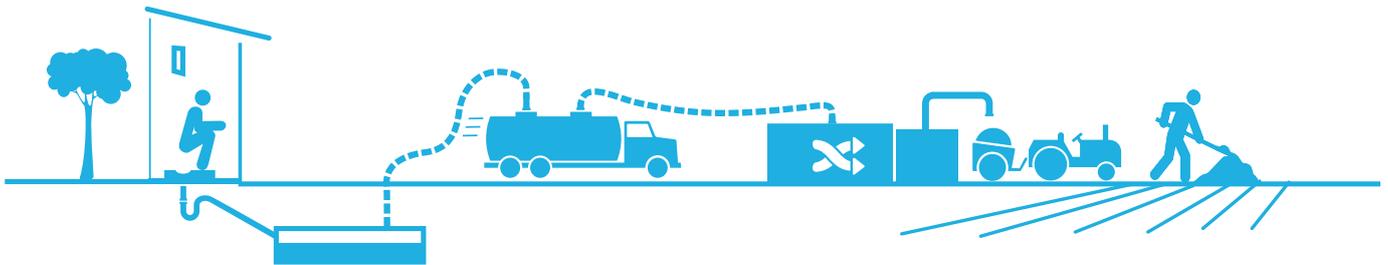
The liquid and solid material that is pumped from a septic tank after it has accumulated over a period of time.

In on-site systems, toilet waste tends to be far more concentrated than the waste conveyed through sewerage systems, which is diluted by greywater.

A 5m³ truck of faecal sludge dumped into the open contains the equivalent of 5000 people defecating into the open!¹

SANITATION VALUE CHAIN

The sanitation value chain aims to safely manage human waste generated by on-site systems.



Source: Water, Sanitation and Hygiene, BMGF, 2010.

CONTAINMENT

Human waste is contained in an on-site system, possibly together with greywater. Waste is partially treated due to the time it is contained, and is known as faecal sludge or septage depending on the system used.



EMPTYING

The system is emptied, typically by a desludging truck with a vacuum mechanism.



TRANSPORT

Faecal sludge or septage is transported safely in a closed truck.



TREATMENT

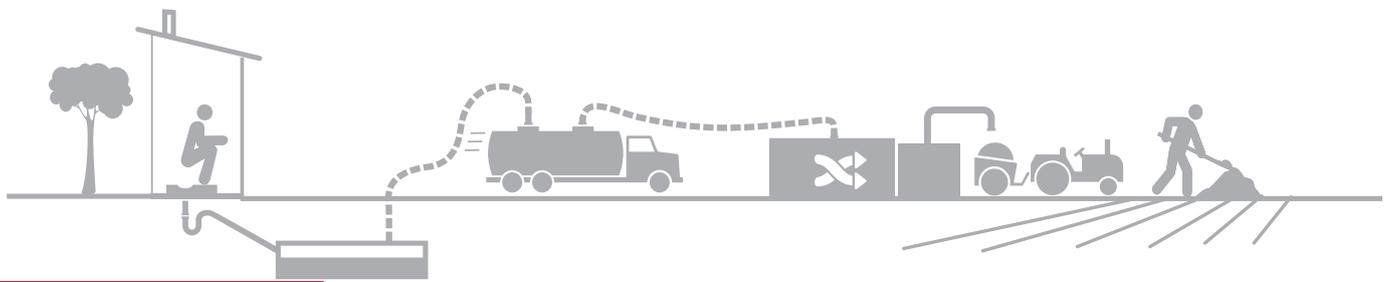
Faecal sludge or septage can be treated either at a Faecal Sludge Treatment Plant (FSTP), or co-treated with sewage at a Sewage Treatment Plant (STP).



REUSE / DISPOSAL

The treated waste can now be safely reused or disposed.

The following pages provide an overview of each of these five steps of the sanitation value system.



CONTAINMENT

EMPTYING

TRANSPORT

TREATMENT

REUSE / DISPOSAL

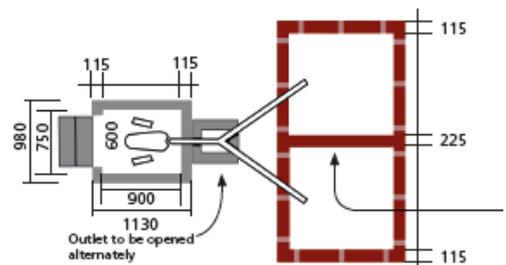


Over 3 crore toilets¹ have been built since 2014 under the Swachh Bharat Mission.

In the absence of a sewerage network, toilets are generally connected to:

Pervious Containment System:

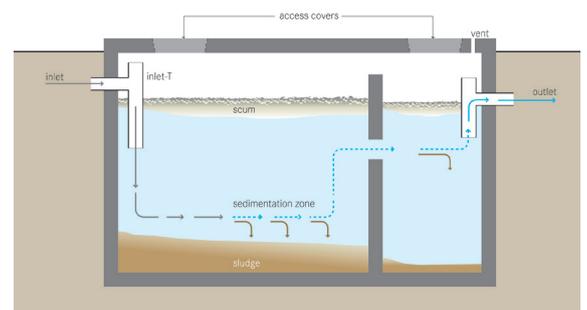
Toilet with one or two pits for collection and decomposition of human waste; the liquid permeates into the surrounding soil e.g. pit latrine. Typically, greywater is not connected to this containment system.



Source: Manual on Sewerage and Sewage Treatment - Part A: Engineering, CPEEHO, 2012.

Impervious Containment System:

A tank in which human waste is retained long enough to permit sedimentation and digestion, e.g. septic tank. The tank has an inlet and outlet pipe, with liquid being released to the soil, ideally through a soak pit for further filtration. Typically, greywater is also connected to this containment system.



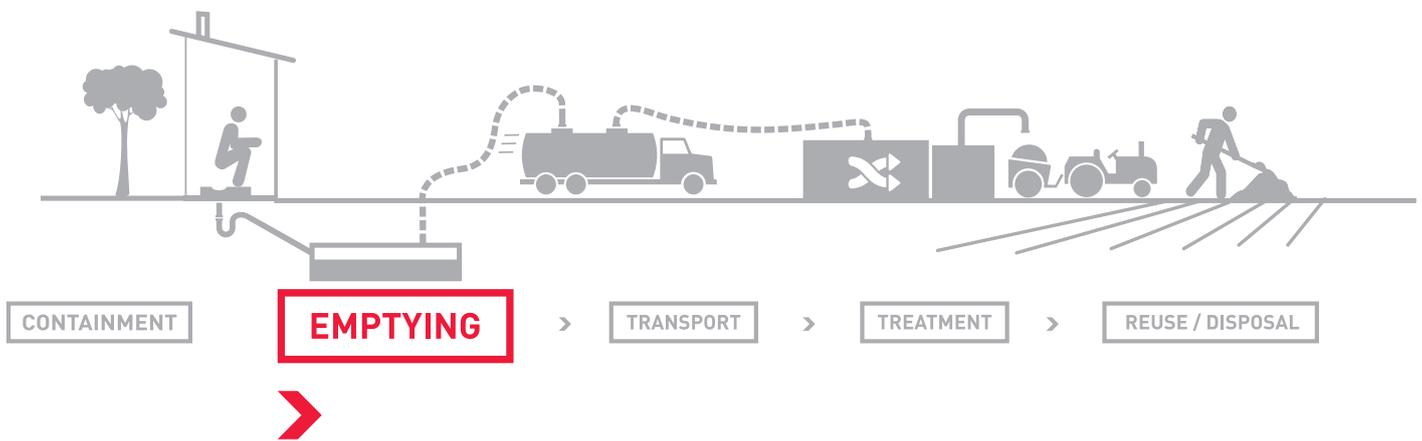
Source: Compendium of Sanitation Systems and Technologies, 2nd ed., EAWAG.

DID YOU KNOW?

Masons sometimes construct 'septic tanks' that are not lined at the bottom, to decrease the frequency of emptying; this is not a septic tank!

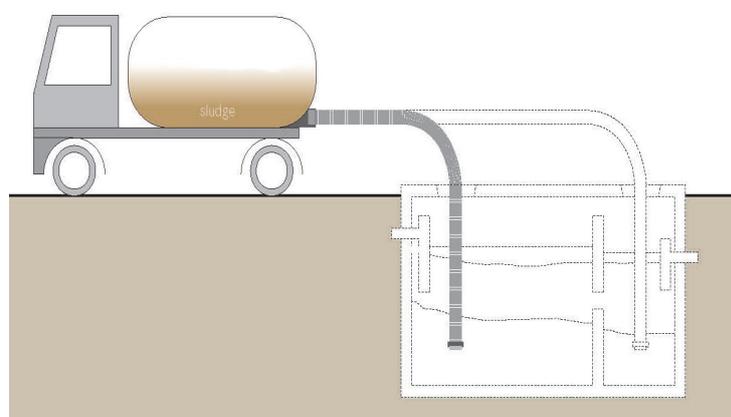
If the outlet from a septic tank is connected to a storm water drain, it is still a public health hazard; the liquid runoff needs to be channeled into soak pits or other appropriate systems!

1. Derived from SBM website: <http://sbm.gov.in/SBMReport/Home.aspx>



Containment units need to be desludged regularly to remove faecal sludge and septage, avoid contamination and increase efficiency of treatment within the containment unit.

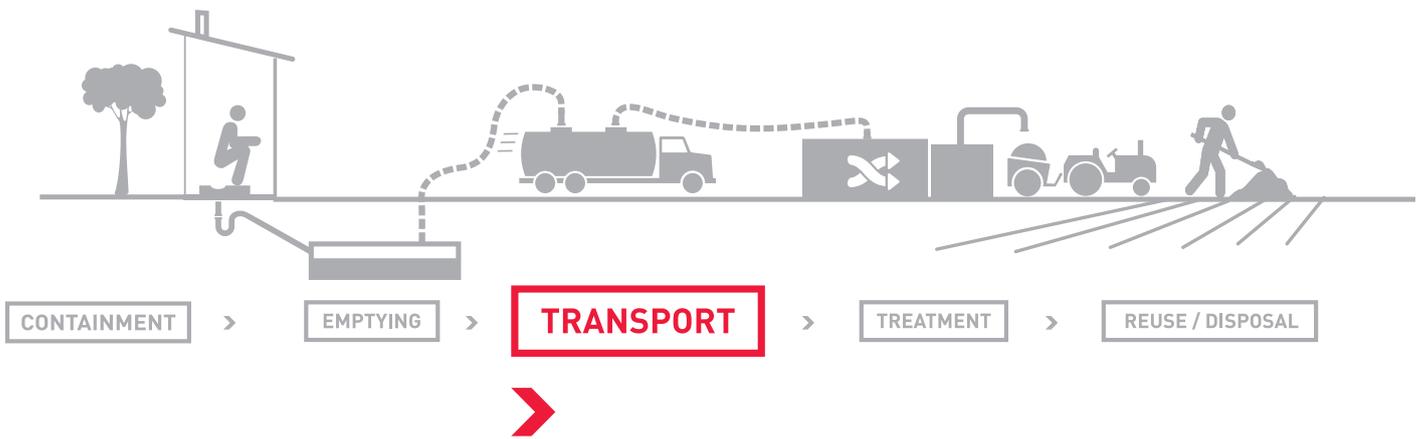
- Desludging at regular intervals is essential.
- An on-demand model is prevalent in India, where households call and pay truck operators when needed - which is often much too late, e.g. when the system clogs or overflows!
- Truck operators need to use appropriate protective equipment.



Source: Compendium of Sanitation Systems and Technologies, 2nd ed., EAWAG.

DID YOU KNOW?

In addition to being unsafe, it is also illegal for people to directly handle human waste in India. Truck operators need to wear personal protective equipment and use mechanical devices for emptying.



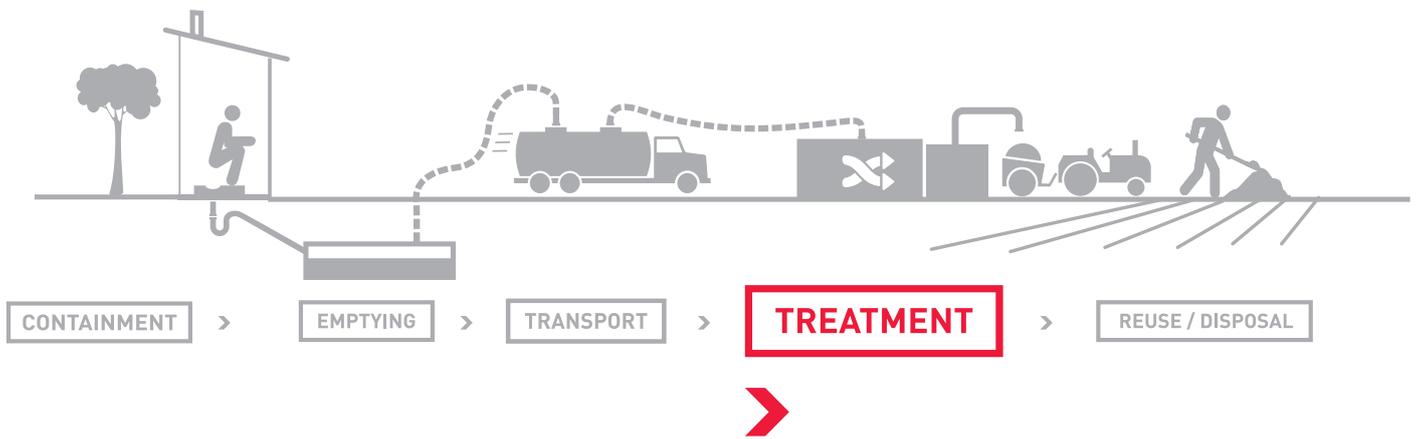
- Once the trucks pick up the faecal sludge and septage, it is transported to a Faecal Sludge Treatment Plant (FSTP) or a Sewage Treatment Plant (STP).
- Private emptying and transport businesses are prevalent in India; these need to be subject to safety standards and regulations.

Does Distance Matter?

- Truck operators tend to dump into the open or into manholes if distances to an STP or FSTP are long.
- Given that FSTPs are cheaper than STPs, there is potential to build FSTPs within smaller distances to close the gap in the value chain.

Case Study

- Warangal is the first Indian city to introduce and implement FSSM regulations.
- Truck operators have been trained on best-practice desludging techniques.
- Licenses to operate mechanised desludging are issued by the city government.
- Licensed vehicles are fitted with GPS, to enable tracking and monitoring.



Untreated faecal sludge is harmful to public health and the environment, and thus needs immediate attention.

The entire treatment process generally includes: solid-liquid separation, stabilization, dewatering/drying, and pathogen removal.

Treatment is done either at:



Sewage Treatment Plant (STP):

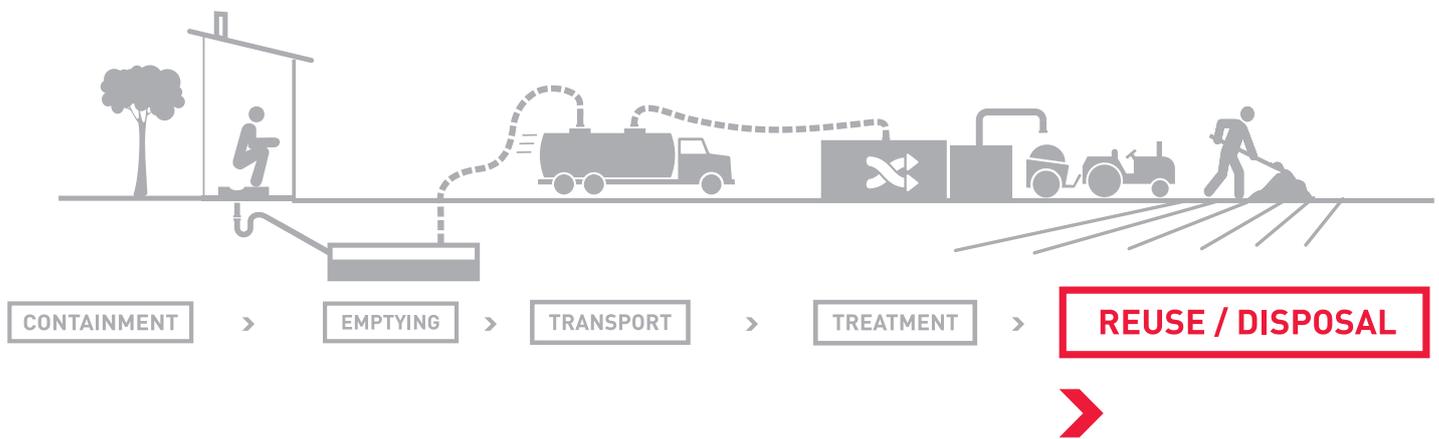
Faecal sludge and septage, after initial processing is treated together with sewage at an STP; this is called co-treatment.



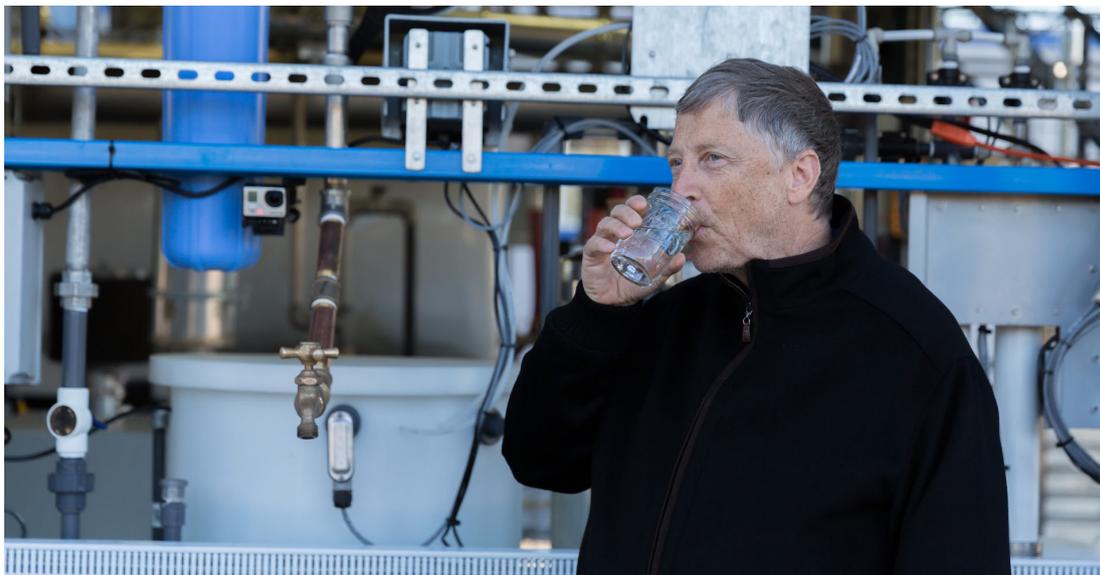
Faecal Sludge Treatment Plant (FSTP):

Only faecal sludge and septage from on-site containment systems is treated here.

A wide range of technologies are used at STPs and FSTPs, depending on the characteristics of the waste and geographic, climatic and financial factors.



Treated faecal sludge, or faecal sludge byproducts are (re)used in a number of ways, depending on the local needs and other factors. The outputs may be used as soil conditioner, or even to generate electricity. Treated wastewater can also be reused, for example in gardens.



Bill Gates drinks water from human waste treated by Janicki Bioenergy's Omni Processor System¹. Treated water from FSTPs can typically be used for non-potable puposes.

DID YOU KNOW?

If all the global human waste was collected and used for biogas generation, it could provide enough electricity for 138 million households (equivalent to all the households in Indonesia, Brazil and Ethiopia combined).²

1. Gates, B. (2015). "This Ingenious Machine Turns Feces Into Drinking Water". Accessible at: www.gatesnotes.com.

2. Schuster-Wallace C.J., Wild C., and Metcalfe C. (2015). Valuing Human Waste as an Energy Resource: A Research Brief Assessing the Global Wealth in Waste. United Nations University Institute for Water, Environment and Health (UNU-INWEH).

COMPARISON OF COSTS

The costs below illustrate that FSSM systems are considerably cheaper than sewerage systems; if set up and maintained well from end to end, FSSM systems have the potential to mitigate current public health and environment challenges posed by untreated sewage.

Once FSSM systems are developed, we can incorporate greywater (water from kitchen, bathing and laundry) treatment.

SEWERAGE SYSTEM	FSSM SYSTEM	FSSM AND GREYWATER
<p>1.</p> <p>Average capital cost per capita: INR 10,500</p>	<p>1.</p> <p>Average capital cost per capita: INR 910</p>	<p>1.</p> <p>Average capital cost per capita: INR 2910</p>
<p>2.</p> <p>Average operating cost per capita per annum: INR 600</p>	<p>2.</p> <p>Average operating cost per capita per annum: INR 80</p>	<p>2.</p> <p>Average operating cost per capita per annum: INR 350</p>

All costs provided are informed estimates, calculated in 2018.

CONCLUSION

We hope you take away the following three points from this guide:

- Treatment of human waste is important; untreated waste is a public health hazard!
- On-site systems are widely prevalent in India, and regular collection and adequate treatment of waste from on-site systems is the need of the hour!
- FSSM systems are significantly cheaper than sewerage systems and much faster to deploy.

Here's what we can potentially achieve by focusing on FSSM systems:

Expanding sewer networks is a very long-term and expensive process; complementing sewerage systems with FSSM systems could potentially enable us to achieve 100% sanitation sooner.

Contact Details

To find out more, please reach out to:

Technology Taskforce: wshtech@dasra.org

NFSSM Alliance: NFSM@dasra.org

TECHNOLOGY TASKFORCE MEMBERS:

- Administrative Staff College of India (ASCI)
- Bill and Melinda Gates Foundation (BMGF)
- Bremen Overseas Research & Development Association (BORDA)
- Centre for Science and Environment (CSE)
- Consortium for DEWATS Dissemination Society (CDD Society)
- Dasra
- Indian Institute for Human Settlements (IIHS)
- Indian Institute of Technology Madras
- International Water Management Institute (IWMI)
- National Institute of Urban Affairs (NIUA)
- Research Triangle Institute (RTI)
- Swiss Federal Institute of Aquatic Science and Technology (EAWAG)
- WABAG
- Water, Sanitation and Hygiene Institute (WASHi)

