Water Pollution = sewage + partial treatment = pollution

Without affordable and sustainable citywide sanitation for all we cannot clean our rivers

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July 22, 2020
River lessons from Lock-down 2020

- CPCB has monitored pollution in air and in water during the lockdown months of April-May 2020
- While air quality in cities has shown a dramatic reduction; this is not the same with river pollution
- In the case of air quality; vehicles were off our roads; factories were shut – combustion is clearly the contributing factor for pollution
- But in rivers..
Ganga: pre-during lockdown
Learning from this evidence

Why improvement?
- Increased water flow because of reduction in usage by industry
- Less chemical load from industry
- Physical appearance of rivers improved because people did not throw offerings into river

But
- Sewage continued to flow into rivers; showing that without interception; treatment of biological waste. our rivers cannot be cleaned
River pollution = sewage

More water supply per capita and more sewage we generate per capita

80% water leaves homes as sewage

So simple maths:

More water = more waste

More waste less treatment = pollution

Cities in our world are struggling to build infrastructure to keep pace with water and disposal/reuse of treated effluent
Excreta Matters I


71 city data analyzed
City water-waste profiles
Where does water come?
Where does waste go?
Simple questions
But not asked
Never answered
Excreta: sums that don’t add up

Cities get water from longer distance as local water is not available/contaminated
Cost of supply of water increases/distribution losses increase/ cannot recover costs
Costs of taking back wastewater – intercepting it; conveying it; and then treating it to portable levels for discharge in rivers with low assimilative capacity is very high – unaffordable
So cities treat waste of some/mixed with untreated waste of majority = pollution
‘Shit’ Flow Diagrams

• Helped to map the flow to excreta in our cities and to understand policy/practice implications

• Determine systems in terms of on-site; off-site
• Determine if excreta is collected and how
• Determine if excreta is transported and how
• Determine if excreta is safely disposed off
Recognize and build on reality

• We found most in our cities (over 100 SFD’s done) are not connected to sewage system
• They have ‘on-site’ treatment
• Toilets are connected to soak pits or connected to drains or septic tanks with no underground lining
• Excreta is then transported from ‘tanks’ to drains which make way to river; or river
• Reality is an opportunity for new paradigm
MANAGING SEPTAGE IN CITIES OF UTTAR PRADESH
An analysis of the sanitation chain in 66 cities, through SFDs

ASSESSMENT OF EXCRETA MANAGEMENT
SFD factsheets for 66 cities in Uttar Pradesh
UP: Overview

• Our analysis shows;
• Roughly 70% of state is ‘on-site’
• 80% ‘septic tanks’ in state are connected to open drains where liquid is discharged
• 50% of the ‘septic tanks’ are mechanically cleaned – whenever there is need
• 90% of septic tank waste is not treated – disposed off in drains/rivers/land
Faecal Sludge and Septage “Management”
Type of Containment Systems
Type of emptying
Transportation
“Treatment" and Disposal
Uttar Pradesh (Urban), India
SFD Level: 2 - Intermediate SFD

Date prepared: 23 December 2018
Prepared by: CSE

Key:
- WW: Wastewater
- FS: Faecal sludge
- SN: Supernatant
- Green: Safely managed
- Red: Unsafely managed

Note: This SFD is done based on study of 66 towns and cities, representing 60% of urban population in UP
Reality is our opportunity

- Majority of households are connected to on-site systems (quality indifferent)
- These systems are cost-effective
- Governments do not have to build underground sewerage
- People are managers
- If septic tank is overflowing then people will have backflow – will call and get cleaned
- **NIMBY**
- Already exist – do not have to re-engineer entire cities for sewerage networks
Reality: Landline or mobile?

• 20 years ago, India was building landlines to connect people with phones
• Today, we go through satellites – mobile phones
• 10 years ago, world was building energy grids to connect people with electricity
• Today, people are installing solar systems on rooftops
• If we can jump-skip-leapfrog the landline-grid route in connectivity in telephones and energy access then why not in sanitation?
So, what needs to be done?

Agenda for city sanitation/rivers

- **Step 1**: Map the ‘shit-flow’ of the city to understand reality and plan for it
- **Step 2**: Plan for full interception of sewage – piped or truck (on-site or off-site)
- **Step 3**: Focus on regulating transport of on-site systems and not construction of septic tanks to begin with (work with what exists)
- **Step 4**: Treatment – intercept or transport to existing STPs and build new ones for Faecal Sludge Treatment (FSTP)
- **Step 5**: Plan deliberately for reuse and recycling of treated water and sludge
Re-use and re-invent for land

• Today’s sewage system is water-based – water for flush and water to convey sewage and then after treatment disposal into water

• This destroys the nitrogen-cycle of world

• Nutrients lost

• Food security lost

• Water polluted

• Land-based sewage systems can repair this
Land-based sewage: circular economy

- Nutrients-Food-Excreta-Nutrients-Food
- Excreta can be used as nutrients for soil – reused in agriculture or compost
- If we design to remove pathogens and deliberately design for re-use
- Option to combine compost; make pellets for energy...
- Need to scale up; otherwise we will collect, even treat; but have vast amounts of sludge to handle
CSE has set up a state-of-art laboratory to analyze how these technologies are working. Important to know:

- **Inlet** water quality
- **Outlet** water quality

We can then understand better what needs to be done.
The performance efficiencies of selected technologies in the current study is as below:

<table>
<thead>
<tr>
<th>S. no</th>
<th>FSTP location</th>
<th>Technology</th>
<th>Description</th>
<th>Post treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bhubaneswar, Odisha</td>
<td>Decentralized wastewater treatment system (DEWATS)</td>
<td>Settler, anaerobic baffled reactor (ABR) and planted gravel filter (PGF)</td>
<td>No tertiary treatment</td>
</tr>
<tr>
<td>2</td>
<td>Dhenkanal, Odisha</td>
<td>Decentralized wastewater treatment system</td>
<td>Unplanted sludge drying bed (USDB), ABR and PGF</td>
<td>Tertiary treatment using sand filter and activated carbon filter</td>
</tr>
<tr>
<td>3</td>
<td>Jhansi, Uttar Pradesh</td>
<td>Decentralized wastewater treatment system</td>
<td>Planted sludge drying bed (USDB) and PGF</td>
<td>No tertiary treatment</td>
</tr>
<tr>
<td>4</td>
<td>Karunguzhi, Tamil Nadu</td>
<td>Decentralized wastewater treatment system</td>
<td>Unplanted sludge drying bed (USDB) and PGF but without ABR</td>
<td>No tertiary treatment</td>
</tr>
<tr>
<td>5</td>
<td>Ketty, Tamil Nadu</td>
<td>Decentralized wastewater treatment system</td>
<td>Planted sludge drying bed (PSDB) and PGF but without ABR</td>
<td>No tertiary treatment</td>
</tr>
<tr>
<td>6</td>
<td>Adigaratty, Tamil Nadu</td>
<td>Decentralized wastewater treatment system</td>
<td>Planted sludge drying bed (PSDB) and PGF but without ABR</td>
<td>No tertiary treatment</td>
</tr>
<tr>
<td>7</td>
<td>Leh, Ladakh</td>
<td>Decentralized wastewater treatment system</td>
<td>Planted sludge drying bed (PSDB) and PGF but without ABR</td>
<td>No tertiary treatment</td>
</tr>
<tr>
<td>8</td>
<td>Unnao, Uttar Pradesh</td>
<td>Decentralized wastewater treatment system</td>
<td>Screw press technology for solid-liquid separation, integrated settler, ABR, PGF</td>
<td>Tertiary treatment using sand filter, activated carbon filter and UV radiation</td>
</tr>
<tr>
<td>9</td>
<td>Warangal, Telangana</td>
<td>Package STP and pyrolysis</td>
<td>Anaerobic, anoxic, aeration and sedimentation zones</td>
<td>Tertiary treatment using sand filter, activated carbon filter and chlorination</td>
</tr>
<tr>
<td>10</td>
<td>Tenali, Andhra Pradesh</td>
<td>Moving bed biofilm reactor (MBBR)</td>
<td>MBBR, tube settler and clarifier</td>
<td>Tertiary treatment using sand filter, activated carbon filter and chlorination</td>
</tr>
<tr>
<td>11</td>
<td>Kalpetta, Kerala</td>
<td>Tiger bio-filter technology</td>
<td>Anaerobic digestion followed by two stage vermin-filtration</td>
<td>Tertiary treatment using sand filter, activated carbon filter and chlorination</td>
</tr>
<tr>
<td>12</td>
<td>Bharwara, Uttar Pradesh</td>
<td>STP co-processing</td>
<td>Upflow anaerobic Sludge blanket (UASB), pre-aeration tank, polishing pond</td>
<td>Tertiary treatment using chlorination</td>
</tr>
</tbody>
</table>
Percentage reduction of Biochemical oxygen demand

Source: CSE 2020

BOD of final discharge water from different FSTPs

Source: CSE 2020
Percentage chemical oxygen demand removal by FSTPs

COD % removal

Jhansi: 48.8
Unnao: 97.4
Bhubaneswar: 80.1
Dhenkanal: 86.0
Leh: 37.7
Karunguzhi: 62.4
Ketty: 50.0
Adigratry: 54.5
Wayanad: 85.6
Warangal: 48.7
Tenali: 64.7
Bharara: 78.7

FSTP Locations

DWWT with ABR system

DWWT without ABR system

Tiger biofilter
Packaged STP
MBBR
STP co-treatment

Source: CSE 2020
Faecal coliform in final discharge water from the different FSTPs

Source: CSE 2020
Learning: future agenda

• 11 FSTPs; 1 co-treatment plant (Bharwara STP/Lucknow) analysed

• Effective treatment (BOD-COD) under standards (anaerobic digestor worked better)

• But faecal coliform values in treated water still very high; not meeting discharge standards

• No focus on sludge treatment and reuse (next study we will analyse sludge/compost)
City’s sanitation is about **River’s Quality**

**We need**

- Affordable sanitation **to all**
- Sewage interception **of all**
- **Sewage treatment for reuse and recycling**

- This will ‘clean’ the river; improve quality of **life and health**
- This will make waste into a resource
Because
We all live downstream
Your waste is my water