Faecal Connection - Ganga and its cities

Suresh Kumar Rohilla, Senior Director
Water Programme

Anil Agarwal Dialogue :
AAETI
Feb.12, 2019
Faecal Waste / Septage

CITIES

River Pollution Connection ?

Ganga

Faecal Waste / Septage
Sewage Vs Faecal Sludge & Septage?

Sewage: untreated wastewater (faeces + urine) and generally grey water (kitchen & bathroom water) also become part of Sewage. BOD range is 150-350 mg/l.

Faecal Sludge / Septage: Semi solid slurry emptied out of septic tanks / pits and is much more concentrated than sewage.

But,

What is BOD of FSS?

2000-40000/60000/ even above 200000 mg/l

Note: BOD (Biological DO): It’s the amount of DO used by microorganisms while metabolising organic matter (sewage or pollutants)
CSE’s Assessment

Volume 1 - dwells on how urban India is soaking up water, polluting rivers and drowning in its own waste (296 pages).

Volume 2 - contains a very detailed survey of 71 cities, and presents an assimilation of the survey's results (496 pages) building on various previous publications:
Excreta Matters I

• Where does water come?
• Where does waste go?
• Simple questions.
• But not asked
• Never answered
Water = waste

Cities plan for water, **forget waste**

80% water leaves homes as sewage
More water = more waste
Cities have **no accounts** for sewage
Cities have **no clue** how they will convey waste of all, treat it, clean rivers
Excreta: *sums*

**Challenge**

Most of our cities do not have underground sewerage

Where there is pipeline; broken; sewage does not reach treatment plants

Most treatment plants are under-utilized

Building hardware will not clean rivers

So what do we do?
First count of toilets and their connections: where waste goes?

<table>
<thead>
<tr>
<th>Census 2001</th>
<th>Census 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>No latrine</td>
<td>Flush/pour toilet latrine connected to</td>
</tr>
<tr>
<td>Service latrine</td>
<td>a. Piped sewer system</td>
</tr>
<tr>
<td>Pit latrine</td>
<td>b. Septic system</td>
</tr>
<tr>
<td>Water closet</td>
<td>c. Other system</td>
</tr>
<tr>
<td><strong>Pit latrine</strong></td>
<td></td>
</tr>
<tr>
<td>With slab/ventilated</td>
<td>6.4</td>
</tr>
<tr>
<td>improved pit</td>
<td></td>
</tr>
<tr>
<td>Without slab/open pit</td>
<td>0.7</td>
</tr>
<tr>
<td>Night soil disposed into</td>
<td>1.2</td>
</tr>
<tr>
<td>open drain</td>
<td></td>
</tr>
<tr>
<td><strong>Service latrine</strong></td>
<td></td>
</tr>
<tr>
<td>Night soil removed by human</td>
<td>0.3</td>
</tr>
<tr>
<td>Night soil serviced by</td>
<td>0.2</td>
</tr>
<tr>
<td>animals</td>
<td></td>
</tr>
<tr>
<td>**No latrine within</td>
<td></td>
</tr>
<tr>
<td>premises</td>
<td></td>
</tr>
<tr>
<td>Public latrine</td>
<td>6.0</td>
</tr>
<tr>
<td>Open</td>
<td>12.6</td>
</tr>
</tbody>
</table>

Source: Census of India 2011, Houses, Household Amenities and Assets: Latrine Facility,
Recognise our reality...

- People are not connected to sewage system
- They have ‘on-site’ treatment
- Septic tanks – connected to soak pits or connected to drains or with no underground lining
- **CSE research shows situation is the same in UP as in the rest of the country**
- This is where **new opportunity lies to address river pollution**
Ganga cleaning very important - CPCB data shows more is needed to reduce pollution. New approach.

From U.P to West Bengal not even one of the monitoring stations on the banks of Ganga reported water quality fit for drinking as per standards set by CPCB.
70% of Ganga river pollution is attributed to dumping of untreated municipal sewage.
Excreta: sums

Water supply, wastewater generation, treatment in Class I & II cities (MLD)
1978-2015

Two cities Delhi & Mumbai have 31% of total treatment capacity installed in India.

Sewage Generation & Treatment Gap (in MLD)

- **Total WW generation**
  - India: 62000 MLD
  - Ganga Basin: 7301 MLD

- **Treatment capacity utilisation**
  - India: 18883 MLD
  - Ganga Basin: 2125 MLD
Sewage Treatment in Ganga Basin - Gap

• Sewage generation in India- 62000 mld and Sewage Treatment Capacity in India- 18883 mld

• 11 Ganga Basin States- 12050 mld (class I & II cities) - approx. 20 % of total.

• 5 Ganga basin state along main river stem (175 Class I and 102 Class II towns) generate- 7301 mld

• Sewage Treatment Capacity in Ganga Basin – 2125 mld (1188 mld under approval/ construction) 3313 mld

• Shortfall of 8737 mld / 3988 mld along river stem

Source: MoWRRD&GR, RAJYA SABHA UNSTARRED QUESTION NO. 152 ANSWERED ON 25.04.2016
CLEANING THE RIVER: DAUNTING CHALLENGE

Status of existing sewerage infrastructure
- 10 out of 97 towns contribute almost 64% of total sewage discharge
- 10 towns: Kolkata (highest sewage discharge) followed by Kanpur, Patna, Varanasi, Allahabad, Howrah, Haridwar, Bhagalpur, Farrukhabad & Bally

No. of towns on Ganga main stem 97
(Main stem states: UK, UP, Bihar, Jharkhand & WB)

Sewage generation 2,953 MLD

Projection of sewage generation in 97 towns by 2035 3,603 MLD

Treatment capacity of existing 84 sewage treatment plants (STPs) - 1,584 MLD
- 39 are working satisfactorily (treat 733 MLD)
- 14 operational but underutilised (Capacity - 581 MLD)
- 31 are defunct (Capacity - 270 MLD)

GANGA CLEANING BANKS ON FATE OF ONGOING PROJECT
- No. of sanctioned projects under ‘Namami Gange’ programme - 195
- No. of sewage infrastructure projects - 102 (out of 195)
- It’ll treat 2,369 MLD of sewage
- Remaining projects (93 out of 195) are related to crematoria development, river front development, river surface cleaning, institutional development, biodiversity conservation, afforestation, rural sanitation and public participation

STATUS OF 102 SANCTIONED SEWAGE INFRA PROJECTS:
- Completed 24
- Under execution 45
- Under various stages of tendering 33
Planning for hardware

Cities plan for treatment not sewage

• Treatment plants are not simple answers

• Most cities do not have underground sewage But engineers sell pipe-dreams of catching up with infrastructure

• We lose rivers. Generations of lost rivers
Wastewater Scenario
The current paradigm – water supply

More water supplied = More waste water generated = more costs for treatment = Unsustainable
Excreta Matters II

Water-toilet-septage / faecal sludge -sewage-treatment-reuse in town / cities
Urban India – Septage / Sewage: Shit Flow Diagram

- **Containment**: 50% WC to sewer
- **Collection**: 33%
- **Transport**: 17%
- **Treatment**: 33%
- **Reuse/disposal**: 19%

**On-site facility**
- Septic tanks, covered pits, VIPs etc.
- 41%

**Open defecation (including open pits)**
- 9%

**Leakage**
- Not treated to standard
- 17%

**Unsafely emptied or discharged**
- Not treated but unknown where it goes
- 41%

**Local area and beyond, via drains**
- 81%

**Receiving Waters**

**Source:** Census 2011

**Table:**

<table>
<thead>
<tr>
<th>Sewer coverage</th>
<th>No of Cities</th>
<th>% of population</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10%</td>
<td>191</td>
<td>16.45%</td>
</tr>
<tr>
<td>10 - 30%</td>
<td>158</td>
<td>20.10%</td>
</tr>
<tr>
<td>30 - 60%</td>
<td>75</td>
<td>24.22%</td>
</tr>
<tr>
<td>&gt;60%</td>
<td>78</td>
<td>39.23%</td>
</tr>
</tbody>
</table>
Ganga Basin – All Classes of Towns in Basin States

<table>
<thead>
<tr>
<th>Sewer coverage</th>
<th>No of Cities</th>
<th>% of sewered population</th>
<th>% of population</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10%</td>
<td>738</td>
<td>10%</td>
<td>2%</td>
</tr>
<tr>
<td>10 - 30%</td>
<td>348</td>
<td>24%</td>
<td>6%</td>
</tr>
<tr>
<td>30 - 60%</td>
<td>33</td>
<td>38%</td>
<td>9%</td>
</tr>
<tr>
<td>&gt;60%</td>
<td>17</td>
<td>28%</td>
<td>6%</td>
</tr>
</tbody>
</table>

Source: Census 2011

Local area and beyond, via drains

Receiving Waters

- Containment
  - WC to sewer: 23%
  - On-site facility: 60%
  - Open defecation (including open pits): 17%
- Collection: 23%
- Transport: 23%
- Treatment: 10% Treated, 60% Not treated to standard, 13% Not treated but unknown where it goes
- Reuse/disposal: 90%
Excreta Flow - unsafe disposal in Ganga Basin states is 90-95 % as higher compared to 81 % national average.

SBM lists 400 towns/cities to be declared ODF, have only 8 cities from Ganga basin.
Coverage of Toilets and its Dependence in Urban Areas

- Septic Tanks continue to be a constant source of containment considering the current rate of Sewerage network growth.

2.56 Billion litres set to seep into ground water with pit technology.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Urban Toilets</th>
<th>Toilets with OSS (Urban)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>64 Million</td>
<td>38 Million</td>
</tr>
<tr>
<td>2015</td>
<td>83 Million</td>
<td>44 Million</td>
</tr>
<tr>
<td>2017</td>
<td>93 Million</td>
<td>51 Million</td>
</tr>
<tr>
<td>2019</td>
<td>107 Million</td>
<td>49 Million</td>
</tr>
</tbody>
</table>

Number of Households (in Millions)
On-site challenges

• Toilet connected to underground ‘box’
• Design quality of septic tank is unknown – in many cases these are tanks, emptied regularly or simply linked to municipal drain
• In most cities Informal (mafia) collects waste for a price – growing and thriving business
• In all cities there is no system for safe disposal of this waste
• In all cities, waste from septic tanks is ‘dumped’ in open sewers; rivers; municipal sewers; fields...
Thriving private business: but where does this go?
Disposal: Over land or Drains – River
Disposal: in garbage dumps
Ganga Basin is fast becoming ODF. If the fecal sludge is not managed, instead of reducing contamination, it will further add to Ganga’s pollution load.
Ganga in peril

Under Namami Gange, the government will check the flow of untreated sewage into the river from 118 towns and cities. CSE visited 10 towns and cities along the Ganga and found that the authorities have miserably failed to manage faecal sludge, which is only going to increase in volume with the implementation of on-site sanitation under Swachh Bharat Mission.

Load of Swachh Bharat Mission

Faecal sludge to be produced by states along the Ganga on going open defecation-free

- Uttar Pradesh: 72.73 MLD
- Bihar: 30.89 MLD
- West Bengal: 69.05 MLD
- Jharkhand: 0.31 MLD

Total faecal sludge generated by the states following the Swachh Bharat Mission: 180 MLD

Faecal sludge from major cities under Namami Gange (in 1,000 litres/day)

- Cities surveyed by CSE

Data sources: Various sources

Prepared by DTE/CSE Data Centre

For more such infographics visit www.indianscientistfoundation.org/infographics
Excreta Management: Understanding Sanitation Chain - SFD
What is an SFD

An SFD is a graphic that shows faecal flows and its fate in conjunction with a service delivery report – IT IS NOT a stand alone diagram.
What is an SFD

• An effective communications and advocacy tool to engage city stakeholders
• Based on contributing populations, it gives an indication of where the excreta goes
• A representation of public health hazard
• An overview from which to develop sanitation priorities

What is NOT an SFD

• Based on volumes/mass – these are determined by other related factors
• A representation of public health risk (risk = hazard x behaviour)
• A precise scientific analytical tool
Using excreta flow diagrams (SFDs) as an integral part of city wide sanitation planning for Indian cities.
Faecal Flow Assessment: Shit Flow Diagram (SFD) of target AMRUT & Namami Gange Towns / cities in Uttar Pradesh
Assessment of Faecal Sludge and Septage Management in Uttar Pradesh

<table>
<thead>
<tr>
<th>Containment</th>
<th>Emptying</th>
<th>Transport</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offsite sanitation</td>
<td>WW contained: 29%</td>
<td>WW contained delivered to treatment: 17%</td>
<td>16% WW treated</td>
</tr>
<tr>
<td></td>
<td>WW not contained: 8%</td>
<td></td>
<td>2% SN treated</td>
</tr>
<tr>
<td>Onsite sanitation</td>
<td>SN not contained: 25%</td>
<td>FS contained – not emptied: 7%</td>
<td>7% FS contained – not emptied</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FS contained – emptied: 7%</td>
<td>2% FS treated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FS not contained – emptied: 8%</td>
<td></td>
</tr>
<tr>
<td>Open Defecation</td>
<td>4%</td>
<td>12% FS not delivered to treatment</td>
<td>17% WW not delivered to treatment</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12% FS not delivered - not emptied</td>
<td>1% FS not treated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>22% SN not delivered to treatment</td>
<td>1% SN not treated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>12% SN not delivered to treatment</td>
<td>4% WW not treated</td>
</tr>
</tbody>
</table>

Key: WW: Wastewater, FS: Faecal sludge, SN: Supernatant

Safely managed

Unsafely managed

Note: This SFD is done based on study of 66 towns and cities, representing 60% of urban population in UP. To know more about SFDs, visit https://sfd.susana.org

Date prepared: 23 December 2018
Prepared by: CSE
Analysis of Sanitation Chain in 66 cities of Uttar Pradesh through SFDs: Assessment of Faecal Sludge & Septage Management
# Assessment of Faecal Sludge and Septage Management in Uttar Pradesh: Summary

## Key Observations

<table>
<thead>
<tr>
<th>Observation</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 60% of the total population</td>
<td>is dependent on onsite sanitation systems like septic tank and pit latrine. Out of which, the faecal sludge and septage of 7% of the population is treated.</td>
</tr>
<tr>
<td>Septic tank effluent (overflow)</td>
<td>of 50% of the population is discharged in open drains, of which 2% is treated by tapping of nullahs and drains.</td>
</tr>
<tr>
<td>29% of the population</td>
<td>is connected to sewerage network. Of which, sewage of 16% of the population is treated.</td>
</tr>
<tr>
<td>More than 80% of the sewerage network in the state</td>
<td>is found in 7 cities (out of 635).</td>
</tr>
<tr>
<td>Sanitation provision through sewer system</td>
<td>increases with the increase in population of cities.</td>
</tr>
<tr>
<td>Excreta of 8% of the population</td>
<td>is discharged directly in open drains.</td>
</tr>
<tr>
<td>Excreta of 4% of the population</td>
<td>still defecates in the open.</td>
</tr>
<tr>
<td>Excreta of 27% of the total population</td>
<td>is safely managed. 7% of which is safely stored in containment systems.</td>
</tr>
<tr>
<td>No city</td>
<td>is 100% sewered.</td>
</tr>
</tbody>
</table>

**Note:** This technical report draws data collected by CSS in October 2013.
Assessment of Faecal Sludge and Septage Management in Uttar Pradesh

Location of 66 target cities and towns in Uttar Pradesh

Legends
○ Cluster 1 (Cities with population of more than 5 lakhs)
○ Cluster 2 (Cities with population between 2.5 and 5 lakhs)
○ Cluster 3 (Cities with population between 1.2 and 2.5 lakhs)
○ Cluster 4 (Cities with population less than 1.2 lakhs)
Type of Containment Systems in select 66 cities

- 37% Septic Tank connected to open drain
- 49% Fully Lined Tank connected to open drain
- 4% Lined pit with semi-permeable walls and open bottom
- 2% Fully lined tank with no outlet
- 2% Fully lined tank connected to open ground
- 2% Pit latrine
- 2% Septic Tank connected to soak pit
- 3% Lined tank with impermeable walls and open bottom
Type of Containment Systems
Emptying practices in select 66 cities

Break up of service providers
- 79% Private
- 21% Government

Type of emptiers prevalent
- 10313 Manual emptiers
- 493 Mechanical emptiers

Type of vehicles prevalent
- 91% Tractor mounted
- 9% Truck mounted
Type of Emptying
Transportation
Extent of Sewage and faecal sludge treatment

- 53% Sewage not treated
- 47% Sewage treated

- 13% FS treated
- 87% FS not treated
Treatment and Disposal
Cluster 1: Large cities (More than 10 lakh)

- 47% population is connected to sewerage network
- 41% population connected to onsite systems
- Around 38% population gets their tank emptied only after 15-20 years
- Most of these cities have allowed disposal of faecal sludge at pumping stations or STPs
- There are 43 STPs in the cluster, with 1952 MLD capacity, but receive only 1532 MLD of wastewater
Cluster 2: Medium cities (5-10 lakh)

- 72% population depend on onsite systems and more than 60% of these tanks are overflowing in drains
- Around 38% population gets their tank emptied only after 15-20 years
- Wastewater that is being treated at STP is majorly by interception and diversion of open drains
- There are 11 STPs in the cluster, with 230 MLD capacity, but receive only 168 MLD of wastewater
Cluster 3: Small and medium cities (1.2 - 5 lakh)

- 84% population depend on onsite systems and more than 75% of these tanks are overflowing in drains.
- Only 28% tanks qualified to be called as septic tanks.
- Around 46% population gets their tank emptied only after 15-20 years.
- 5% population still defecates in open.
- There are 10 STPs in the cluster which only take care of excreta of only 2% population.
Cluster 4: Small cities (less than 1.2 lakh)

- 81% population depend on onsite systems and more than 70% of these tanks are overflowing in drains
- 9% population still defecates in open
- Around 40% population gets their tank emptied only after 15 - 20 years
- 97% of vacuum tankers are tractor mounted
- Sewage treatment plants in only three cities out of 21 cities in the cluster
Cluster 5: Select cities along the River Ganga

- **40% population** connected to sewerage network, but excreta of 27% managed
- **38% population** connected to onsite systems, out of which 24% overflow in drains
- **19% population** directly discharging excreta in drains without any onsite systems
- **There are 18 STPs** in the cluster of cumulative capacity of 826.5 MLD, **which receive 655.7 MLD**
Toilet - STP+++  

• Current sanitation focus is on **building toilets** (important and necessary)  
• Current pollution-control focus is on **building sewage treatment plants** (unnecessary without conveyance)  
• But people are building septic tanks – there is no official conveyance; no official treatment  

• **End result is:** pollution
On-site needs:

• **Recognition**: official acceptance that these are not part of the past but the future

• **Regulations**: construction; collection; treatment

• **Technologies**: disposal and reuse
Proposed FSSM Approach Urban Areas in U.P.

**Full FSM with dedicated treatment facility**

- Jhansi, Loni, Moradabad, Gorakhpur, Bahraich, Fatehpur, Amroha, Ayodhya-Faizabad, Hapur, Shahjahanpur
- Allahabad, Varanasi, Agra, Kanpur, Lucknow, Ghaziabad

**Partial FSSM – Combined FSSM & Sewerage system; co-treatment; DEWATs; On-site treatment system, FSSTP wherever necessary.**

- Raebareli, Firozabad, Bareilly
- Aligarh, Meerut

**Gap filling – Complete Sewerage; FSSM only for non-sewered pockets with treatment at FSSTP or Co-treatment at STP.**

Cluster 4 (less than 1.2 lakh)
- Full FSSM

Cluster 2 & 3 (1.2 – 10 lakh)
- Partial FSSM
- Partial FSSM
- Gap filling FSSM

Cluster 1 (more than 10 lakh)
- Partial FSSM
- Partial FSSM
- Gap filling FSSM
More toilets and septic tanks built without sewer or safe disposal / treatment of septage will swamp the state & further increase manifold Ganga river pollution attributed to faecal coliform.
Thank You
URBAN SHIT

Every flush in 20 houses in Indian cities and towns conveys tens of thousands of litres of faecal sludge. Municipalities do not have a proper plan to deal with the charge of the faecal sludge collected in these tanks. Where does this sludge go?

RESEARCH BY SURESH KUMAR PANDIYA, EDITORS LAVENDER, BIKASH SARKAR, SHARAD SANJAY PRABHA AND NAIDU

BLIND SPOT IN NAMAMI GANGE

Two flagship programmes of Prime Minister Narendra Modi are working at cross-purposes. In 2019, when Swachh Bharat Mission comes to an end, some 30 million septic tanks and pits would have been dug along the Ganges. These tanks and pits would produce 100 million litres of faecal sludge every day, which will eventually find its way into the Ganga, defeating Namami Gange. It’s time the Central, state and local sanitation programmes recognised faecal sludge management as a priority to ensure a clean Ganga.

RESEARCH BY SURETHA, SHARAD SARKAR PANDIYA, ANIL YADAV, ANAND KUMAR DUBRA and DEEPAK KUMAR VERMA

PIPE DREAM

Unless Swachh Bharat Mission addresses septage management, it will end up defeating Namami Gange.
Defining & Monitoring River Water Quality

• **DO** (Dissolved Oxygen): refers to free non-compound oxygen present in water or other liquids. **It is crucial for survival of aquatic life.**

• **BOD** (Biological DO): It’s the **amount of DO used by microorganisms** while metabolising organic matter (sewage or pollutants)

• **Total Coliform**: Class of bacteria found in faeces / excreta. It’s **presence in drinking water** may indicate a possible presence of harmful, **disease causing organisms**
CPCB: What makes water fit for drinking?

Class A
Fit for drinking after disinfection
Water in this category has dissolved oxygen (DO) of more than 6 mg/l and biochemical oxygen demand of less than 2 mg/l. Total coliform should be less than 50/100 ml.

Class C
Conventional treatment and disinfection
Fit for drinking with conventional treatment after disinfection. It should have dissolved oxygen of more than 4 mg/l and biochemical oxygen demand of less than 3 mg/l. The pH range should be between 6 to 9 while total coliform should be below 5,000/100 ml.

Neither in Class A nor Class C
Water that does not fall in Class A or Class C is fit for drinking only after organised conventional/advanced treatment, including disinfection.

...AND FOR BATHING
For water to be fit for bathing, it should have dissolved oxygen more than 5 mg/l and biochemical oxygen demand of less than 3 mg/l. Acceptable faecal coliform range is from 500/100 ml to 2,500/100 ml. The pH range should be between 6.5 and 8.5.
HAR-KI-PAURI GHAT
Haridwar is where the Ganga enters the plains. It’s so far so good here with the water fit for bathing.

KANPUR (RANIGHAT)
The first major industrial city in the river’s path. The red icons tell the story.

ALLAHABAD (SANGAM)
The meeting place of Ganga, Yamuna and the mythical Saraswati, the water quality here is such that the pious dip is teeming with impurities.

GARDEN REACH
This is near Kolkata and the water quality is predictably bad, keeping with the trend in the bigger cities.

ULUBERIA
The last monitoring station before the river flows into Bay of Bengal. It ends its journey no better than along most of its route.