Quality Assurance in Faecal Septage Management Systems (FSMS)

Central Public Health and Environment Engineering Organisation (CPHEEO)
Onsite sanitation practices is population dependent.

Source: Census 2011
Background

**Status - Sewerage Systems in India**

- **32.7%**
  - Sewerage Coverage
  - Source: Census 2011

- **1:10**
  - One STP exists among 10 ULBs (Including Census Towns)

**816**
- STPs in Urban India
- Total Capacity: 23,277 MLD
- (37% of 62,000 MLD sewage generated)

**81%**
- STPs Operational (as on Mar ‘15)
- Total Operational Capacity: 18,883 MLD

- Effectively Only 30% of total sewage generated being treated.

**Status - Household Sanitation in India**

- **>60%**
  - Households still dependent on On Site Sanitation (OSS)

- **431 Lakhs**
  - Existing household toilets with no treatment / disposal facilities
Swachh Bharat Mission (Urban) - Overview

**Major Objectives**
- Eradication of Open Defecation in all Statutory towns
- 100% Scientific Solid Waste Management in all Statutory towns

**Implementation Components**
- Individual household toilets
- Community toilets/Public toilets
- Solid waste management
- Information, Education and Communication (IEC)
- Capacity Building (CB)

- 0.66 crore IHHL
- 5.08 lakh CT/PT seats
- Awareness Outreach Advocacy

**Estimated cost of implementation:** Rs. 62,009 crore

**Government of India share:** Rs. 14,623 crore
India’s commitment to Sustainable Development Goals (SDGs)

**Target 1.3**: By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance.

**Target 3.3**: By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases.

**Target 6.3**: By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.

**Target 11.6**: By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management.

*Without 100% sanitation coverage, efforts on missions such as Namami Gange and Smart City Mission will be futile...*
Toilet Construction Status

93.4% IHHL have been built or are under construction

Mission Target: **66.42 lakh seats**
Completed: **54.64 lakh seats**
Under construction: **7.41 lakh seats**

99.2% of CTs & PTs have been built or are under construction

Mission Target: **5.08 lakh seats**
Completed: **4.64 lakh seats**
Under construction: **0.39 lakh seats**
Open Defecation Free (ODF) – Current Status

Urban areas of 22 States/UTs have been declared ODF*

*Andaman & Nicobar Islands, Andhra Pradesh, Chandigarh, Chhattisgarh, Dadra & Nagar Haveli, Daman & Diu, Gujarat, Haryana, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Manipur, Mizoram, Punjab, Puducherry, Rajasthan, Sikkim, Telangana, Tamil Nadu, Tripura and Uttarakhand
SBM-U has largely focused on achieving ODF

A high percentage of Urban Toilets discharge into Onsite Containment - Primarily Septic Tanks

Unmanaged Septic Tanks Choke - leading to surface overflows in populated areas - Need Organised Maintenance

Comparison of Effluent Parameters - Faecal Septage Vs. Raw Sewage - India

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Raw Sewage</th>
<th>Faecal Septage</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD (mg/l)</td>
<td>110-350</td>
<td>440-78,600 (6480)</td>
</tr>
<tr>
<td>COD (mg/l)</td>
<td>250-800</td>
<td>1500-703,000 (32,000)</td>
</tr>
<tr>
<td>TSS (mg/l)</td>
<td>120-400</td>
<td>310-93,000 (12,860)</td>
</tr>
</tbody>
</table>

One truck of untreated faecal septage dumped in the open = 3,000 people defecating in the open

ODF has no meaning unless above issues are resolved...

Further, ODF is not the end of the sanitation value chain - ODF+++ and Management of Septage help to close the loop...
Robust Monitoring Protocols -

SBM ODF+, SBM ODF++ protocols launched

**SBM ODF+**
Focuses on cleanliness and sustainability of Community and Public Toilets

* Till date, 116 ULBs have been certified as ODF+

**SBM ODF++**
Focuses on cleanliness and sustainability of Community and Public Toilets, along with safe containment, processing and disposal of fecal sludge and septage

* Till date, 11 ULBs have been certified as ODF++
<table>
<thead>
<tr>
<th>Sanitary Fixtures (Privacy, Convenience)</th>
<th>Effluent Management (Conveyance, Treatment and Disposal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enclosures</td>
<td>Discharge drains (internal)</td>
</tr>
<tr>
<td>Pans</td>
<td>Inspection Chambers</td>
</tr>
<tr>
<td>Traps</td>
<td>Sewers- laterals, branch, mains, trunks</td>
</tr>
<tr>
<td>Ablution Water tanks, valves and connections</td>
<td>Manholes, Pumping stations</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Treatment</strong> – partial/comprehensive</td>
</tr>
<tr>
<td></td>
<td>- onsite/ decentralised??/ centralised</td>
</tr>
<tr>
<td></td>
<td>- small scale/ large scale?? - Right Sized</td>
</tr>
<tr>
<td></td>
<td><strong>Disposal incl Reuse</strong></td>
</tr>
</tbody>
</table>
Sanitation

/sanɪˈteɪʃ(ə)n/

noun

Conditions relating to public health, especially the provision of clean drinking water and adequate sewage disposal. -Google

Sanitation is the process of keeping places clean and healthy, especially by providing a sewage system and a clean water supply.

-Collins dictionary.com

1: the act or process of making sanitary.
2: the promotion of hygiene and prevention of disease by maintenance of sanitary conditions (as by removal of sewage and trash)

-Merriam-Webster.com

Sanitation refers to the provision of facilities and services for the safe management of human excreta from the toilet to containment and storage and treatment onsite or conveyance, treatment and eventual safe end use or disposal.

-WHO
Fate of Septic Tank Outflow
(No Soakwells Constructed)
Urban Centre/ Ward
Population -100,000
HH - 22,000
Septic Tank Coverage- 60% (15,000 HH)

Wastewater released in drains over two years
-15000*500*730
- 5.475 Billion Litres
(@100 litres/capita/day)

Wastewater managed as Septage in the same period
-15000*2000
- 30 Million Litres
(@2000 litres tank per HH)

NOT EVEN 1%
➢ Provide Toilet enclosures with pans
➢ Provide water in toilets for ablution, pan cleaning + hand wash
➢ Provide Onsite disposal through Septic tank, holding tank
➢ Provide Treatment of collected Septage at a facility
Constraints & Recommended Approach

**Recommended Approach**

Under present circumstances, while a **National Urban Sanitation Mission (NUSM)** is the **Need of the Day**, Development of **Faecal Septage Management Systems (FSMS)** is **need of the hour** to tide over the grim situation.

**A Graded Response**

- To provide sanitation for the entire population, FSM as a solution can be adopted while Sewer networks and STPs (Centralised and Decentralised) are provided in denser urban zones.
- Sewerage (Sewer network + STP) and FSMS have to co-exist considering various factors like unviability of sewer network in outer (less dense) urban areas.
- Stage-1  
  FSM Sub-Mission (Low hanging fruit)
- Stage-2  
  Septic Tank System Improvement Sub-Mission

**Fund Requirement**

-to cover all urban areas with sewer network and STP based solutions

**2.43 Lakhs Crore**

**Infrastructure Set up of Sewerage Systems**

**2.36 Lakh Crores**

**Operations & Maintenance**

Funds available under existing programmes like AMRUT not sufficient to cover the funding requirements of STPs
The Ministry envisions that all ULBs in India would introduce safe management of faecal sludge and septage (ODF+ and ODF++).

In ODF++ protocol, emphasis has been given to safe management and treatment of faecal sludge/septage, greywater, effluent from onsite sanitation systems and sewage/wastewater.
India: Burden of Water Borne Diseases

80% of diseases in human beings are water – borne due to water pollution/ contamination and water logging

Water Sanitation and Hygiene related diseases contributed to 28,597 deaths in the year 2004
- Global Health Observatory (GHO) data, WHO, 2004

<table>
<thead>
<tr>
<th>No.</th>
<th>Impact</th>
<th>Loss ($ billion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Health</td>
<td>38.5</td>
</tr>
<tr>
<td>2.</td>
<td>Access time (safe WSS)</td>
<td>15.0</td>
</tr>
<tr>
<td>3.</td>
<td>Tourism</td>
<td>0.5</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>54.0 (~INR 2.43 lakh Crores)</strong></td>
</tr>
</tbody>
</table>

Source: World Bank, 2006 ($ 1 = INR 44.93 in 2006)
SANITATION OPTIONS

A) Sewerage (Sewer Network + treatment)

B) Septic Tank Systems

C) Twin Pits - for very low density
Technological options: Sewerage System Vs FSM System

A) Containment and Collection

**Sewer Network**
- Robust centralised/decentralised system with high level of process control.
- Process results in the complete removal of wastewater solids and pathogens to treatment plant.
- Grey water is also transported for treatment and possible reuse.
- Most suited for densely populated areas.
- Highly Cost Intensive (Infrastructure) (Roughly Rs 7000/ capita)
- Time Consuming (3-5 years needed to setup Sewerage incl STP)
- Needs a minimum water supply for functioning

**Septic Tank Systems + Faecal Septage Collect & Transport**
- Onsite localised system.
- Partial collection of waste water- (retentate from Septic Tanks).
- Effluent from septic tank with considerable BOD continues to be discharged into the environment.
- Removal of pathogens discharged depends on septic tank system efficiency.
- Grey water conveyed to environment untreated.
- Suitable for less dense populated areas/ Upcoming developments.
- Cost Effective to Municipal Body (Owner’s responsibility)
- Modular- Ready as soon as premises occupied
- PPP and involvement of small entreprenuers
Technological options: Sewerage System Vs FSM System

B) Treatment and Reuse

<table>
<thead>
<tr>
<th>Sewage Treatment Plants (STP)</th>
<th>Faecal Sludge Management Facility (FSMF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Robust Centralised/Decentralised system with high level of process control. Allows Co-processing of septage.</td>
<td>• Decentralised system to receive high concentration septage</td>
</tr>
<tr>
<td>• Black and Grey water are treated</td>
<td>• Faecal sludge and septage are treated</td>
</tr>
<tr>
<td>• Process results in the complete elimination of pathogens</td>
<td>• By-products of FST are not always FCO compliant and hence may not be certified for agricultural use.</td>
</tr>
<tr>
<td>• By-products of sewage treatment e.g. compost can be safely used for agriculture</td>
<td>• Suited for less dense population areas</td>
</tr>
<tr>
<td>• Most suited for densely populated areas</td>
<td>• Cost Effective</td>
</tr>
<tr>
<td>• Cost Intensive (Infrastructure and O&amp;M)</td>
<td>• Around 0-1 year needed to construct a FSM facility</td>
</tr>
<tr>
<td>• Time Consuming (3-5 years needed to construct a STP)</td>
<td></td>
</tr>
</tbody>
</table>
Feacal Septage Management System (FSMS)

Toilets
- SBM is rapidly closing this gap with 100% coverage expected by October 2019

On-Site Storage = Septic Tanks, Pits
- 60% toilets will have OSS by 2020

De-sludging trucks clean Septic Tanks/Pits
- Unorganized sector, mostly private
- Decent service levels & Profitable businesses
- More needs to be done to eliminate manual scavenging

Faecal Septage should be treated
- Biggest gap
- Existing STPs can co-treat – quick solution
- Dedicated FSTPs need to be built also

Treated Sludge and water can be re-used
- Potential for nutrient recycling to soil

FSSM paramount to ODF Sustainability and enhanced SBM outcomes
Some Septage Treatment Options for FSTF

**Group A: Septage to Compost**
- Sedimentation ponds / Settling Tank / Thickening ponds
- Sludge drying bed / Unplanted sludge drying bed
- Planted sludge drying bed
- Co-composting
- Mechanical Dewatering
- Waste Stabilization pond (Non-aerated)
- Advanced Nutrient Recovery

**Group B: Septage to Energy**
- Bio-Methanation/Anaerobic biogas reactor
- Incineration
- Gasification
- Pyrolysis
Faecal Septage Management

By 2020, 70% of urban toilets will have on-site storage (tanks, pits)
Problem Statement
Rapid adoption of FSM across India

- 442 towns tender and announcement for FSTPs
  - Odisha 114
  - Maharashtra 100
  - Andhra Pradesh 76 towns awarded tender
  - Uttar Pradesh 31 towns
  - Tamil Nadu 49 towns
  - Telangana 72 towns

Conventional and new approaches to FSM still being attempted
- Passive technologies, thermal technologies, truck-mounted FSM

Lack of experienced practitioners specific to FSTPs/FSM
FSM and Quality

FSM requires quality interventions

• With standards to align our objectives

• With manuals and guidelines to implement FSM that meet policy and standards consistently

• With tools to identify and manage risks
Quality Framework – A holistic approach

Framework components

- Linkage with country regulations / policy
- Definition of Quality and Standards Development
- Operational Guidelines
- QA Tools

Component Dimensions

- Outcome Standards: Standards that directly affect outcomes, e.g., biosolids standards
- Process Standards: Standards and guidelines for processes e.g., CPHEEO manual
- Service Standards: Benchmarks for services, including the citizen perspective, e.g., response time for filling service requests etc.
- Ownership: Who is responsible for delivering a particular component of FSM
- Procedural Guidelines: What provisions and guidelines exist to ensure compliance for each component of FSM based on a graded risk assessment
- Checklists, templates etc., that help operationalize the Procedural Guidelines

Brief Description

- National Fecal Sludge Management policies along with policies on sanitation, water pollution, SWM and state policies
Thank You