MODULE PURPOSE

• Basic understanding of Urban sanitation and Faecal Sludge and Septage Management

• Target audience/trainees: Staff of Urban Local Bodies, State governments, Training Institutes, Private Sector and NGOs, Consultants, Academia and students

• Handbook on FSSM Orientation provides the narrative context to this Module
Learning Objectives

- Urbanization trend in India and the urban sanitation challenge
- Understanding ODF and ODF+ concepts and experiences
- Decentralized septage, sludge and waste water treatment solutions are technically sound options for Indian towns and cities, and are not sub optimal solution as compared to centralized sewerage systems
- Assessment & Planning for FSSM at the city level
- Overview of policy, regulation and behaviour change communication
- Gender, caste and class dimensions of sanitation
Session 1

Fundamentals of Urban Sanitation and Faecal Sludge and Septage Management
Urbanisation trends in India

- Urban Population - 377 million (31.16 %)
- Total number of urban centers: 7935
- Statutory Towns (4041 nos.) are administered by Urban Local Bodies
- Census towns have trebled over a decade. Increase in Statutory Towns has been much slower.

<table>
<thead>
<tr>
<th>Type of Urban Units</th>
<th>2011 Census</th>
<th>2001 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Towns:</td>
<td>7,935</td>
<td>5,161</td>
</tr>
<tr>
<td>(a) Statutory Towns</td>
<td>4,041</td>
<td>3,799</td>
</tr>
<tr>
<td>(b) Census Towns</td>
<td>3,894</td>
<td>1,362</td>
</tr>
<tr>
<td>2. Urban Agglomerations</td>
<td>475</td>
<td>384</td>
</tr>
</tbody>
</table>

Census Towns are administered via rural administration — provision of urban services not mandatory in these areas.
### Urban Sanitation Situation in India (Census 2011)

#### On Site Sanitation and Off Site (Sewerage)

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household Toilet</td>
<td>81.4%</td>
</tr>
<tr>
<td>Septic tanks</td>
<td>38.2%</td>
</tr>
<tr>
<td>Pit Latrines</td>
<td>8.8%</td>
</tr>
<tr>
<td>Insanitary (Dry &amp; Bahao) Latrines</td>
<td>1.7%</td>
</tr>
<tr>
<td>Sewerage Connection</td>
<td>32.7%</td>
</tr>
</tbody>
</table>

#### Sanitation Facilities

- No Household Toilets: 18.6%
- Community Toilets: 6%
- Open Defecation: 12.6%

#### Safe Disposal

- Safe Disposal: 31% (11,467 MLD out of 38,254 MLD from Class I & II towns)

#### Water Quality

- 75% of fresh water resource which is being used for drinking purpose is contaminated.
- Sewage contributes 60% of total pollution load.
- 93% of total domestic wastewater is generated in Class-I cities.

Ref.: CPCB Report, 2009
Key Sanitation facts from CENSUS 2011 - INDIA

- **18.6%** of urban HHs have reported **No Toilets**
- **32.7%** of urban HHs have access to **Piped Sewer**
- **38.2%** of HHs have **Septic Tanks**
- **6%** of HHs depend on **Public Toilet**
- **12.6%** of HHs resort to **Od**

Source: CEPT
Sanitation situation in INDIA...

Access To Sanitation in India:
- **Open defecation**:
  - Community or toilets: 6%
  - Individual toilets: 82%
  - Total: 67,025
  - Percentage: 12%

Collection and Conveyance:
- **Pit toilets**:
  - 7%
- **Septic tanks**:
  - 45%
- **Sewerage**:
  - 44%
- **Others**:
  - 4%

Treatment:
- **Untreated waste**:
  - 70%
- **Treated waste**:
  - 30%

Over 50% of HHs are dependent on Onsite system.

37 million people practice open defecation in urban India.

28 million people with individual toilets use unsanitary methods of disposal of waste.

43,117 MLD untreated wastewater is discharged in water bodies or on land.

Note: (1) Others includes primitive methods of C&C such as pour flush toilets-other systems, night soil disposed intro open drain and latrines serviced by humans and animals, (2) *Inventory of sewage treatment plants* report by Central Pollution Control Board of India (CPCB), 2015.
Recap

• What is the major sanitation challenge faced by India in this century

• What is the major sanitation challenge faced by your city/state
Understanding Terms

• Black Water, Grey Water
• Sanitation
• Septage
• Faecal Sludge
• Sanitation Value Chain
• FSM Value Chain
• Faecal Sludge and Septage Management
Sewage:
Sewage is a waste water from a community, containing solid and liquid excreta, coming from houses, factories and industries.

Sullage:
Sullage means waste water which does not contain excreta. For example, waste water from kitchen and bathrooms.
What is Faecal Sludge . . .

“Faecal sludge is the solid or settled contents of pit latrines and septic tanks.

Faecal sludge (FS) comes from onsite sanitation system such as pit latrines, non-sewered public ablution blocks, septic tanks, aqua privies, and dry toilets.”

What is Septage ...

"It is the liquid and solid material that is pumped from a septic tank, cesspool, or such onsite treatment facility after it has accumulated over a period of time.

Septage is the combination of scum, sludge, and liquid that accumulates in septic tanks".

Septic Tank
THIS is SEPTAGE – also called Faecal Sludge
Onsite sanitation and FSM – emerging questions

38.2% URBAN HHs HAVE SEPTIC TANKS

Are septic tanks linked to soak pits
Are they built as per Codes / Specifications?
How often are they cleaned?
Where does the effluent flow?
What happens to the SLUDGE?

Source: CEPT
THIS is what is in SEPTAGE

Bacteria

Protozoa

Ascaris lumbricoides

Trichuris trichura

Hook worm
1 truck of Faecal Sludge and Septage carelessly dumped = 5,000 people shitting in the open!

1 Gram of Feaces may contain:

- 100 parasites eggs
- 1000 Protozoa
- 1,000,000 Bacteria
- 10,000,000 Virus

Sanitation Systems

- Non-Sewered Sanitation System
  - Fecal Sludge

- Sewered Sanitation System
  - Wastewater

- Fecal Sludge Management

- De-Centralized Wastewater Treatment System (DEWATS)

- Centralized Wastewater Treatment
## Comparison of Centralized and Decentralized Method

<table>
<thead>
<tr>
<th>Implementation</th>
<th>Centralized</th>
<th>Decentralized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital costs</td>
<td>High cost</td>
<td>Low cost</td>
</tr>
<tr>
<td>Skilled manpower</td>
<td>High requirement</td>
<td>Not required</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Operations</th>
<th>Centralized</th>
<th>Decentralized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water needed</td>
<td>More than 135 LPCD</td>
<td>Less requirement of water compared to 135 LPCD</td>
</tr>
<tr>
<td>O&amp;M costs</td>
<td>High costs</td>
<td>Low on municipality</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall issues</th>
<th>Centralized</th>
<th>Decentralized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implementation challenges</td>
<td>High</td>
<td>Low on municipality</td>
</tr>
<tr>
<td>Life Span</td>
<td>More than 20 years</td>
<td>Upto 10 years</td>
</tr>
<tr>
<td>Treatment</td>
<td>Easier Centralized or DEWATS</td>
<td>Challenging for municipalities</td>
</tr>
</tbody>
</table>
Sanitation Value Chain

FSSM Value Chain

User Interface → Storage/Containment → Emptying and Transport → Treatment → Use / Safe Disposal
Recap: Challenges of Urban Sanitation and Waste Water

• Unlined and unscientific septic tank toilet system
• No treatment of septage waste

• Large number of small towns and cities without sewerage system
• A large volume of untreated waste water generated, not treated.
Significant gaps exist across the sanitation value chain in Urban Rajasthan

Number of ULBs\(^1\) : 185

<table>
<thead>
<tr>
<th>Access to type of sanitation ('000s of HH)(^1)</th>
<th>Method of collection of waste ('000s of HH)</th>
<th>Methods of conveyance of waste ('000s of HH)</th>
<th>Treatment of wastewater (in MLD)</th>
<th>Disposal of waste (in MLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open defecation</td>
<td>Others(^1)</td>
<td>No/drains</td>
<td>Untreated</td>
<td>Not reused</td>
</tr>
<tr>
<td>Community toilets</td>
<td>Pit toilets</td>
<td>Open drains</td>
<td>Treated</td>
<td>Reused</td>
</tr>
<tr>
<td>Individual toilets</td>
<td>Septic tanks</td>
<td>Closed drains</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewerage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Source:
1. Census 2011 – Tables on Households Amenities

~431,000 HH practice open defecation and
~156,000 HH with personal toilets use other method of waste collection
~363,000 HH have no drains for conveyance of wastewater
~1,139 MLD of wastewater is left untreated every day
~345 MLD of treated wastewater is disposed off without being reused
Significant gaps exist across the sanitation value chain: AMRUT Cities of Rajasthan

Number of ULBs: 29

<table>
<thead>
<tr>
<th>Access to type of sanitation ('000s of HH)</th>
<th>Method of collection of waste ('000s of HH)</th>
<th>Methods of conveyance of waste ('000s of HH)</th>
<th>Treatment of wastewater (in MLD)</th>
<th>Disposal of waste (in MLD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open defecation 10%</td>
<td>No drains 10%</td>
<td>Untreated 67%</td>
<td>~1178 MLD</td>
<td>~384 MLD</td>
</tr>
<tr>
<td>Community toilets 5%</td>
<td>Open drains 45%</td>
<td>Treated 32%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Individual toilets 88%</td>
<td>Septic tanks 49%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sewerage 42%</td>
<td>Pit toilets 4%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Others 1%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- ~201,000 HH practice open defecation and
- ~90,000 HH with personal toilets use other method of waste collection
- ~191,000 HH have no drains for conveyance of wastewater
- ~794 MLD of wastewater is left untreated every day
- ~345 MLD of treated wastewater is disposed off without being reused

Source:
1. Census 2011 – Tables on Households Amenities
Significant gaps exist across the sanitation value chain: Non-AMRUT Cities of Rajasthan

Number of ULBs\(^1\) : 156

### Access to type of sanitation ('000s of HH)\(^1\)
- Community toilets: Open defecation 24%, Closed drains 74%
- Individual toilets: Open drains 70%, Closed drains 9%

### Method of collection of waste\(^1\) ('000s of HH)
- Open defecation: 9%
- Pit toilets: 11%
- Septic tanks: 70%
- Sewerage: 9%

### Methods of conveyance of waste\(^1\) ('000s of HH)
- No drains: 18%
- Open drains: 65%
- Closed drains: 18%

### Treatment of wastewater\(^2\) (in MLD)
- Untreated: 100%

### Disposal of waste\(^2\) (in MLD)
- Not reused: 100%

\(^{1}\) Census 2011 – Tables on Households Amenities
Overview of sanitation situation in Maharashtra

Only 33 cites out of 360+ cities have partial sewer network

Only 20 cites have wastewater treatment facility

20% of treated wastewater is reused

Source: CEPT
Extent of septage management (SM) required in Maharashtra

Total 259 Cities with 30.2 million population requiring FSM

1. Large city partial
   22 Cities
   (16.6 Mn population)

2. Small city partial
   19 Cities
   (1.2 Mn population)

3. Medium-small cities near STPs
   36 Cities
   (with STP within 15/30 km.)
   (3.1 Mn population)

4. Citywide FSM - medium
   56 Cities >50,000
   Pop. (5.8 Mn population)

5. Citywide FSM - small
   126 Cities < <50,000
   Pop.
   (3.6 Mn population)

Source: CEPT
Wastewater flow diagram

- **Containment**
  - WC to Sewer (0%)
  - WC to Septic tank (17.7%)
  - Pit Latrines (1.9%)
  - Open defecation (0.4%)

- **Emptying**
  - Safely emptied
  - Never emptied
  - Safely abandoned when full

- **Conveyance**
  - Greywater
  - Effluent
  - Conveyed through Drains
  - Leakage

- **Treatment**
  - No treatment
  - Illegally dumped

- **Reuse/disposal**
  - Effluent
  - No treatment
  - Ground Water

Existing Situation

- **Domestic environment**
  - 98.2%

- **Water Bodies**
  - 1.9%

- **Solid waste dumped site**
  - 1.9%

- **Ground Water**
  - 6.3%

- **Reuse/Disposal**
  - 91.1%
Integrated FSM and Waste Water Planning

WC to Sewer (0%)

WC to Septic tank (20%)

Grey Water (80%) (Bathroom/Kitchen)

Grey Water (80%)

Greywater (80%)

Conveyed through settled sewer

Conveyance

Treatment

Reuse/disposal

99.6%

Reuse in agriculture

42.9%

Water bodies

50%

Proposed Situation

Containment

Emptying

Effective treatment (STP)

Septage treatment facility

99.6%

Reuse as compost

0.2%

Remains in septic tank

Ground Water

0.4%

Remains in septic tank

Never emptied

Septage (6.7%)

Safely emptied

Effluent (12.9%)

PIT Latrines (0%)

Open defecation (0%)

99.6%
Policy and Programmes

• ODF Protocol
• ODF and ODF Plus
• NFSSM Policy
ODF City : Definition

A city / ward can be notified/declared as ODF city/ ODF ward if, at any point of the day, not a single person is found defecating in the open.
ODF Protocol

1) All households that have space to construct toilet, have constructed one.
2) All occupants of those households that do not have space to construct toilet have access to a functional community toilet within a distance of 500 meters.
3) All commercial areas have functional public toilets within a distance of 1 kilometer.
4) Details of all Individual household toilets (IHHL) constructed from 2011 onwards will have to mandatorily be uploaded on the SBM-Urban portal.
5) Pictures of all functional community and public toilets in the city, irrespective of the date of construction, will have to mandatorily be uploaded on the SBM-Urban portal.
<table>
<thead>
<tr>
<th>Maharashtra ODF and ODF Plus Protocol</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ODF City</strong></td>
</tr>
<tr>
<td>Elimination of OD practices</td>
</tr>
<tr>
<td>- Not a single person found defecating in the open</td>
</tr>
<tr>
<td>- No traces of faeces are visible in the city at any time of the day.</td>
</tr>
<tr>
<td>Access to toilets</td>
</tr>
<tr>
<td>- All the properties in the city have access to either own toilet or functional community/public toilet</td>
</tr>
<tr>
<td>- Floating population in the city has an access to sufficient and functional public toilets</td>
</tr>
<tr>
<td>Conveyance and treatment of faecal waste</td>
</tr>
<tr>
<td>- All toilets are connected to a disposal system</td>
</tr>
</tbody>
</table>

| **ODF+ City**                        |
| Elimination of OD practices          |
| - Not a single person found defecating in the open |
| - No traces of faeces are visible in the city at any time of the day. |
| Access to toilets                    |
| - At least 80% of residential properties in the city have access to own toilets |
| - Remaining properties and floating population in the city have access to functional community/public toilets |
| Conveyance and treatment of faecal waste |
| - All toilets are connected to a disposal system |
| - Regular and safe collection, conveyance and treatment of all the faecal matter |

| **ODF++ City**                       |
| Elimination of OD practices          |
| - Not a single person found defecating in the open |
| - No traces of faeces are visible in the city at any time of the day. |
| Access to toilets                    |
| - At least 95% of residential properties in the city have access to own toilets |
| - Remaining properties and floating population in the city have access to functional community/public toilets |
| Conveyance and treatment of faecal waste |
| - All toilets are connected to safe disposal system |
| - Regular safe collection, conveyance and treatment of all faecal matter and waste water including septic tank effluent and grey water |
Facilities like *septic tanks*, dry latrines, community toilets, or other types *accumulate faecal sludge*.

*Septage needs to be removed periodically.* If this septage is *not properly managed*, *negative impacts* on the *urban environment* and *public health* may result.

*Environmental pollution* is caused by *effluents of not regularly de-sludged septic tanks* or community toilets;

*Improper handling of septage* regenerates the risks of faecal matter *re-entering the domestic environment*.

---

**Table 3: Pollutants in the effluent of on-site treatment Systems**

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Reason for concern</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total suspended solids</td>
<td>In surface waters, suspended solids can settle and form sludge deposits that smother benthic invertebrates, fish eggs and can contribute to benthic enrichment, toxicity and sediment oxygen demand. Colloidal solids can block sunlight, affect aquatic life and lower the ability of aquatic plants to increase the dissolved oxygen in the water.</td>
</tr>
<tr>
<td>Biodegradable organics (BOD)</td>
<td>Biological degradation of organics can deplete the dissolved oxygen in surface waters resulting in anoxic conditions, harmful to aquatic life.</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>Nitrogen could lead to eutrophication and dissolved oxygen loss in surface waters. High levels of nitrate nitrogen in drinking water can cause methemoglobinemia in infants and pregnancy complications for women. Livestock can also suffer from drinking water high in nitrogen.</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>Phosphorus would also lead to eutrophication and reduction of dissolved oxygen in surface waters.</td>
</tr>
<tr>
<td>Pathogens</td>
<td>Parasites, bacteria and viruses can cause communicable diseases through body contact, ingestion of contaminated water or shellfish. Transport distances of some pathogens (bacteria and viruses) can be quite significant.</td>
</tr>
</tbody>
</table>

*Source: Advisory on septage management, Govt. of India, MoHUA*
Policy initiatives, Guidelines and Schemes for FSSM:

- **2017**
  - National Policy on Faecal Sludge and Septage Management

- **2014**
  - Smart City Mission, Swachh Bharat Mission and AMRUT

- **2013**
  - Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013

- **2008**
  - National Urban Sanitation Policy
Discussion
Challenges and Opportunities of FSSM

• What are current practices and challenges from your state perspective?

• What are institutional and monitoring challenges in FSSM?

• Divergent Challenges faced by different stakeholders
  - Households,
  - Private emptier,
  - City government
  - End Users

• Links with SBM / AMRUT
The key objective of the urban FSSM Policy is to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all ULBs such that safe and sustainable sanitation becomes a reality for all in each and every household, street, town and city.

**Milestones:**

- Leveraging FSSM to achieve 100% access to safe sanitation
- Achieving integrated citywide sanitation
- Mainstreaming sanitation
- Sanitary and safe disposal
- Awareness generation and behavior change

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**NATIONAL POLICY ON FECAL SLUDGE AND SEPTAGE MANAGEMENT (FSSM)**
Challenges in Access

**Individual Toilet**
- Space issues
- Affordability issues
- Inadequate water supply in selected regions
- Dilapidated/Quality
- Insanitary toilet - Unsafe toilet

**Community Toilet**
- Poor condition
- Lack of O&M
- Water Supply and Electricity issue
- Limited time access
- Not adequate
- Require huge space at prime location
- Categorized as Unsafe toilet as per Joint Monitoring programme

**Public Toilet**
Challenges in collection system

- Septic tanks are below the toilets and don’t have access covers
- Inaccessible septic tanks with sealed tops
- Septic tanks located near drains and sealed from the top

- Single pit toilets
- Oversized septic tanks
- Toilets directly connected to drains
Septic tanks of different materials used in Maharashtra and Jharkhand

Plastic

RCC
## Recommended sizes of septic tanks

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Number of Users</th>
<th>Length (m)</th>
<th>Breadth (m)</th>
<th>Liquid depth for Cleaning once/2 years</th>
<th>Liquid depth for Cleaning once/3 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>1.5</td>
<td>0.75</td>
<td>1.0</td>
<td>1.05</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>2.0</td>
<td>0.9</td>
<td>1.0</td>
<td>1.40</td>
</tr>
<tr>
<td>3</td>
<td>15</td>
<td>2.0</td>
<td>0.9</td>
<td>1.3</td>
<td>2.0</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>2.3</td>
<td>1.1</td>
<td>1.3</td>
<td>1.8</td>
</tr>
<tr>
<td>5</td>
<td>50</td>
<td>5.0</td>
<td>2.0</td>
<td>1.0</td>
<td>1.24</td>
</tr>
<tr>
<td>6</td>
<td>100</td>
<td>7.5</td>
<td>2.65</td>
<td>1.0</td>
<td>1.24</td>
</tr>
<tr>
<td>7</td>
<td>150</td>
<td>10</td>
<td>3.0</td>
<td>1.0</td>
<td>1.24</td>
</tr>
<tr>
<td>8</td>
<td>200</td>
<td>12</td>
<td>3.3</td>
<td>1.0</td>
<td>1.24</td>
</tr>
<tr>
<td>9</td>
<td>300</td>
<td>15</td>
<td>4.0</td>
<td>1.0</td>
<td>1.24</td>
</tr>
</tbody>
</table>


## Recommended sizes of twin pits/leaching pits

<table>
<thead>
<tr>
<th>Pit type</th>
<th>5 users</th>
<th>10 users</th>
<th>15 users</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Diameter in m</td>
<td>Depth in m</td>
<td>Diameter in m</td>
</tr>
<tr>
<td>Dry pits</td>
<td>0.9</td>
<td>1.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Wet pits</td>
<td>1.0</td>
<td>1.3</td>
<td>1.4</td>
</tr>
</tbody>
</table>

Challenges in Conveyance system

- Services mainly provided by city governments
- Unsafe handling of septage
- Informal Private sector

- No monitoring mechanism for informal sector
- Cleaning cycle greater than 8-10 years against recommended cycle of 2-3 years
- Due to infrequent cleaning, septage begins to solidify in tanks and septic tank fills up, faecal matter along with effluents is released into the drains

Emptying when the tank is full
Challenges in Disposal system

Disposal of septage at dump site

NO TREATMENT OF FAECAL SLUDGE & SEPTAGE

Disposal of septage in open land

Disposal of septage in water bodies

Standards for Disposal

Effluent discharged standards for Sewage Treatment Plant are mentioned below:

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Industry</th>
<th>Parameters</th>
<th>Standards for New STPs (Design after notification date)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sewage Treatment Plant</td>
<td>pH</td>
<td>6.5-9.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BOD</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>COD</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TSS</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td></td>
<td>NH₄-N</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N-total</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fecal Coliform</td>
<td>&lt;100</td>
</tr>
</tbody>
</table>

(MPN/100ml)  

Note:
(i) All values in mg/l except for pH and Coliform.
(ii) These standards will be applicable for discharge in water resources as well as for land disposal. The standards for Fecal Coliform may not be applied for use.

Source: Gazette notification by MoEF, 24th November 2015
http://www.moef.gov.in/sites/default/files/Draft%20notification%20of%20Sewage%20Treatment%20plan.PDF

Actual quality of septage that is being disposed off

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Parameter</th>
<th>Faecal Sludge &amp; septage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>pH</td>
<td>7.6-9</td>
</tr>
<tr>
<td>2</td>
<td>BOD</td>
<td>6000 - 16500</td>
</tr>
<tr>
<td>3</td>
<td>COD</td>
<td>11408 - 27776</td>
</tr>
<tr>
<td>4</td>
<td>TSS</td>
<td>9000 - 90000</td>
</tr>
<tr>
<td>5</td>
<td>Total Nitrogen (as N)</td>
<td>300-800</td>
</tr>
<tr>
<td>6</td>
<td>Faecal Coliforms (MPN/100ml)</td>
<td>&gt;1600</td>
</tr>
</tbody>
</table>
Discussion
Challenges and Opportunities of FSSM

• What are current practices and challenges from your state perspective?

• What are institutional and monitoring challenges in FSSM?

• Divergent Challenges faced by different stakeholders
  - Households,
  - Private emptier,
  - City government
  - End Users

• Links with SBM / AMRUT
SESSION 2

FSSM Planning Process
Five Stages of Assessment . . .
Stage 1: Assessing Service Performance Across the Full Service Chain

Assessing service performance across the service chain through a city level assessment is the first step in planning process.

It is an important exercise, which provides an initial sense of the state of FSM in the city, help in understanding the context and identifying gaps in key services.

The data collection and field assessments in the city should start with a kick-off meeting with key stakeholders.
Stage 1: Assessment across sanitation Service Chain

**Access**
- Identify Dependence on Various Toilet Facilities
- Capture details of community/public toilets
- Spatial Variations

**Collection**
- Assess details of Septic Tanks related to location, size, design and access
- Dependency on On-Site Systems
- Inaccessible Septic Tanks with sealed tops
- 3 chambered septic tanks of sufficient size with access covers

**Conveyance**
- Assess available infrastructure and process for septic tank emptying
- Details related to type/size of Trucks
- Coverage in different parts of city
- Number of Septic tank emptied annually
- Private sector availability

**Treatment / Disposal / Reuse**
- Identify present location of septage disposal/treatment
- Assess the capacity requirement/adequacy of a Septage Treatment Facility
- Reuse of treated septage
- Market and Demand for Reuse
### Citywide Sanitation Indicators
*(Sewerage system + Onsite systems)*

<table>
<thead>
<tr>
<th>1. Coverage of toilets</th>
<th>Percentage of properties with access to toilet facility in the city</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Coverage of adequate sanitation system</td>
<td>Percentage of households with individual or group toilets connected with adequate sanitation systems (sewer network/ septic tank / double pit system) to total households in the city.</td>
</tr>
<tr>
<td>3. Collection efficiency of sanitation system</td>
<td>Weighted average of collection efficiency of each sanitation system, weighted by share of households dependent on each sanitation system.</td>
</tr>
<tr>
<td>4. Adequacy of treatment capacity of sanitation system</td>
<td>Weighted average of adequacy of treatment plant capacity available for each sanitation system, weighted by share of households dependent on each sanitation system.</td>
</tr>
<tr>
<td>5. Quality of treatment of sanitation system</td>
<td>Weighted average of quality of treatment of each sanitation system, weighted by share of households dependent on each sanitation system.</td>
</tr>
<tr>
<td>6. Extent of reuse and recycling in sanitation system</td>
<td>Weighted average of extent of reuse of treated wastewater and sludge after adequate treatment as a percentage of wastewater and sludge received at the treatment plant, weighted by share of household dependent on each sanitation system.</td>
</tr>
</tbody>
</table>
Stage 1 : Tools for Assessing Service Performance

• Sani Plan
• Rapid Assessment Tool
• Shit Flow Diagram
RAPID ASSESSMENT TOOL

SHOW ITS OPERATION
SFD FILM

https://www.youtube.com/watch?v=7a3VdJh2WAQ&feature=youtu.be
Stage 2: Assessment of enabling environment: Policy, Regulation and Institutions

It is important to **understand** and **assess** the **prevailing enabling** and **regulatory environment** as well as **capacity** of local **stakeholders** to **manage** the citywide **FSM services**.

This can be **assessed** by a review of: a) **State/national policies** and guidelines on FSM, b) **Regulatory framework** for treatment, disposal, and reuse of faecal matter, and c) assessing **roles** and **responsibilities** of **local government** for FSM.
Stage 2: Review of state policies, acts & programmes that enable FSSM
### Stage 2: Tools for policy and governance assessment

#### TOOLS available for ASSESSING policies, REGULATIONS and CAPACITY of Local government

<table>
<thead>
<tr>
<th>Assessment areas</th>
<th>Assessment Tools</th>
<th>Download</th>
</tr>
</thead>
<tbody>
<tr>
<td>National and state policy and guidelines</td>
<td>5. Assessing policies and regulations affecting FSM at local levels</td>
<td>a. Sample policies and guidelines (NUSP, FSM guidelines GOI / GoM, GoTN, FSM in Urban Maharashtra, Other Sanitation Acts)</td>
</tr>
</tbody>
</table>
| Regulatory regime for FSM and the institutional roles | 6. Assessing capacity at local level: local government and other stakeholders | a. Examples of Process mapping  
b. Examples of citizens charter  
c. Interview guide for local government to assess capacity for PSP |
| Assessing local capacity for FSM | | |

Source: IFSM toolkit - [http://ifsmtoolkit.pas.org.in/](http://ifsmtoolkit.pas.org.in/)
Stage 3: Technology options for FSSM services

In designing a citywide FSSM service, it is important to **assess technology options** for each link in the **service chain**.

This ranges from **appropriate toilets** and **onsite systems** such as septic tanks to **conveyance** as well as **treatment** and reuse.

- **Toilets and its connectivity**
  - Twin pit
  - Bio-digestor toilet

- **Emptying services**
  - Conventional Vacuum Tanker
  - Mini-Vacuum Tanker (Vacutug)

- **Treatment technologies**
  - Sludge drying bed
  - Co-composting
Stage 3: Assessing options for toilets and septic tanks

Twin pit toilets

2-3 Chambered septic tanks

Bio Digester toilets

Source: Guidelines for Swachh Bharat Mission – Urban (2017), Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI)
Stage 3: Assessing options for emptying services and conveyance

“When the pit is Full”.

Often a tank is emptied when it is full. There is a tendency to use/build oversized septic tanks to avoid frequent emptying. It is important to assess how often a septic tank is emptied. Such information will need to be gathered through a household surveys.

Planning Decision

| Demand desludging | V/S | Scheduled desludging |

Example

In India: the Central Public Health Engineering and Environmental Organization (CPHEEO) suggests:

“Yearly desludging of septic tank is desirable, but if it is not feasible or economical, then septic tanks should be cleaned at least once in two-three years, provided the tank is not overloaded due to use by more than the number of persons for which it is designed”

Pg 9-22, CPHEEO Manual

Sketch adopted from compendium of sanitation systems and technologies, Eawag
Stage 3: **Vehicular options for septage collection**

- **Conventional Vacuum Tanker**
  - For septic tanks which have proper access roads, a larger vehicle maybe used

- **Mini-Vacuum Tanker (Vacutug)**
  - For septic tanks located in narrow lanes or those that do not have proper access roads, smaller vehicles maybe used

- **Gulper**
  - Smaller mechanized tricycle/motorcycle mounted collection tanks of 20–40 litres

---

**Four types of vacuum sludge removal techniques**

- **Vacuum system**
  - High vacuum - Low airflow

- **Pneumatic conveying**
  - Air bleed nozzle
  - High vacuum - Medium airflow

- **Constant air drag system**
  - Low vacuum - High airflow

- **Plug drag system**
  - High vacuum - Medium airflow

---

Stage 3: Assessing options for treatment and reuse of faecal sludge/septage

Treatment / Reuse / Disposal

- Treatment at existing sewage treatment plants
  - Septage addition at the nearest sewer manhole
  - Septage addition at the STP
  - Septage addition to sludge digesters/sludge drying beds

- Treatment at independent septage treatment plants
  - **Space is not a constraint**: Lime treatment, Sludge drying beds, Anaerobic baffled reactor, stabilization pond, Constructed wetland, co-composting with solid waste
  - **Space is a constraint**: Mechanical Dewatering system

- Properly treated sludge can generate energy and can be reused to reclaim parched land by application as soil conditioner, and/or as a fertilizer

Source: Advisory note on Septage management in Urban India (2013), MoUD, GoI
Stage 4: Exploring Potential private sector role across the service chain

While the city governments generally have the mandate to ensure service provision, often there is an active private sector that provides FSM services in the city.

It is necessary to assess the current role of private sector providers as well as their potential role in a citywide service provision.

The assessment will thus need to start with a quick landscape analysis, and can be followed by a detailed assessment after the FSM strategy is developed.

1. Operational role of the private contractor
2. Source of revenue
3. Investment/ownership of capital asset
4. Payment structure
5. Contract length and value
6. Risk mitigation and allocation

Bundled or Unbundled contract?
Who should invest in capital assets?
Revenue stream enough to meet private players’ return expectations?

How to address the major risks for the private player and the LG?
What is the appropriate contract duration for private and LG?
To ensure financial **sustainability** of **FSSM services**, it is important to **assess capacity for financing** both capital and O&M expenditure over the plan period.

This can start with an **assessment of financial requirements** for both **capital** and O&M expenditures.

The assessment also **provides guidance** on **potential sources of finance** for meeting these expenditures including through external **grants**, **private sector investments**, user contributions, external **debt** or through local government internal resources.

### Assessment of Financing requirement across FSSM service chain

<table>
<thead>
<tr>
<th>FS Flow Diagram</th>
<th>User Interface</th>
<th>Collection</th>
<th>Conveyance</th>
<th>Treatment/Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Capex</strong></td>
<td>New septic tanks</td>
<td>Refurbishment of septic tanks</td>
<td>New Suction Emptier Trucks</td>
<td>Treatment Facility - Land cost, construction cost</td>
</tr>
<tr>
<td><strong>Opex</strong></td>
<td>Operation of Emptier trucks - Fuel cost, salaries of truck driver, etc</td>
<td></td>
<td>Operation of Treatment Facility - staff salary, electricity bill, pumps replacement, etc</td>
<td></td>
</tr>
</tbody>
</table>
Stage 5: Potential sources of finance

A. Potential sources of finance for Capital Expenditure

- **User Interface**
  - New septic tanks
  - Households
  - Government Subsidy
  - CSR fund

- **Collection**
  - Refurbishment of septic tanks
  - Households
  - Government Subsidy

- **Conveyance**
  - Suction Emptier Trucks
  - Central/state Grants
  - Private sector
  - Local government fund

- **Treatment/Disposal**
  - Treatment Facility
    - Central/state Grants
    - Private sector
    - Local government fund
    - CSR fund

B. Potential sources of finance for O&M Expenditure

- **User Interface**

- **Collection**

- **Conveyance**
  - Operation of Emptier trucks

- **Treatment/Disposal**
  - Operation of Treatment Facility
    - Sanitation Tax/tariff
    - Emptying fees
    - Sale of Septage
Stage 5: Review of required tariffs

- Local government become financially sustainable by levying taxes and/or user charges so as to recover O&M costs of recent urban development programmes.

- It is therefore imperative that any proposed investment plan includes ways to recover O&M costs.

- Besides meeting operating expenses, the ULB is required to keep sufficient surplus to meet repayment obligations in addition to its committed capital expenses.

Assessment of current tariffs levels across FSM service chain

References


- Ministry of Urban Development (MoUD), (2013), ”Advisory note on septage management in urban India”. MoUD, GOI.

- Ministry of Urban Development (MoUD), (2017), ”National Policy on Faecal Sludge and Septage Management (FSSM)” . MoUD, GOI.


Group Exercise
Prepare FSSM plan for a city

Participants will plan for infrastructure that is required for implementing a FSSM plan for a city.

<table>
<thead>
<tr>
<th>Sr.No</th>
<th>Description</th>
<th>No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Population</td>
<td>65251</td>
</tr>
<tr>
<td>B</td>
<td>Total households (HHs)</td>
<td>13112</td>
</tr>
<tr>
<td>C</td>
<td>HHs having toilets with septic tanks</td>
<td>9901</td>
</tr>
<tr>
<td>D</td>
<td>No. of community/ public toilets having septic tanks</td>
<td>21</td>
</tr>
<tr>
<td>E</td>
<td>Average volume of household and community toilet septic tanks (cum)</td>
<td>5</td>
</tr>
<tr>
<td>F</td>
<td>Septic tank cleaning cycle for HHs (Years)</td>
<td>3</td>
</tr>
<tr>
<td>G</td>
<td>Septic tank cleaning cycle for CT/PT (Days)</td>
<td>7</td>
</tr>
<tr>
<td>H</td>
<td>No. of working days in an year</td>
<td>300</td>
</tr>
<tr>
<td>I</td>
<td>No. of trips possible per emptying vehicle per day (trip/day/vehicle)</td>
<td>4</td>
</tr>
</tbody>
</table>
Key Outputs . . .

- **Number of tanks to be emptied daily** = ________ daily
  - HHs toilets connected to septic tank / cleaning cycle for HHs = ______ annually
    - HHs toilets to be cleaned daily = annual cleaning / number of working days = ______ daily
  - CTs connected to septic tank / cleaning cycle for CTs = ______ daily

- **Number of trucks required** = ______ nos
  - Number of tanks to be emptied daily / Number of trips per day = _____ nos

- **Volume of septage to be treated** = ________ cum/day
  - Average volume of HHs and CTs septic tanks x Number of trips per day = ___ cum/day
FILM
DEVANAHALLI FAECAL SLUDGE TREATMENT PLANT
SESSION 4

PLANNING AND TECHNOLOGY SELECTION FOR FSSM
Objective of the Session

- In designing a citywide IFSM service, it is important to **plan** and **assess technology options** for each link in the **service chain**. This ranges from **appropriate toilets** and **onsite systems** such as septic tanks to **conveyance** as well as **treatment** and reuse.

- The session will give brief overview on how to plan FSSM services in a city.

- The session will also provide guidance on various parameters that need to be considered to select **appropriate technology** based on local conditions.
Planning and Technology selection for FSSM

- Planning and technology option for onsite systems
  - Demand based desludging
- Planning and technology selection for emptying and conveyance
  - Scheduled desludging
- Planning and technology option for treatment and reuse
  - Factors affecting identification of new Septage treatment site
  - Factors for selecting septage treatment technology
Septage Quantity Calculation

Volume of Septic Tank

- Requires detailed survey of each property (residential, community, commercial, institutional)
- Total volume of all types of collection system

Per capita generation Standard

- Based on Std norm of 230 litres/capita/year (GOI septage guidelines)
- Septage quantity (litres/year) = population * 230
Planning and Technology selection for FSSM

Planning and technology option for onsite systems

- Planning and technology selection for emptying and conveyance
  - Demand based desludging
  - Scheduled desludging

- Planning and technology option for treatment and reuse
  - Factors affecting identification of new Septage treatment site
  - Factors for selecting septage treatment technology
**Technology option for onsite systems (1/3)**

**Applicability:**
- Water use: 25-50 lpcd

**Soil characteristic:**
- Highly permeable soil

**O&M Requirement:**
1. Desludging, once pit is full
2. The undigested and unstabilized sludge must be treated and disposed of safely.

**Limitation and risk:**
1. Manual desludging of excreta and its indiscriminate disposal
2. Not Applicable if the bottom of the pit is < 2 m. above the groundwater table
3. Problems arise when water use increases
4. Not designed to cater for sullage water

**Linked technologies:**
- Pit emptying and faecal sludge treatment

---

Source: Guidelines for Swachh Bharat Mission – Urban (2017), Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI)
Technology option for onsite systems (2/3)

Applicability:
1. Where there is no sewerage network.
2. Appropriate in peri-urban settlements as they do not require any centralized infrastructure.

Soil characteristic:
1. Must be suitable for infiltration of effluent
2. Micro wetland can help through increased evapo-transpiration losses and moisture uptake

O&M Requirement: Septage must be removed and transported off-site for treatment prior to disposal.

Limitation and risk:
1. High cost and space requirements for the soak away or drain field
2. Common practice is to discharge effluent directly into an open drain as leaching system is often not constructed
3. Retention time is insufficient if Septic tank receives too much wastewater
4. Commonly the householder bypasses the soak away and connects the overflow directly to a surface water drain
5. Performance monitoring of septic tanks is rarely undertaken
6. Regulation to control private desludging operators is problematic

Linked technologies: Periodic emptying

Technology option for onsite systems (3/3)

Bio-Digester toilets

Bio-toilet

Source: Guidelines for Swachh Bharat Mission – Urban (2017), Ministry of Housing and Urban Affairs (MoHUA), Government of India (GoI)
Existing types of emptying & conveyance systems...

- Services mainly provided by city governments
- Unsafe handling of septage
- Informal Private sector

- No monitoring mechanism for informal sector
- Cleaning cycle greater than 8-10 years against recommended cycle of 2-3 years by GoI advisory on Septage Management
- Due to infrequent cleaning, septage begins to solidify in tanks and septic tank fills up, faecal matter along with effluents is released into the drains
# Manual Scavenging Act


Came into force on Dec 6, 2013

“Prohibition of Insanitary Latrines and Employment and Engagement for cleaning of Sewers or Septic Tanks as Manual Scavenger”

### Prohibition of Activity

| Local authorities to survey Insanitary latrines and provide Sanitary community latrines. | Survey of manual scavengers in urban areas by Municipalities. | Duty of local authorities and other agencies to use modern mechanical technology for cleaning of sewers and onsite systems, etc. |

### Rehabilitation

Rehabilitation of persons identified as Manual Scavengers by a Municipality. Housing and Financial Assistance to be given.
Technology options for emptying and conveyance

**Conventional Vacuum Tanker**
For septic tanks which have proper **access roads**, a **larger vehicle** maybe used.

**Mini-Vacuum Tanker (Vacutug)**
For septic tanks located in **narrow lanes** or those that do not have proper access roads, **smaller vehicles** maybe used.

**Gulper**
**Smaller mechanized tricycle/motorcycle mounted collection** tanks of 20–40 litres capacity with gulper or smaller vacuum pumps at the primary level backed by a secondary transport system may work in the informal slum settlements.
Parameters for assessing conveyance options

1. Distance of treatment site
2. Road Width
3. Access to site
4. Characteristics of septage
5. Size of septic tanks/pits
6. Traffic congestion
7. Fuel requirement and its implication in opex
8. Financial budget of emptying services
## Parameters for assessing conveyance options

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Mini Vacuum Truck (Vacutug)</th>
<th>Conventional Vacuum truck</th>
<th>Gulper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance of treatment plant from emptying point</td>
<td>Small-Haul distance</td>
<td>Long-Haul distance</td>
<td>No means of disposing the sludge off site</td>
</tr>
<tr>
<td>Road width</td>
<td>To be used where road widths are narrower</td>
<td>To be used where road widths are broader</td>
<td>Can be used in narrower road widths</td>
</tr>
<tr>
<td>Access to site</td>
<td>To be used where site access is difficult for large vehicles</td>
<td>To be used where site access is easy for large vehicles</td>
<td>Can access most locations</td>
</tr>
<tr>
<td>Type of onsite sanitation system (septic tanks/pits) and characteristics of septage</td>
<td>Difficulty emptying high viscosity sludge</td>
<td>Can handle high viscosity sludge</td>
<td>Hand pumps can be used for liquid and, to a certain degree, viscous sludge</td>
</tr>
<tr>
<td>Size of septic tanks/pits</td>
<td>Applicable for Smaller volume (500-2000 litres)</td>
<td>Applicable for Larger size (3000-5000 litres)</td>
<td>Cannot empty entire pit (if pit is deep); Slow emptying times</td>
</tr>
<tr>
<td>Traffic congestion</td>
<td>To be used in areas with high traffic congestion</td>
<td>Difficulty in moving in areas with high traffic congestion</td>
<td>Not affected by traffic congestion</td>
</tr>
<tr>
<td>Fuel requirement and its implication in opex</td>
<td>Requires less fuel; low opex</td>
<td>Requires more fuel; high opex</td>
<td>No fuel requirement; very low Opex</td>
</tr>
<tr>
<td>Financial budget of emptying services</td>
<td>Not financially viable for long-haul transport</td>
<td>Proves to be financially viable for long-haul transport</td>
<td>Not financially viable for large septic tanks/pit size and for long-haul transport</td>
</tr>
</tbody>
</table>
Occupational Safety

- Municipalities should provide workers with safety gear.
- Each worker should be made aware of the risks of the work through trainings.
- Workers should be held liable for not using available protective gear.

Use of safety gears by a sanitation worker
## Demand v/s Scheduled Emptying

<table>
<thead>
<tr>
<th>On-Demand Basis</th>
<th>Scheduled Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning is done <strong>on-call</strong> by the household, who do not see the need for regular cleaning.</td>
<td>Septic tanks will be cleaned on a <strong>predetermined schedule</strong>.</td>
</tr>
<tr>
<td>The <strong>cleaning services</strong> of the ULB are currently treated as a <strong>complaint redressal</strong> system for overflowing septic tanks rather than a regular cleaning and maintenance service.</td>
<td><strong>Regulations</strong> and <strong>penalties</strong> will be set in place to <strong>ensure periodic cleaning</strong>.</td>
</tr>
<tr>
<td>The ULBs operates the trucks (either owned or borrowed) when the demand arises.</td>
<td>Awareness <strong>generation</strong> activities will educate households about the need for regular cleaning.</td>
</tr>
<tr>
<td>Households generally pay a certain amount once in &gt;8-10 years to get tanks cleaned during the time of overflow.</td>
<td>Each town will require an additional <strong>number of trucks to meet service standards</strong> (which can be <strong>operated by a private player</strong>).</td>
</tr>
<tr>
<td></td>
<td><strong>Local taxes levied</strong> by the ULB will be used to recover the <strong>operating expenses</strong> for regular cleaning.</td>
</tr>
</tbody>
</table>
Demand Based emptying services

HHs call emptying service when system is full
Provide service and charge the HHs

If non-regulated,
- No regular cleaning
- Overflowing system pose environmental and health risk
- Private emptier may charge higher
- No safety precautions
- No monitoring of septage disposal

Plan for Regulated Demand based emptying services

- Awareness and regulations to HHs for regular desludging
- Empanelment and training of desludging operators
- Monitoring of emptying services through GPS enabled trucks
- Mandatory safety measures during desludging
- Regulations for emptying charge/tax system

Dakar Model
Schedule of emptying services

Septic tank cleaning cycle of 3 years

- To maintain a cycle of 3 years, roughly **2800 septic tanks** need to be cleaned annually
- Each vehicle needs to make **4 to 5 trips daily**
- Roughly **300 Working Days** are required
- To clean **2800 septic tanks**, **2-3 nos of suction emptier trucks of 5000 capacity** would be required

2-3 nos of trucks of 5000 litre capacity are required for cleaning HHs and non-residential septic tanks

Divide the city into zones and prepare a yearly plan

<table>
<thead>
<tr>
<th>Year</th>
<th>Zones</th>
<th>No. of septic tanks to be cleaned annually (no)</th>
<th>No. of Days required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>Zone 1</td>
<td>1889</td>
<td>201</td>
</tr>
<tr>
<td></td>
<td>Zone 2</td>
<td>947</td>
<td>101</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2836</td>
<td>302</td>
</tr>
<tr>
<td>Year 2</td>
<td>Zone 2</td>
<td>1262</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>Zone 3</td>
<td>1582</td>
<td>169</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2844</td>
<td>303</td>
</tr>
<tr>
<td>Year 3</td>
<td>Zone 3</td>
<td>2762</td>
<td>294</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>2762</td>
<td>294</td>
</tr>
</tbody>
</table>
Regulating emptying services . . .

Licensing of septage transporters

Emptying services by ULB or by private agencies: management contracts. In case of private sector contract, ULBs should certify and license private septage transporters to de-sludge and transport waste to the designated treatment facility.

Septage Transporter Permit for _________ Municipality

In accordance with all the terms and conditions of the current _______ Municipality’s Rates, Rules and Regulations, the special permit conditions accompanying this permit, and all applicable rules, laws or regulations of Government of Maharashtra, permission is hereby granted to:

NAME OF PERMITTEE: _______________________________

ADDRESS: _________________________________________

For the disposal of septage from domestic septic tank or commercial holding tank at the ____________________ treatment facility.

This Permit is based on information provided in the Septage Transporter Permit application which constitutes the Septage Management Hauled Permit.

This Permit is effective for the period set forth below, may be suspended or revoked for Permittee’s Condition Non Compliance and is not transferable. The original permit shall be kept on file in the Permittee’s office. A copy of this Permit shall be carried in every registered vehicle used by the permittee.

EFFECTIVE DATE: ________________________________

EXPIRATION DATE: ________________________________

CHECK IF RENEWED PERMIT

Permit is liable to be cancelled in case of violations of any Acts, Rules and Regulations relating to the operation of Septage System or in cases of safety protocols not being adhered to or in case of non-permitted disposals.

Sample licensing format

Source: Operative guidelines for septage management for urban and rural local bodies in Tamil Nadu.(2014)
Planning and Technology selection for FSSM

- Planning and technology option for onsite systems
  - Demand based desludging
  - Scheduled desludging
- Planning and technology selection for emptying and conveyance
- Planning and technology option for treatment and reuse
  - Factors affecting identification of new Septage treatment site
  - Factors for selecting septage treatment technology
### Septage quality results of cities.

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Parameter</th>
<th>Unit</th>
<th>Wai Household septage</th>
<th>Wai Public toilet septage</th>
<th>Sinnar Household septage</th>
<th>Sinnar Public toilet septage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>BOD5 at 20°C</td>
<td>mg/l</td>
<td>6000 - 16500</td>
<td>228 - 5400</td>
<td>336 - 39000</td>
<td>346 - 2533</td>
</tr>
<tr>
<td>3</td>
<td>COD</td>
<td>mg/L</td>
<td>11408 - 27776</td>
<td>395.2 - 9523</td>
<td>1000 - 88000</td>
<td>920 - 7200</td>
</tr>
<tr>
<td>4</td>
<td>Total Solids by volume</td>
<td>%</td>
<td>0.992 - 8.07</td>
<td>0.071 - 1.36</td>
<td>0.42 - 7.74</td>
<td>0.43 - 1.06</td>
</tr>
<tr>
<td>5</td>
<td>Total Nitrogen (as N), by volume</td>
<td>%</td>
<td>0.044 - 0.0719</td>
<td>0.016-0.067</td>
<td>0.02 - 0.16</td>
<td>0.06 - 0.11</td>
</tr>
<tr>
<td>6</td>
<td>Phosphorus (as P), by volume</td>
<td>%</td>
<td>0.004 - 0.009</td>
<td>0.001 - 0.007</td>
<td>0.0002</td>
<td>0.0002</td>
</tr>
<tr>
<td>7</td>
<td>Pottasium (as K) by volume</td>
<td>%</td>
<td>0.004 - 0.014</td>
<td>0.005 - 0.015</td>
<td>0.006 - 0.027</td>
<td>0.017 - 0.029</td>
</tr>
<tr>
<td>8</td>
<td>Gross Calorific Value, on dry basis</td>
<td>cal/g</td>
<td>4148</td>
<td>*</td>
<td>3226 - 4817</td>
<td>1281 - 2732</td>
</tr>
<tr>
<td>9</td>
<td>Faecal Coliforms</td>
<td>/100ml</td>
<td>&gt;1600</td>
<td>&gt;1600</td>
<td>22 - 920</td>
<td>32 - 170</td>
</tr>
</tbody>
</table>

**Test results**

Note: * - Not analyzed due to insufficient quantity of sample

- **BOD and Total Solids are affected by emptying frequency**
  - The more frequently the septic tank is emptied: Less is the BOD and Total solids and vice versa

- The emptying frequency is also dependent on type of housing.
  - Flats are emptied more frequently as compared to bungalows / row houses

**Septage Quality differs City to City . . .**
Septage Quantity calculation.

Volume of Septic tank

- Requires detailed survey of each property (residential, community, commercial, institutional)
- Total volume of all types of collection system

Per capita generation Standard

- Based on Std norm of 230 litres/capita/year (GOI septage guidelines)
- Septage quantity (litres/year) = population * 230
Identify new Septage treatment site . . .

i. Distance of treatment site
   - Long distance: costly
   - A site that is too far away implies fewer trips per day, less revenue and more fuel costs to private operators.

ii. Land availability
   - Government land availability
   - ULB should also explore the possibility of developing septage treatment facility at solid waste dumping or treatment site.

iii. Reliability of electricity
   - If treatment technology has mechanical operated parts.

iv. Neighborhood
   - A treatment site may generate nuisance, especially bad odors.
   - It should be located at an appropriate distance from the residential areas.

v. Geological Parameters
   - Groundwater table
   - Type of soil
   - Prone to flooding

Identify and compare treatment Technology based on following factors...

- **Technical performance of treatment option:**
  - Technology providing required quality output,
  - Popularity in local context, advantages and disadvantages,
  - Requirement of pre-treatment or post treatment,
  - Level of difficulty in handling or discharging endproduct generated, etc.

- **Site condition:** Permeability, groundwater table, soil type etc

- **Capital and operating cost**

- **Simplicity in Construction & Operation**

- **Level of mechanization** required for its operation

- **Efficiency of energy recovery**
Various Septage treatment options are available...

**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

Based on literature reviews and international case studies...
Group Exercise
### Tariff requirement to recover O&M cost

**Step 1: O&M cost for schedule septic tank emptying service**

<table>
<thead>
<tr>
<th></th>
<th>Fuel cost for schedule emptying service = (Number of septic tank to be emptied daily(\times)300(\times)Average distance (\times) 2 (\times) Fuel price/ Fuel efficiency)</th>
</tr>
</thead>
</table>
| 1 | - Assume Fuel efficiency for truck = 5 km per liter  
- Assume Fuel price = Rs 70 per liter |

<table>
<thead>
<tr>
<th></th>
<th>Repair and maintenance cost = (Number of suction emptier truck requirement(\times) 12 (\times) 2,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>- Assume average repair &amp; maintenance cost = Rs 2,000 per month</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Establishment expenses = ((Number of suction emptier truck requirement(\times) 12 (\times) No of manpower (\times) Monthly Salary)</th>
</tr>
</thead>
</table>
| 3 | - Assume, 2 manpower requirement per truck  
- Assume, Salary = Rs 10,000 per month |

<table>
<thead>
<tr>
<th></th>
<th>Sub-total = (1+2+3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Overhead + Insurance + other Miscellaneous cost = Sub-total(4)(\times)X%</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>- Assume, other cost as X% of sub-total (4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total O&amp;M cost for schedule septic emptying service = (4+5)</th>
</tr>
</thead>
</table>
# Tariff requirement to recover O&M cost

## Step 2: O&M cost for septage treatment facility

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
</table>
| 1 | Energy cost for Septage treatment facilities = (Energy cost per month * 12)  
**Energy cost**  
- < 25 cum/day = Rs 5,000 per month  
- 25-50 cum/day = Rs 10,000 per month  
- 50-75 cum/day = Rs 15,000 per month  
- > 75 cum/day = Rs 20,000 per month |
| 2 | Repair and maintenance cost = (Avg. Repair & maintenance cost * 12)  
- Assume average repair & maintenance cost = Rs 10,000 per month |
| 3 | Establishment expenses = (No. of manpower*Monthly Salary *12)  
- Assume, 4 manpower requirement (in 2 shifts)  
- Assume, Salary = Rs 10,000 per month |
| 4 | Sub-total = (1+2+3) |
| 5 | Overhead + Insurance + other Miscellaneous cost = (4*X%)  
- Assume, other cost as X% of sub-total (4) |
| 6-B | Total O&M cost for managing Septage treatment facility = (4+5) |
Key Outputs . . .

A. **Annual O&M Cost** = $6-A + 6-B$

B. **Per property tariff requirement for septage management** =

\[ \text{=(Annual O&M cost (A)/ total properties)* collection efficiency} \]

- **Considering tax collection efficiency** = 70%
- **Note**: Users may calculate differential tariff structure across property uses; properties with toilet facility v/s properties dependent on community toilet etc.
SESSION 5

FINANCING for FSSM
Objective of the Session

- This session will highlight that to ensure financial *sustainability* of FSM services, it is important to *assess capacity for financing* of both capital and O&M expenditure over the plan period.

- The session will give brief overview on how to *assess financial* requirements for both *capital* and *O&M expenditures* for implementation of FSSM in a city.

- The session will also *provide guidance* on potential sources of *finance* for meeting these expenditures including through external *grants, private sector investments*, user contributions, external *debt* or through local government internal resources.
The first step in Financial Assessment is to determine the financing requirements for proposals for the full service chain – starting with toilets in the user interface, to collection, conveyance and treatment or disposal.

The finance requirements are essentially based on costs of achieving the various improvement activities planned.

It is also important to ensure that both capital costs and O&M costs are assessed.
Potential sources of Financing

- For developing a financing plan for FSM, potential sources of funds for capital expenditures will be required and terms and conditions for each will need to be identified.

- The potential sources for capital expenditures may include grants from national/provincial government; own resources of local government, CSR funds from corporate sector or loan from financial institutions.

- In case of private sector participation, the willingness of private players to meet capital expenditure will also need to be assessed.

- Similarly, background assessment of various ongoing programmes at the state and national levels will provide an idea of the possibility of accessing such funds to meet the capital expenditure requirements.

- The potential sources for operating expenditure may include local government own fund, levy of user charge or tax, sale of treated sludge to end users.
## Identify potential sources of Financing

<table>
<thead>
<tr>
<th>Access</th>
<th>Conveyance</th>
<th>Treatment/ Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPEX</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New toilets and Refurbishment of septic tanks</td>
<td>Suction Emptier Trucks</td>
<td>Treatment Facility- Land and construction cost</td>
</tr>
<tr>
<td>Households</td>
<td>Central/State Grants</td>
<td>Central/State Grants, VGF</td>
</tr>
<tr>
<td>Government Subsidy</td>
<td>Local Govt. funds</td>
<td>Local Govt. funds</td>
</tr>
<tr>
<td>CSR fund, Crowdfunding, Credit</td>
<td>Private Sector/PPP</td>
<td>Municipal Bonds/Public Finance</td>
</tr>
<tr>
<td>Repair of toilets and septic tanks</td>
<td>Operation of Emptier trucks– Fuel cost, salaries of truck driver, etc</td>
<td>Operation of Treatment Facility- Salary, electricity, pumps replacement, etc</td>
</tr>
<tr>
<td>Households, Housing society fees</td>
<td>Sanitation Tax/Other Taxes</td>
<td>Sanitation Tax/Other Taxes</td>
</tr>
<tr>
<td></td>
<td>User Charges (Emptying fees)</td>
<td>Sale of Compost</td>
</tr>
</tbody>
</table>
Assess sources for CAPEX....

- Current Government Programmes and funds availability
  (eg: SBM, AMRUT, 14th FC)

- Own funds of Urban Local Body for capital financing

- Willingness of Private sector to invest

- Innovative financing
  Eg: CSR, Crowdfunding, loans
### CAPEX: Emptying & Conveyance

#### A. Potential sources of finance for Capital Expenditure

<table>
<thead>
<tr>
<th>Suction Emptier Trucks</th>
<th>Demand based FSM Services</th>
<th>Scheduled FSM Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central/state Grants/ Local Government Funds</td>
<td>Several states have earmarked funds/grants for procurement of vacuum trucks for urban local governments.</td>
<td>Private sector is generally willing to bring investment for vacuum trucks</td>
</tr>
<tr>
<td>Private sector</td>
<td>Private sector is already investing as per demand</td>
<td></td>
</tr>
</tbody>
</table>
# CAPEX: Treatment system

## A. Potential sources of finance for Capital Expenditure

<table>
<thead>
<tr>
<th>FSSTP</th>
<th>Demand based FSM Services</th>
<th>Scheduled FSM Services</th>
</tr>
</thead>
</table>
| Central/state Grants | Size of treatment units is relatively small. Large cities may mobilize from own funds. Small cities may mobilize from 14th FC funds/AMRUT. | - Large cities may use ongoing national level programmes  
- Small cities may require small size of grant from state programme or mobilize from 14th FC funds. |
| Local governments |                                                                                           |                                                                                       |
| Private /VGF | Private sector is willing with VGF                                                        |                                                                                       |
| Innovative Finance |                                                                                           | CSR, Social Impact Investor, Donor funding etc                                        |
Identify Existing Revenue sources

To make FSM activities sustainable, assessing the revenue sources is very important

- Local government become financially sustainable by levying taxes and/or user charges so as to recover O&M costs of recent urban development programmes.

- It is therefore imperative that any proposed investment plan includes ways to recover O&M costs.

- Besides meeting operating expenses, the ULB is required to keep sufficient surplus to meet repayment obligations in addition to its committed capital expenses.

Assessment of current tariffs levels across FSM service chain

Per capita Property Tax

Per Capita Property Tax (2012-13)

Source: Municipal finances and service delivery in India (2014), ASCI
Scheduled Desludging through Sanitation Tax

**Basis** - a) sanitation tax collected from owners of OSSs, and  
   b) mandatory scheduled desludging of tanks/pits.

**Sanitation tax** is collected by the local authority either as a percentage of property tax or by the public utilities as a surcharge on water bills.
Discussion points

- What are key issues in financing FSSM?

- Emptying charge or Sanitation tax?

- Potential Sources for CAPEX and OPEX in your state?
  - Emptier trucks
  - Treatment plant
Session 6

Behaviour Change
Communication and Sanitation
Learning Objectives

• Behaviour Change Communication in sanitation is more than just conveying a message through mass media campaigns, films and posters.
• Messaging for urban sanitation should be proof tested for any gender, caste and class stereotyping. Negative messaging can strengthen status quo of a deprived social group or class, and gains made in behaviour change may be short lived at best.
• Understanding the audience amounts to understanding deeper level self-perception barriers that prevent adoption of improved behaviours at the individual and community level.
• BCC in the containment and access (individual and public toilets) has been researched. Lessons learnt need to be tested for other parts of the FSSM value chain.
Behaviour Change: Some Key Learnings

- Lack of knowledge and awareness of negative health impacts are not the primary barriers to behaviour change in rural sanitation and are unlikely to be a case in urban sanitation as well.

- Lack of public toilet/sanitation infrastructure particularly in slums and poor settlements needs to be addressed first, before addressing behaviour change.

- Behaviour change in urban sanitation comes with systemic change to address toilets, solid waste, drainage and FSSSM.
  - As long as there is a lack of public individual and toilet infrastructure in slums (adequate, functional and clean toilets and urinals for women and men that are connected to sewerage systems) as long as there are waste dumps in poor settlements and along market yards, public bus stands and hospitals that are not cleaned up by public authorities on a regular basis - no amount of individual awareness and motivation can address urban sanitation challenge.
Before initiating a general BCC-IEC mass media or a community wide awareness campaign for construction and usage of toilets:

- An assessment needs to be done to find out if there are any deeper individual and community level self-perception barriers of gender, caste and class – for not using toilets or keeping them clean. BCC research in rural sanitation has shown that there are major barriers to adoption at individual level.
- Whether gender, caste and class impact on the access to public toilets in poor settlements need to be explored.
- Whether administrative bottlenecks (contractual employment of sanitary staff, SBM subsidy release issues, etc.), are a constraint.
Behaviour Change Messaging for sanitation

- BCC messaging through mass media needs to be gender sensitive and not re-enforce the stereotype role of men (as earners and decision makers) and women (as care givers).

- BCC messaging should recognize and honour the hard lives and work that the working poor do, and gently motivate them to also improve their sanitation and hygiene behaviours.
  - Mocking people or making fun of their habits or using threats and coercion, without understanding deeper self-perception barriers, may fall on deaf ears and at best bring temporary change in sanitation behaviours.

- A more incremental and long lasting approach can be to address practical infrastructure and O&M challenges that impede toilet usage first, and then address behaviour change and affordability challenges of individual and community/public sanitation.
BCC Messaging for FSSM

• Behaviour Change priorities for FSSM can be for:
  • Understanding the barriers to adopting toilet usage
  • Construction of a standard septic tank
  • Regular scheduled desludging and
  • Preventing indiscriminate disposal and dumping of septage waste.

• BCC strategies for FSSM need to reach out to multiple stakeholders – HHs, community, masons, emptier operators, ULB officials, elected representatives, policy makers...

• Key BCC Messaging for FSSM :
  • Safe containment systems : septic tank design and construction norms
  • Health safety of sanitary workers : emptying and transportation of sludge
  • Incremental improvements : start dumping faecal sludge in trenches or in designated disposal area or into sewer networks
  • Option of treatment in farmers fields through trenching : advocate for Farmers health safety
  • Different technological solutions available in the market : advocate all solutions
• UMC to please add more slides on BCC and IEC