Faecal Sludge Treatment Plant: Devanahalli

Directorate of Municipal Administration, Government of Karnataka
## About Devanahalli

<table>
<thead>
<tr>
<th><strong>Location</strong></th>
<th>Devanahalli, 39km NE of Bangalore</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td>~35,000 (28,309 in Census 2011)</td>
</tr>
<tr>
<td><strong>Area</strong></td>
<td>16 Sq. Km</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Near airport and state capital</td>
</tr>
<tr>
<td><strong>WatSan Status</strong></td>
<td>Partial piped water system</td>
</tr>
<tr>
<td></td>
<td>No sewerage system, and not viable</td>
</tr>
</tbody>
</table>
FSM Value Chain
Toilets Situation

6,400 Households

5,780 (90%) With Toilets
- Single pit
- Septic tank
- Open drain
- Twin pit

620 (10%) Without Toilet
- Open defecation (62%)
- Shared toilets
- Public toilets
FSM Value Chain
On-Site Storage

- Single Pit: 78%
- Septic Tank: 10%
- Twin Pit: 3%
- Open drain: 6%

- Septic tank/Pit with lining: 770 HH (35%)
- Septic tank/Pits without lining: 1,446 HH (65%)
Adopting FSM at Devanahalli

- Step-by-step implementation of holistic FSM

1. DMA Bought Truck, ULB Started offering Service
2. Built FSTP for Safe Treatment of Sludge
3. Integrated O&M Contract for Truck + Treatment Plant
4. Implement FSM Policy
   - Licensing
   - Penalties
   - Monitor

1. Completed
2. In-progress
FSM Value Chain
Desludging Frequency

- Never: 917 (44%)
- >5 Yrs: 339 (16%)
- <5 Yrs: 821 (40%)
De-sludging Services

• DMA bought a Truck: Rs 16,00,000

• 2 private operators in area

Economics of Municipality-operated Truck (for 2015):

• De-sludged 53 houses (0.9% of HHs)

• Non-operational for 5 months for repairs

• Average 7.5 services per month

• Cost per de-sludging=Rs 3,960 (with depreciation = Rs 6,900)

<table>
<thead>
<tr>
<th>Revenue</th>
<th>Rs 53,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Costs</td>
<td>Rs 1,50,000</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Rs 2,75,000</td>
</tr>
<tr>
<td>Loss</td>
<td>Rs 3,71,000</td>
</tr>
</tbody>
</table>
Faeal Sludge Treatment Plant
Plant Description

- **Capacity**: Serves 30,000 people (de-sludging every 4 years)
- **Technology**: Gravity-based Biological Treatment
- **Area**: $650m^2 (7,000 ft^2)$
- **Priority**: Simple, low cost O&M
- **Structure**: Mostly underground, completely covered, odorless
- **Capital Cost**: Rs 90 Lacs (Rs 300 per capita)
- **Operating Cost**: Rs 24 Lacs per year (Rs 80 per capita per year)
- **Lifecycle cost**: Rs 1,500 per capita—very low
Operational Days = 78

Truck Loads received = 90

100 Operators Trained

Prevented pathogens equal to 4,400 people defecating in the open every day

Faecal Sludge Received = 171,600 Liters

Engagement with local farmers—interest in buying treated water and sludge

350+ visitors incl. 100+ international visitors, 200 senior officials
Treatment Modules

Flow - Diagram

Screening ➔ Sludge-Liquid Separation ➔ Sludge Stabilization ➔ Dewatering ➔ Disinfection ➔ Liquid Treatment
• Should a single private operator do O&M of both and plant?
  • Easier for ULB to monitor, reduce cost to ULB
  • What is the right tendering process?

• Adopting and implementing FSM policy
  • Licensing Players, Periodic de-sludging, Penalties…

• Scaling Up—275 ULBs in Karnataka:
  • Is technology appropriate for other cities? Other options?
  • Clustering towns and launch group tenders
  • Skills to maintain FSM System and Treatment Plants?
  • Financing?
Swachh Bharat Mission
Progress Highlights

Dr. Ramakant
Deputy Advisor, CPHEEO
Ministry of Urban Development
<table>
<thead>
<tr>
<th>Details</th>
<th>Mission Target (2014-19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual Household Toilets, Nos.</td>
<td>1.04 crore</td>
</tr>
<tr>
<td>Community &amp; Public Toilets, No. of seats</td>
<td>5.08 lakh</td>
</tr>
<tr>
<td>Municipal Solid Waste Management</td>
<td>100% door to door collection and safe disposal in 79,500 wards</td>
</tr>
</tbody>
</table>
Mission Progress

- IHHTs
- CTs & PTs
- MSWM

Target (2015-16), Nos.
Achieved so far, Nos.
Fast Progressing States

IHHTs Application Received FY 2015-16

IHHTs Target FY15-16 vs. Achievement
### Slow Progressing States

IHHTs Application Received vs. Constructed

<table>
<thead>
<tr>
<th>State</th>
<th>Application Received</th>
<th>Constructed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Himachal Pradesh</td>
<td>2,820</td>
<td>-</td>
</tr>
<tr>
<td>Uttarakhand</td>
<td>1,166</td>
<td>25,953</td>
</tr>
<tr>
<td>Odisha</td>
<td>2,000</td>
<td>170,000</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>88,760</td>
<td>2,767</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>185,436</td>
<td>2,797</td>
</tr>
</tbody>
</table>
Fast Progressing States

CTs & PTs Target FY 15-16 vs. Achievement

- Tamil Nadu: 16,656
- Madhya Pradesh: 6,960
- NCT of Delhi: 5,776
- Chhattisgarh: 3,571
- Maharashtra: 2,689

- Tamil Nadu: 11,824
- Madhya Pradesh: 7,942
- NCT of Delhi: 2,184
- Chhattisgarh: 3,520
- Maharashtra: 11,740
Slow Progressing States

CTs & PTs Target FY 15-16 vs. Achievement

- Punjab: 2146
- Bihar: 5,222
- Telengana: 3,063
- Uttarakhand: 163
- Jharkhand: 2,442
Way Forward

- Develop and Disseminate Technology alternatives, as PILOTs for sanitation & solid waste management (DST)
- **MSW Rules 2015 Notified** incorporated provisions for responsibility of Ministries, State Govt.ULBs, Pollution Control Boards and also extended producers’ responsibility and other enforcements (MoEFCC)
- Harness **NSS, NCC, Nehru Yuvak Kendras, Scouts & Guides** and Eco Clubs for Swachh Bharat activities (MoYA/MoEF/MOD/MHRD)
- First working day of the week be practiced as **Swachhta Diwas** in all educational institutions (MHRD)
Thank You

Visit us at: www.swachhbharaturban.gov.in
Fecal Sludge Management – International Best Practices

Roshan Shrestha Ph.D.
Technical Lead - South Asia, WSH
April 07, 2016
FECAL SLUDGE MANAGEMENT IN MALAYSIA

• Prior to 1995, Local Authorities managed sewerage & sludge in urban Malaysia. Sludge and sewerage management was neglected.

• In 1995, a concession was given to Indah Water Konsortium (IWK).
  • operate & maintain sewerage & sludge facilities
  • scheduled desludging of septic tanks
  • safely treat and dispose sewage & sludge

• About 1.2 million septic tank customers and about 800,000 pour flush toilets exists in IWK operational area.

• Scheduled desludging did not succeed due to the lack of enforcement

• Since 2008, the responsibility of desludging septic tanks every 3 years has been placed on house owners.

• All sludge removed is treated and disposed safely

• Reuse and recycling efforts are being made but have limited success
INSTITUTIONAL SET UP FOR WASTEWATER AND FSM IN MALAYSIA

Ministry of Energy, Green Technology & Water

- Policy & Control of National Sewerage Agenda

SPAN
- Suruhanjaya Perkhidmatan Air Negara

Regulator of Sewerage Services

Ministry of Finance
- Govt. Support Loan & Subsidy

Indah Water

- 1. Sewerage Services
- 2. Operator in 88 Local Authority Areas.
- 4. Undertakes Refurbishment/Upgrading Projects Funded by Govt.

Ministry of Natural Resources & Environment

Regulator of Effluent Standards
- Policy & Compliance Requirements

Reference: Indah Water Training Materials
DESLUDGING VEHICLES

- 2.5 cubic meters
  - Used for narrow lanes in cities
  - Village use
  - Small septic tanks

- 4.5 cubic meters
  - Commonly used
  - Use in domestic and commercial customer; IST size < 2.0 cu.m
  - Other use: Seeding treatment plants

- 11 cubic meters
  - Use in industrial and government buildings; IST size > 4.0 cu.m
  - Other use: Interworks (STP Sludge removal)
  - Private STP sludge removal

Reference: Indah Water Training Materials
REGULATORY REQUIREMENTS FOR COLLECTOR

- Vehicle Permit – Commercial Vehicle Licensing Board
- Vehicle Inspection for road worthiness by Road Transport Department
  - Every 6 months
- Safety Inspection by Department of Occupational Safety and Health
  - Every 15 months
- Vehicle is Fit to Drive - service every 3 months or 5000 km.
- Drivers must have Good Driving License (GDL)
  - Medical check up – pass the check up to renew the license
- Adhere to Operational Instruction and Procedures
  - Disposal to approved and authorized sites

Reference: Indah Water Training Materials
OCCUPATIONAL HEALTH SAFETY

Basic PPE:
1. Safety Shoes
2. Safety Helmet
3. Uniform

Others:
1. Glove
2. Reflective Vest
3. Safety Spectacles
4. Wellington Safety Boot
5. Rain Coat
6. Life Vest
7. Antiseptic Soap

Reference: Indah Water Training Materials
SLUDGE REMOVAL PROCESS

Desludging Works

- Park Vehicle
- Open Cover
- Take Hose
- Connect Hose
- Clean up
- Put back Hose
- Desludge

Reference: Indah Water Training Materials
FSM TREATMENT FACILITIES – SIMPLE VS COMPLEX IN MALAYSIA

Reference: Indah Water Training Materials
TRENCHING TECHNIQUE
TRENCHING TECHNIQUE (...... CONTD)
TREE PLANTATION IN TRENCHING GROUND
Day 7 at 6.00pm
Height = 0.9 meter
Volume = 140.5m³
Condition = Wet

Day 8 at 8.30 am
Height = 0.7 meter
Volume = 175m³
Condition = Wet

Day 9 at 8.30 am
Height = 0.5 meter
Volume = 186.5m³
(39 trips – 4.5m³)
Condition = Wet
Need to install another Geobag (start rotation)
FECAL SLUDGE TREATMENT / PROCESSING

Centralised Sludge Treatment Facility

- Belt Press
- Mobile Dewatering
- Centrifuge Decanter
- Filter Press

Reference: Indah Water Training Materials
DEDICATED SLUDGE TREATMENT FACILITIES WITH DEPARTMENT OF ENVIRONMENT APPROVAL NATIONWIDE

**IWK CURRENT SLUDGE FACILITIES**

- Trenching System: 31 Nos
- Drying Beds: 1,799 Nos
- Sludge Lagoon System: 1 Nos
- Sludge Reception Facility: 12 Nos
- Mechanised Dewatering Unit: 8 Nos

**Filter Press**
- 83 units

**Belt Press**
- 58 units

**Centrifuge**
- 19 units

Reference: Indah Water Training Materials
KEY SUCCESS FACTORS

• Clear policy governing septage/sludge management
• Legislative (law and regulations)
• Clear responsibilities: owner, permit holders, treatment facility manager
• Guidelines for management
• Appropriate technologies & gradual upgrading
• Economics: permit holders and sludge facility operators
• Monitoring & Enforcement
• Education & Communication
DAKAR: CITY PROFILE

- Total Population: 1,056,009
- Total Number of Households: 211,202
- Total Area: 83 km²
- Population Density: 12,500/km²
- Temperature: 24 – 31°C
- Rainfall: 495 mm per year
Capture and Containment

**On-site Infrastructure:** Individual toilet with septic tank and pits  
**Off-site Infrastructure:** Public/Community toilet with septic tank and pits

- Toilets: 98%  
- Open Defecation: 2%  
- On-site Infrastructure: 71%  
- Off-site Infrastructure: 29%
Collection and Conveyance

Manual Scavenging
- $25 per desludging
- No capital investment
- No barriers to entry
- Negative impact on surrounding
- Health issues

Mechanical Desludging
- $50 per desludging
- Capital investment
- Requires operational license
- No negative impact on surrounding
- No health issues

50 % Manual Scavenging
50 % Mechanical Desludging
Mechanical Desludging – Operating Model

Customer Management Platform Operated by National Sanitation Utility (ONAS), Senegal

Steps Involved:
- Customer calls centre when they require desludging
- Desludging Operators are invited to submit an offer (quote)
- Calls for bids goes out over cell phone messages
- Lowest bidder among the operators is awarded the job
- Household gets service within 2-3 days

Key Points:
- Operational from 2013
- Database created for 59,000 Household Septic Tanks and 138 Desludging Trucks
- Each Operator does 7 trips per week (on an average)
- Each job takes 2-3 hours of operation
- High price might be there, but it is maintained by increased competition
Key Points:

- Three Faecal Sludge Treatment Plants in Dakar, Senegal (1 established in 2004 and 2 in 2006) – each catering to 41,500 citizens \((\text{approximately})\)
- Treatment modules: Settling/Thickening Tank and Unplanted Drying Beds
- Treatment Capacity: 100 cubic meters per day (each)
- Total volume of treated Faecal Sludge: 350,000 m\(^3\) per year
- Bill and Melinda Gates Foundation to set up Omni-Processor in Dakar (with a capacity to treat 450 m\(^3\)/day)
Reuse

Dry Faecal Sludge as Fuel*

- Calorific Value (in MJ/KgDM)

<table>
<thead>
<tr>
<th>Straw/Hay</th>
<th>Charcoal</th>
<th>Wood</th>
<th>Dry FS</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
<td>32</td>
<td>17</td>
<td>22</td>
</tr>
</tbody>
</table>

+ Mostly used in Cement Industries
+ Valued @ 59 USD per ton
- Not used widely, since initial investment is high

*Only if:
- Coagulants are used in the settling tank (Lime, Chitosan, etc.)
- Alternative filter material are used in Unplanted Drying Bed (Shell, Glass, etc.)
- Daily turning of FS in drying beds

As a soil fertilizer

Usually given away for free or @ 3.6 USD per ton to farmers
Omni-Processor – in operation in Dakar for FS Treatment

Combusts fecal waste, destroying all pathogens
Recycles water from sludge into clean drinking water
http://www.wired.com/2015/01/week-on-the-internet-5/

Creates excess electricity
Does not require electrical grid
Revenue producing and profitable for owner
MANILA-PHILIPPINES

<table>
<thead>
<tr>
<th>Philippines</th>
</tr>
</thead>
<tbody>
<tr>
<td>138 cities, 1,496 municipalities, and 42,027 barangay</td>
</tr>
<tr>
<td>Urban Pop (MILL)</td>
</tr>
<tr>
<td>% Septic Tanks</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

| Reference: Sewerage and Septage Management Presentation-Manila Water Inc |

<table>
<thead>
<tr>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>313</td>
</tr>
<tr>
<td>Treatment Capacity (MLD)</td>
</tr>
<tr>
<td>466</td>
</tr>
<tr>
<td>Sewer Lines (km)</td>
</tr>
<tr>
<td>4,678</td>
</tr>
<tr>
<td>Served Area (ha)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>63 % Sewer Coverage</td>
</tr>
</tbody>
</table>
### Total Households Served (1997-2007): **267,178**

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Households Served</td>
<td>95</td>
<td>506</td>
<td>532</td>
<td>663</td>
<td>2,584</td>
<td>11,636</td>
<td>20,584</td>
<td>33,581</td>
<td>37,630</td>
<td>54,258</td>
<td>105,109</td>
<td>170,844</td>
</tr>
</tbody>
</table>

Reference: Sewerage and Septage Management Presentation - Manila Water Inc
SEPTAGE TREATMENT FACILITIES IN METRO MANILA

**San Mateo Septage Treatment Plant (MTSP: North SpTP)**
586 cum/day

**Pinugay Septage Treatment Plant**
600 cum/day

**FTI Septage Treatment Plant (MTSP: South SpTP)**
814 cum/day

Reference: Sewerage and Septage Management Presentation-Manila Water Inc
SEPTAGE TREATMENT PLANTS

SOUTH (FTI TAGUIG)
- Septage 814 m$^3$/day
- + FTI WW 2,000 m$^3$/day

NORTH (SAN MATEO)
- Septage 586 m$^3$/day

Reference: Sewerage and Septage Management Presentation-Manila Water Inc
BIOSOLIDS DISPOSAL

Biosolids transported and applied to sugarcane in lahar areas (600+ hectares available)

~ 6 truckloads per day

High transportation cost from Manila to Pampanga and Tarlac

Ongoing studies on high rate composting (new business?)
In 1985, the first two municipal treatment plants were constructed at Khon Khane and Phuket provinces.

Up to 2013, Thailand government
- spent 1.8 billion USD to construct 101 treatment plants
- But, cover only 1% of 7,775 municipalities
- Can handle ~ 30% of wastewater generated
- ~ 70% of the untreated remain discharging into water bodies

Reference: AIT, Bangkok
Unveiled Sanitation Issues in Thailand

Daily production

Domestic wastewater management

- 90% Grey water: 8.83 million cu.m.
- 8%: 0.08 million cu.m.
- 10% Toilet: 0.98 million cu.m.

Faecal sludge management

- 13%: 0.005 million cu.m. (Legal truck, licensed)
- 87%: 0.035 million cu.m. (Illegal truck, unlicensed)
- 12%: ~0.005 million cu.m.

- 73%: 6.43 million cu.m.
- 27%: 2.4 million cu.m.

Drainage system: X 80 mg/L (514.4 tons)
Wastewater treatment plant: X 20 mg/L (48 tons)
FS treatment plant: X 450 mg/L (2.25 tons)

Receiving water: X 2100 mg/L (73.5 tons)

Groundwater

Reference: AIT, Bangkok
In Thailand:
- Food poisoning
- Diarrhea cases, major organisms from flora, *E. coli* (EPEC), *Salmonella*, *Shigella* (Pruksananonda, 2008)

2006 North American E. coli outbreak

From Wikipedia, the free encyclopedia

(Redirected from 2006 United States E. coli outbreak)

The 2006 North American E. coli outbreak was an outbreak, in two principal phases, of foodborne *E. coli* 0157:H7, a potentially deadly bacterium that can cause bloody diarrhea and dehydration.[1] The initial outbreak occurred in September 2006 and involved fresh spinach. A subsequent outbreak, in November-December 2006, was initially attributed to green onions served by two restaurant chains — *Taco Bell* and *Taco John's* — but later was determined to have been caused by prepackaged iceberg lettuce.[2] All told, at least 276 consumer illnesses and 3 deaths have been attributed to the tainted produce.[3]

Reference: AIT, Bangkok
Nonthaburi Municipality is located in Bangkok Metropolitan Region and highly urbanized city.

Area 38.9 km²
Population 264,649
Households 106,074

Reference: AIT, Bangkok
Fecal Sludge Management

- 4 Collecting Trucks
- 4 Staffs + 1 coordinator
- Providing services 6 days/week (except Sunday)
Anaerobic Digestion Tanks
Cap 40m³/day

Fertilizer Storage Building

Effluent Storage Pond

31 Sand Beds
Dried sludge used as Soil Conditioner/Fertilizer

• Sell to the gardeners/farmers i.e. Nonthaburi city municipality sell dried FS 3,000 Baht/ton (100 USD/ton)*.

*Chemical fertilizer 12,000-15,000 Baht/ton (400-500USD/ton)

• Mixed with organic wastes
Covered lagoon

- FS truck emptying
- Covered lagoon
- Liquid:
  - Aerobic pond
  - Constructed wetland
- Solid:
  - Drying bed
- Storage pond
- RO+UV plant
- Tap water storage
- Electricity generator from biogas

Gas collector

CH$_4$ 350 m$^3$/day
CONSTRUCTED WETLANDS

A 400 m³/day Wastewater Treatment Plant at Phi Phi Island, Thailand

Source: Laugesen et al. 2009
### TOP 15 PROFITABLE COMPANIES IN LATRINE EMPTYING
(REF. BMGF LANDSCAPE STUDY FSM BUSINESS IN 10 COUNTRIES, 30 CITIES IN AFRICA & ASIA)

<table>
<thead>
<tr>
<th>Country</th>
<th>City</th>
<th>Status</th>
<th>No. of trucks</th>
<th>Annual Revenue</th>
<th>Total Expenses</th>
<th>Annual Profit / truck after Depreciation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nigeria</td>
<td>Abuja</td>
<td>Private</td>
<td>4</td>
<td>1,022,581</td>
<td>303,075</td>
<td>$708,181</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Kuala Trengganu</td>
<td>State co.</td>
<td>19</td>
<td>1,275,352</td>
<td>569,834</td>
<td>$594,273</td>
</tr>
<tr>
<td>Malaysia</td>
<td>Melaka</td>
<td>State co.</td>
<td>8</td>
<td>1,155,483</td>
<td>586,673</td>
<td>$494,411</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Abuja</td>
<td>Private</td>
<td>4</td>
<td>$499,211</td>
<td>146,956</td>
<td>$333,382</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Ho Chi Minh</td>
<td>State co.</td>
<td>7</td>
<td>$459,211</td>
<td>199,420</td>
<td>$246,131</td>
</tr>
<tr>
<td>Kenya</td>
<td>Mombasa</td>
<td>Private</td>
<td>4</td>
<td>$267,844</td>
<td>$39,015</td>
<td>$209,264</td>
</tr>
<tr>
<td>Senegal</td>
<td>Dakar</td>
<td>Private</td>
<td>7</td>
<td>$612,901</td>
<td>413,693</td>
<td>$168,511</td>
</tr>
<tr>
<td>Senegal</td>
<td>Dakar</td>
<td>Private</td>
<td>6</td>
<td>$489,294</td>
<td>$310,392</td>
<td>$152,656</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Ibadan</td>
<td>Private</td>
<td>3</td>
<td>$226,485</td>
<td>$72,879</td>
<td>$149,712</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Ho Chi Minh</td>
<td>Private</td>
<td>3</td>
<td>$201,320</td>
<td>$73,388</td>
<td>$123,534</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Ibadan</td>
<td>Private</td>
<td>2</td>
<td>$137,295</td>
<td>$78,328</td>
<td>$52,676</td>
</tr>
<tr>
<td>Nigeria</td>
<td>Abuja</td>
<td>Private</td>
<td>1</td>
<td>$61,151</td>
<td>$32,568</td>
<td>$25,091</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Phnom Penh</td>
<td>Private</td>
<td>1</td>
<td>$42,000</td>
<td>$20,004</td>
<td>$20,496</td>
</tr>
<tr>
<td>Cambodia</td>
<td>Phnom Penh</td>
<td>Private</td>
<td>1</td>
<td>$43,200</td>
<td>$22,235</td>
<td>$18,965</td>
</tr>
</tbody>
</table>
Challenges in Fecal Sludge Management

- Suitable Site
- Public Resistance
- Environmental Concern
- Suitable Technology
- Resources
- Capital Cost
For Successful FSM

Planning

Capacity Building

Institutional

Advocacy

Technical

Financial
Sanitation is not only a “Treatment” business but Infrastructure Development

- Regulated sanitation services
- Job creating industry
- Promote resource recovery
- Local investment
- Market structuring
- Licensing / contracts / tender
- Service provision standards
- Competitive business environment
- Local / regional manufacturing or assembly
- Marketing of the product
- New equipment
- Innovative systems
- Waste-to energy processor
THESE SYSTEMS NEVER USED AFTER CONSTRUCTION – BANGLADESH
LARGE FS AND SOLID WASTE LEACHATE TREATMENT IN NEPAL – NOT IN USED
We can go through website via the project cycle phases and target users.
Supporting tools

List of tools

1. Situational Assessment Tool
2. Stakeholder Analysis Tool
3. FSM Advocacy Manual
4. FSM Media
5. Regulatory Checklist
6. Institutional Setup Assessment Tool
7. AIT Financial and Technical Assessment Tool
8. Job Profile Matrix
9. AIT Logistic Tool
10. AIT Planning Tool
11. Technology Option Assessment Tool
12. Planning Guideline Technical Capacity Building
13. KPI Monitoring List
14. Project Cycle Monitoring Tool
15. Project Management Checklist

Download

Description

Situational Assessment Tool

Situational Assessment is a systematic process of assessing the present situation of fecal sludge management to identify the problems and possible solutions for achieving better FSM situational data. And, Situational Assessment Tool in Toolbox is a design to analyze the existing FSM practices and to plan for better FSM by addressing the needs of informed users and the identification of data intensity.

This tool is an excel-based data entry form which contains questionnaires reflecting institutional, regulatory, financial, technical, advocacy, capacity building and monitoring aspects for the entire FSM chain i.e. Containment, Emptying, Transportation, Treatment and Disposal. Tool not only asks the user assess overall situation of FSM but also asks the user assess any specific FSM chain component depending upon the user's interest and/or the problems in their interested area.

Download Tool
ONLINE COURSE ON FAECAL SLUDGE MANAGEMENT

Apply NOW to one of the six course delivering institutions!

www.fsm-e-learning.net

GLOBAL FAECAL SLUDGE MANAGEMENT e-LEARNING ALLIANCE
Zerodor
Waterless Urinals Technology
An IIT Delhi Incubated Enterprise

Prof Vijayaraghavan M Chariar
Indian Institute of Technology Delhi

www.ekamecosolutions.com I info@ekamecosolutions.com
IITD – Ekam Innovation 1
Zerodor Waterless Urinals

Can be Retrofitted into Existing Urinals
COMPETING SOLUTIONS COMPARISON

- No consumable
- No chemical
- No odour
- No power
- No recurring cost
- Retracts to existing urinals
- Low cost
- Low maintenance

Saves over 100,000 liters of water per annum

- No power
- Saves money
- Saves water
- Saves power
- Zero maintenance
- Touch free
- Easy clean

zerodor
saves water, removes odour
Ammonia Odour Control Efficiency

ZERODOR
FITTED URINAL

**Resistance to Solid Particles:**
Zerodor: above 4mm

**Ammonia Control**
Zerodor: 0.22 - 0.44 ppm

**Zerodor vs Membrane based Trap**

![Graph showing ammonia levels with Zerodor and Membrane based trap](graph.png)
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>Zerodor</th>
<th>MEMBRANE TRAP</th>
<th>SEALANT LIQUID TRAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>MECHANISM OF OPERATION</td>
<td>Ball valve prevents odour</td>
<td>LDPE membrane prevents odour</td>
<td>Liquid seal prevents odour</td>
</tr>
<tr>
<td>COST OF NEW SYSTEM</td>
<td>Cheaper than the existing solutions</td>
<td>Cost of entire system- Rs.5,600/-</td>
<td>Cost of entire system - Rs.10,000/- to 12,000</td>
</tr>
<tr>
<td>REPLACEMENT OF PARTS</td>
<td>No replacement needed</td>
<td>Membrane needs to be replaced</td>
<td>Sealant liquid and cartridge to be replaced atleast 4-5 times/year</td>
</tr>
<tr>
<td>MAINTENANCE COST</td>
<td>No recurring expenditure</td>
<td>Rs.1000-1200 (trap needs to be replaced at least once in six months)</td>
<td>Rs.2,475/- (Sealant liquid Rs.1700/- and Cartridge Rs.775/- for urinals with 50 uses per day- needs to be replaced at least 4-5 times a year)</td>
</tr>
</tbody>
</table>
| MAINTENANCE ROUTINE INVOLVES       | Ball to be retracted from the trap and cleaned | Trap has to be dismantled from urinal and waste pipe | a) Liquid seal replacement for every 1000 uses  
b) Replacement of cartridge 4-5 times a year |
| TIME REQUIRED FOR MAINTENANCE      | 10 minutes | 30 minutes | 10 minutes |
| RETROFITTING OF EXISTING URINALS   | Traps can be installed in existing urinals | Traps can be installed in existing urinals | New pans have to be installed |
| ISSUES / CONSTRAINTS               | Nil (Limited dependence on suppliers) | Supply of membranes | Supply of cartridge and sealant liquid |

*Data based on manufacturer of membrane traps Enswico AG, Switzerland
Data based on manufacturer of sealant liquid based waterless urinals Parryware Roca (Falcon Waterfree)
GREEN WATERLESS URINAL KIOSK

why WASTE
151,000 LITERS
of WATER in FLUSHING
each urinal per year?

GREEN WATERLESS PUBLIC URINAL

Powered by:
zerodor

the next leap forward
Features of Waterless Urinal Kiosk

- Four Urinal Seats fitted with Zerodor Waterless Urinal Technology.
- Prefab Bamboo Structure with Stainless Steel Columns and pillars.
- Urine harvesting tank (500 liters) fitted with submersible pump for onsite urine harvesting.
- Green hedge / Bamboo partition for privacy
WATERLESS URINAL TECHNOLOGY

zerodor™

saves water, removes odour

WATERLESS URINAL TECHNOLOGY
Over **300 mn Ltrs** of Water saved so far.

Over 10,000 installations across India.

200 + clients.
Compelling Reasons to Adopt Zerodor

- Frugal Engineering Innovation from IITD
- Improved Restroom Hygiene
- Green / LEED Rating
- Water Saving Cost (Rs 4000 per Urinal per Year)
- Savings in Plumbing Component (Rs 1000 per Urinal)
- Savings in Sensors etc (Rs 5000)
- No Consumables or Recurring Expenditure
- Long Product Life

- Cost recovered in First Year of Operation
We would love to hear from you - to collaborate and co-create!!

Ekam Eco Solutions
IIT Delhi Startup
New Delhi, India

www.ekamecosolutions.com

uttam@ekamecosolutions.com
+91 99 99 80 72 07

chariarv@ekamecosolutions.com
+91 98 11 64 63 58

Gratitude!
ENBIOLET TECHNOLOGY

ENBIOLET-the Environment Friendly Aerobic Bio-toilet:

.....ushering a revolution in Health, Hygiene & Sanitation.

STONE INDIA LTD.
16, TARATALA ROAD,
KOLKATA. WB.
STONE INDIA, AN EIGHT DECADE OLD MULTI-PRODUCT ENGINEERING COMPANY, HAS DEVELOPED AEROBIC BIOLOGICAL TOILET SYSTEM TOWARDS CONTRIBUTION TO ITS CORPORATE SOCIAL RESPONSIBILITY. AFTER SERVING THE INDIAN RAILWAYS FOR DECADES, STONE INDIA IS NOW LEVERAGING ITS TALENTED POOL OF TECHNICAL RESOURCES, CREATIVITY AND INNOVATION TO SAVE THE PLANET WITH ITS GREEN PRODUCTS.

THE R&D TEAM HAS SPENT 35000 MAN HOURS IN RESEARCH TO DEVELOP ENBIOLET IN WHICH HUMAN WASTE IS COMPLETELY DIGESTED BY THE BIO-MEDIA, PRESENT IN THE BIO-DIGESTER TANK AND IS CONVERTED INTO NON TOXIC WATER AND GAS. THERE IS NO CHANCE OF SOLID WASTE BEING DISCHARGED TO THE GROUND. THIS WILL REVOLUTIONIZE HYGIENE AND SANITATION IN THE COUNTRY.
ENBIOLET---------WORKING PRINCIPLE:

ENBIOLET is a Biological toilet system in which the Human Waste, the fecal matter is converted into non toxic neutral water and traces of CO₂ within a purposefully built patented bio digester tank by the action of multi strain aerobic bacterial culture. The water thus generated is disinfected before it leaves the bio-digester tank and reaches the environment.

UNIQUENESS OF BIO-TOILET:

- Completely Environment & user Friendly;
- Odor free and does not produce any foul smell;
- Uses Natures’ products to clean human waste;
- Water positive solution;
- Virtually maintenance free;
- Prevents soil pollution from open feces discharge;
- Preserves ground water quality;
- Controls the spread of fecal transmitted diseases;
- 100% treatment of solid waste, as per SBM guidelines 2014.
- Does not emits Methane & Hydrogen sulphide.
THE BIOLOGICAL DIGESTION PROCESS:

1. Human wastes go into the system.
2. Patented purpose built bio digester tank.
3. Bio digestion process takes place in the multi chambered bio digester tank.
4. Water flows into disinfection chamber and is disinfected.
5. Wastes converted primarily into water.

Diagram:
- HUMAN WASTES GO INTO THE SYSTEM
- PATENTED PURPOSE BUILT BIO DIGESTER TANK
- BIO DIGESTION PROCESS TAKES PLACE IN THE MULTI CHAMBERED BIO DIGESTER TANK
- WATER FLOWS INTO DISINFECTION CHAMBER AND IS DISINFECTED
- WASTES CONVERTED PRIMARILY INTO WATER
- WATER DISCHARGED
THE BIO-DIGESTOR TANK:
THERE ARE BASICALLY TWO TYPES OF BIO TOILETS BASED ON TECHNOLOGY USAGE:

1. **Aerobic Bio-Toilet:** involves the aerobic bacteria which feeds upon the fecal matter inside the tank, through aerobic bio digestion process and finally degrades the matter into neutral water and traces of CO2.

2. **Anaerobic Bio-Toilet:** involves the anaerobic bacteria which feed upon the fecal matter inside the tank, through an anaerobic process which finally degrades the matter and releases methane gas and treated water.

**ADVANTAGES OF AEROBIC BIO TOILET OVER ANAEROBIC BIO TOILET:**

- Aerobic bio-toilets uses multi strain aerobic bacterial culture where as anaerobic biological toilet uses single strain bacteria culture.
- Anaerobic bio digestion is extremely slow process while aerobic digestion completes within 24hours;
- Aerobic bio digestion generates neutral water & only traces of CO2. Anaerobic bio digestion generates large volumes of Methane, which is a greenhouse gas and emission is banned globally.
- Anaerobic bio digestion generates huge volumes of sludge as digestion is not complete while no sludge remains from aerobic bio digestion;
- Aerobic Bio toilets require a very small volume of bacterial culture for charging while half of the tank of anaerobic bio toilet needs to be filled with bacteria.
- Aerobic Bio digester tank size is nearly half in size of Anaerobic tank.
- Aerobic bacteria is freely available in nature; easy to propagate and store.
CLIENTS:

- TATA
- TATA Consultancy Services
- World Vision India
- Delhi Development Authority
- AMALGAMATED PLANTATIONS
- Balmer Lawrie
- SEED
- GLOBAL PROTEK
- Larsen & Toubro
- South Central Railway
- ICCO
- Simplex Infrastructures Ltd.
- JMC Projects (India) Ltd.
- MECON LIMITED
- APM Terminals
- Maersk Line
- NTPC
- Shapoorji Pallonji
- Mani Change for Good
- Parishudh
- Bill & Melinda Gates Foundation
- Ecopark
- Public Health Engineering Department
- Government of West Bengal
- Suchiwa Mission
SERVICE LEVEL IMPROVEMENT PLANS: A REVIEW

Paramita Datta Dey
National Institute of Urban Affairs
Review of SLIPs

- Proposals received from **28 out of 42 cities** for sewerage reviewed with respect to
- Gap Analysis
  - Existing data and infrastructure
- Bridging the Gap
  - Sustainability (hybrid options, innovation, cost recovery, funding and convergence)

Suggested areas of improvement of SLIPs
Gap Analysis

- Household connections to toilets is provided; More clarity needed on – How many households have toilets with septic tank and how many are connected to the sewerage network?

- Number of households without any outlets for toilets given - clarity needed in the narrative about the sludge

- Number of Toilets – existing, being built, going to be built needs to be provided - information needed

- FWM/ septage management - information not available for many cities
1. Sustainability

Most cities: emphasis on centralized sewerage system

Some cities: mention hybrid system – combination of decentralized & centralized (e.g. Ahmedabad, Shimla, Thanesar, Jabalpur, Gwalior, Dehradun)

Some other cities: willingness to explore recycling and reuse of waste water; details not given (user charges, sale of recycled water & recovery of O & M)
Most cities have emphasized on monitoring of centralized STPs: SCADA (e.g. Kalol, Bharuch, Navsari, Jind, Gwalior, Hoshangabad)

Septage management: no routine cleaning / maintenance in most cities

Thanesar – septage management by empanelling area-wise contractors
# Technology Selection

<table>
<thead>
<tr>
<th>City</th>
<th>Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosur</td>
<td>MBBR, Trenchless Technology</td>
</tr>
<tr>
<td>Pudukottai</td>
<td>MBBR</td>
</tr>
<tr>
<td>Etawah</td>
<td>Bio-digester</td>
</tr>
<tr>
<td>Kaithal</td>
<td>MBBR, SBR</td>
</tr>
<tr>
<td>Gwalior</td>
<td>Waste Stabilization Pond</td>
</tr>
<tr>
<td>Hoshangabad</td>
<td>SBR</td>
</tr>
<tr>
<td>Ahmedabad</td>
<td>UASB, Lagoon, Activated Sludge Process Technology</td>
</tr>
<tr>
<td>Thanesar</td>
<td>SBR</td>
</tr>
<tr>
<td>Khammam</td>
<td>Bio-digester</td>
</tr>
</tbody>
</table>

Technology mentioned; also needs to provide basis of selection.
3. Funds sought for:

- Increase in coverage of sewerage network
- Up gradation of STP, rehabilitation and improvement and cleaning and de-silting of existing sewer lines
- Installation of new STP

Robust Faecal Waste Management System: not proposed by any city
SLIPs: Areas of improvement

- Spatial Plans: Maps of existing and planned on-site and off-site sanitation systems

- Citizen engagement process - stakeholders involvement in the consultation; ward/zone level consultations; exploring alternatives and crowd sourcing; feedback on the suggested alternatives and innovations; prioritization of alternatives based on consultations

- Conditionalities - availability of land, environmental obligation and clearances, required NOC, financial commitment, approval and permission needed to implement the project.
Resilience: Mention needs to be made about what kind of resilience factor would be built in to ensure environmentally sustainable sewerage scheme. Though can be detailed in DPR, points can be mentioned here....

Financial plans: individual projects financed by various stakeholders; details on financial convergence and consultation with funding partners; sustainability of proposed financial structure; financial assumptions; financial convergence with various ongoing projects.
THANK YOU