

Presentation from the

Workshop on Innovations for Scaling up to Citywide Sanitation

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Organised by PAS Project, CEPT University

"Fecal sludge management in India – issues and emerging practices"

Thanks to PAS project,
AIILSG Maharashtra,
UMC Gujarat,
and many friends from ULBs / others
for discussing and sharing their
understanding & photos

Overarching issues

- Little legal and guidance framework for septage management, enforcement absent
- Some Indians probably pay highest amount for septage emptying in Asia (US\$20-300)
- Cheaper municipal septage service, costlier private service. Safety and sanitation worrisome.
- Disposal with treatment (minor quantity) into manholes and STPs. Without treatment to drains, garbage dumps, agriculture fields.
- No regulation and monitoring of FSM.

Overarching issues

- Variety of FS collection; holding tanks (Bangalore), septic tank + soak pit, Only septic tanks with overflow into open drains, only soak pits and pit latrines
- Emptying; manual, suction cum jetting machines, vacuum emptiers.
- Extensive use in farming to grow food / non food.
- Everywhere new sewerage is provided, reluctance of septic tank / soak pit owners to connect to network.
- Sewage / septage quality analysis not done properly, affects design & performance of treatment system

How bad it can get-

Total number water samples tested in Srinagar PHL Jammu & Kashmir, Jan 2011 till Sept 2012 (Source pers. Communication)

S. No.	District	Total no. of water samples collected	Samples found contaminated	% of samples found contaminated
1.	Anantnag	61	31	(50.81%)
2.	Baramulla	47	43	(91.48%)
3.	Budgam	94	58	(61.70%)
4.	Srinagar	51	9	(17.64%)
5.	Pulwama	66	36	(54.54%)
6.	Bandipora	115	107	(93.04%)
7.	Kulgam	61	41	(67.21%)
8.	Shopian	17	8	(47.05%)
9.	Ganderbal	25	5	(20%)
10.	Kupwara	4	4	(100%)
	Total	541	342	63.21

Maharashtra – Satara city existing wastewater situation

- Population (2011) 120,000, area 8.15 sq.km.
- City does not have sewerage network, most households have septic tanks (23500 Nos.)
Some households share the septic tank.
- Septic tank effluent is let into 200km network of surface drains
- City topography rolling terrain

Maharashtra – Satara city FSM

- Emptying septic tanks by the vacuum emptier with municipality.
- Emptying tariff within municipal limits Rs.350 and outside municipal limits Rs.1050.
- Private septic tank emptiers charge Rs. 4000-5000 per emptying.
- Fecal sludge (FS) dumped by municipality with solid waste. Private Service providers dump FS at city outskirts.

Maharashtra – Satara city – FS composting pit area calculation

Average volume of FS reaching composting site per emptying (another 750 l will be added)	1250 liters
	1.25 cum
Volume of one composting pit = 10m x 3m x 1.5m =	45 cum
Thickness of FS in one pit (assuming 4 layers of 20cm solid waste & 4 of FS 20 cm)	0.8 m
Volume of FS in one composting pit = 10m x 3m x 0.8m =	24 cum
Number of septic tank FS accommodated in one composting pit =	19.2
Number of compost pits needed to compost FS from 4700 septic tanks =	244.79 say 245
Total area needed by compost pits =	7350 sq. m
Add 25 % area for circulation of vehicles =	1837.5 sq. m
Total area needed for FS composting =	9187.5 sq. M
If 2 cycles of composting per pit are done per year, area needed = (7350/2)+1838	5512.5 sq. M

Maharashtra – Satara comparative costs of 4 sewerage & treatment options

Sewerage type	STP (ASP) 16 mld cost (Rs.millions)		Capital cost (sew +STP Rs. millions)		Capitalized cost(Rs. millions)		O & M period assumptions (O & M costs capitalized for 15 years)
	Public cost	Private cost	Public cost	Private cost	Public cost	Private cost	
Conventional gravity sewer	128	0	1120	0	1540	0	Sewerage O &M cost @ 2.5% of capital cost. ASP; capital cost / mld 8m. O & M cost /mld 0.6m, land required 0.2ha / mld.
Settled sewerage	24	0	177	132	310	231	Sewerage O &M cost (both public & private@ 5% of capital cost. STP Oxidation Pond; capital cost / mld 1.5m. O & M cost /mld 0.1m, land reqd. 1ha / mld.
Simplified sewerage	128	0	348	176.5	559	282.4	Sewerage O &M cost (public & private@ 4% of capital cost. STP ASP; capital cost / mld 8m. O & M cost /mld 0.6m, land required 0.2ha / mld.
Onsite soak pit / leach field option	0		0	175.65		307.4	O &M cost (private) @ 4% of capital cost.

Maharashtra – Satara – a slum lane and readymade septic tank



Satara recommendations

- **FSM**

- Ensure private sector FSM service providers use suction emptiers
- regulate FS disposal dump sites till sanitary landfills or FS composting units are developed.
- If sewerage is implemented, FS can be either discharged into trunk mains or to STP site.

- **Sewerage**

- Conventional sewerage for Satara costly. Since everyone has septic tank, dismantling them would further add to cost.
- Ideal alternative option to piped sewerage would be Settled Sewerage. Results in steep cost reduction (from Rs.1540m to Rs541m) & cheaper STP since solids capture happens in septic tank.
- high population density does not permit onsite sanitation and DEWATS (needs large pockets of land for treatment) at city wide level.

Maharashtra – Septage composting at Barshi city



Maharashtra – Parbhani city - Schematic of settled sewer for Lauji Nagar slum



- HH with space within House to build toilets
- HH with no space within House to build toilets
- Individual toilet
- Septic tank (individual or shared)
- Sewer lines up to 80mm for settled sewerage

Parbhani – Schematic of Individual clustered toilets and Shared septic tanks



- HH with space within House to build toilets
- HH with no space within House to build toilets
- Vacant space to build toilets
- | Individual toilet
- Septic tank (shared)

Maharashtra – Ambarnath city - existing wastewater situation

- Coastal city, 40 km south of Mumbai
- Ambarnath population (2011) 256,000, area 38 sq.km.
- 57% of city population live in slums. They have municipal services except for toilets and land tenure
- City has good water supply of **118 lpcd** at the consumer end.
- Southern part of city sewerage, 60% of population coverage.
- Sewerage proposed under JnNURM for northern part of city
- Some pockets of the proposed sewer network could function sub optimally due to lower population density.
- With ground water table high, sewerage is the solution for achieving the objective of sanitation in Ambarnath.

Ambarnath slums photos



Many water pipes - Ambarnath slum



Not available for toilets - Ambarnath slum lane

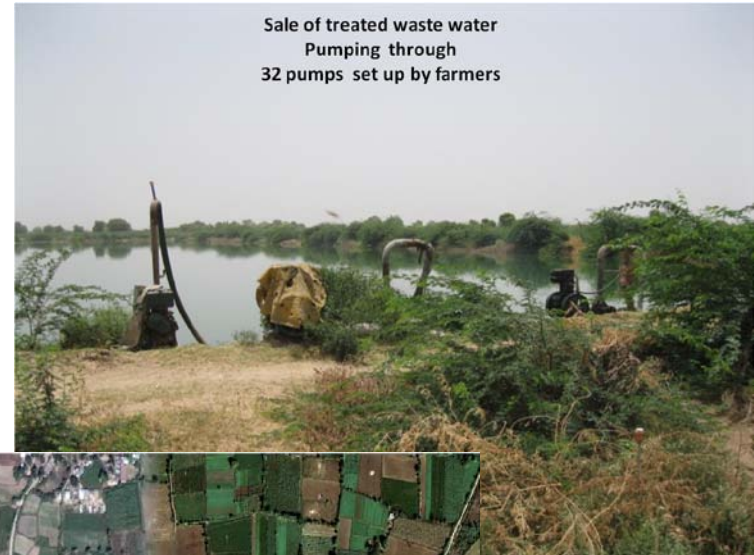


Paved lane - Ambarnath slum

Gujarat – Patan city sanitation

- Population 130,000, area 13.32 sq.km.
- Central half of city sewerred in 1998, sewer connections ensured by stopping septage emptier service. Sewerage Implementation to begin in other half of city now.
- Facultative ponds exist. Garbage / septage dumped adjacent to STP
- City has 90% soak pits, 10%, septic tanks
- Septic tank overflow / sullage to street drain
- O & M of sewer network, pumping station and septage emptier outsourced
- Sewage sold to 32 farmers, pump HP limited to max. 6.5, income per pump Rs.6500 per annum. Cotton grown
- Municipal septic tank / soak pit emptier charges Rs. 600(subsidised). Labour provided by user to open soak pits.

Patan - photos



Gujarat – Anklav; small city sanitation

- Population 24,000, area 21.84 sq. km
- Central half of city seweraged in 2002, only 50% homes connected. Outfall sewer damaged to pilfer sewage, FP STP
- Difficulty to connect everyone to sewerage since emptiers come from nearby cities. Soak pit owners reluctant to connect due to cost
- Sewerage for outer city being implemented.
- Soak pits 6 feet dia & 25 - 40 feet deep !

Anklav – emptying a soak pit



Gujarat - Deesa city- discussion with a vacuum emptier entrepreneur

- About 8 calls per months from Deesa, services nearby villages and places upto 100 km.
- Charges Rs.3000-3500, excluding labour to open septic tank / soak pit and ventilate.
- Septage brought to entrepreneurs own 2 hectare farm and used as soil enricher
- Family run operation
- Cost of emptier Rs.0.28 million, tractor cost Rs. 0.45 million

Gujarat - Dhrangadhra city sanitation

- Septic tank / soak pits very large, take 15-20 years to fill. Most homes have only soak pits
- ULB Charges Rs. 3000 for emptying (done in night). About 4 calls / month
- Storm drain network (of king's period) separate from sullage network

Dhrangadhra - Septage management earlier till Year 2010

- 72 pits dug for septage. Pit size 3mx1.5mx1m.
- Septage dumped from emptier into pit and covered with garbage and soil and systematically composted.
- Operation contracted out, ULB paid annually Rs.100,000 by contractor. Manure sold to farmers.
- Septage management contract not renewed after 2010.
- Vermicompost unit constructed, O & M to be by NGO. Viability an issue.

Dhrangadhra – New vermicompost unit (R) & abandoned septage composting pits (L)



Gujarat - State wide constraints for better sewage & septage management

- Lack of state policy / guidelines and technology support to ULBs
- Land & money
- Willingness; not demand based.
- Raw sewage pilfered to grow cotton etc.
Connection between poor sanitation & public health not established in peoples mind.
- Weakness of existing state institutions re; sanitation.

Gujarat - Suggestions for improvement of sewage & septage management

- Outsource and manage O & M of sewerage, pumping, STP, septage emptying and treatment
- Identify land for septage treatment and facilitate.
- Regulate septage service providers.
- Use mix of small and large septage emptiers to ensure access to narrow lanes
- Ban deep soak pits / oversized septic tanks

Price of septage emptying

City	State (India)	Tariff ULB (US\$)	Tariff private(US\$)
Aizawl, mountainous	Mizoram, NE India	No service	200-300
Dhrangadhra, Deesa, Anklav	Gujarat	40 – 60	80 – 100
Bangalore	Karnataka	20	25 – 70
Visakhapatnam	Andhra Pradesh	No service	40 - 75
Satara, Ambarnath, Parbhani	Maharashtra	12 - 25	50 - 100
Goa cities and villages	Goa	5 - 10	25 - 75

Karnataka state scene

- Recently there were deaths in Kolar, Karnataka state due to septic tank gas. Urban department ordered every one of 30 districts to buy 2 large & 2 small septage emptiers
- What happens to septage; agriculture use after partial / full stabilization or ends up in water bodies / open areas
- In Mysore, Karnataka, City Corporation sends cesspool emptiers which discharge into main sewer manholes.
- Treatment of sewage in 3 facultative aerated lagoon STPs
- Bangalore has 300 + private septage service providers
- Hubli city sends suction cum jetting machines (primarily used for sewerage) for septic tank emptying. Disposal either in manholes or with municipal waste. Septage pits proposed adjacent to municipal waste landfill.

Bangalore method of Fecal Sludge Composting

- Developed at Bangalore in 1939. Recommended when night soil and agro residue composted. Suitable for areas with rainfall < 800mm per year.

Preparation of the pit

- Pits one meter deep dug.
- Site to be at high level to avoid rainwater. Pits to have sloping walls and floor slope of 90-cm to prevent water logging.

Filling the pit

- Organic residue / night soil in alternate layers.
- After filling pit cover with 15cm of refuse. Pit left undisturbed for three months.
- Material settles down and additional night soil and refuse are placed on top and plastered with mud.
- After initial aerobic composting for ten days, material undergoes anaerobic decomposition at slow rate.
- It takes 6-8 months to obtain finished product rich in phosphorous. Sell to fertilizer companies / farmers

Kerala state – a good beginning

- Four STPs in Kerala state (financed by ADB loan; extended aeration & SBR) have incorporated septage collection tanks.
- STPs at various stages of implementation in 3 coastal cities of Trivandrum, Cochin, Kozhikode & Kollam.
- Septage discharge calibrated into sewage so as not to exceed design loads (BOD, TSS etc.)

Legal aspects

- A number of national rules regulate sewage but no specific rules for septage
- Recent draft Indian septage management regulations lack specificity, too much mechanized
- New revised anti scavenging Act 2012. Proposed rehab of workers, stringent punishment to employer
- Regretably part of septic tank / pit cleaning manual; Aizawl, Anklav, Bangalore, Jammu, everywhere.....
- ULBs to be regulators of service than providers. Will be more efficient and responsive.

Wastewater management – Malaysia experience

- Centrally planned sewer connections increased from 5% to 73% during 1993 – 2005.
- 27% septic tanks, by law desludged mechanically once 3 years
- In 1993 wastewater assets transferred to IWK, a private concessionaire. During 1993 – 2008, IWK built all wastewater infrastructure across country
- Govt. developed national policy, mandating scheduled desludging of septic tanks.
- Policy requires private developers to build wastewater infrastructure.
- Public acceptance of wastewater services payment.
- Matched treatment technology to public demand and willingness to pay

Appropriate methods for disposal of Waste Water – Sanitation ladder

- **For Indian cities what are appropriate methods ?**
 - Where soak pits numerous, construct septic tanks
 - Where septic tanks numerous, settled sewer
 - For pit latrines, good collection (using vacuum emptier) followed by septage treatment
 - Virgin areas; shallow sewers or DEWATS (depending on population density)
 - When (135 lpcd) water supply adequate, simplified or piped sewerage
 - Some states have made it mandatory to provide sewerage / STP by developers (Karnatataka 50 dwellings, Andhra 100). State to ensure developers do so.
 - Visit Malaysia to understand best practices

Appropriate method; septage disposal

- Septic tank; clean once in 3-4 years by vacuum septic tank emptiers.
- Septage to treatment, adjacent to solid waste site or STP or manhole.
- Septic tank emptier capacities of 1500 – 9000 lit. Choose appropriately.

Two options for septage treatment;

- spread on ground and apply lime or soil (2-3 inches) over septage.
- dig a pit and cover with soil (2-3 inches) or municipal waste (1:6 ratio) over septage alternately till pit gets filled. Then dig another pit and repeat.
- Contents of the pit as soil enricher after 6-8 months. Treated septage safe for agricultural use.
- When composting with solid waste, septage addition enhances the soil enrichment (Phosphorous & Potassium)

Pricing

- Aim at full cost recovery. It is already happening for private operators

Thank you all