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Septage Management in Urban India – Providing Conceptual Clarity

Introduction and Context

As per Census 2011, only 32.7% of urban households in India have latrines connected to piped sewer networks. Currently, on-site septic tanks and pit latrines account for a substantial proportion (over 47%) of toilets in urban India and this proportion is increasing. As urban households without toilets obtain toilet facilities over the next few years under Swachh Bharat Mission (SBM), it is likely that many will acquire on-site arrangements like septic tanks and pit latrines in towns at locations where sewerage systems are not available.

Septage management has recently (since few years) started getting importance in the sanitation sector in India. It is being recognized as one of the sanitation solutions in towns where sewerage systems are not foreseen in near future.

Initially, septage management was mentioned in the 'National Urban Sanitation Policy' (MoUD, 2008). Later, septage management was introduced as one of the thrust areas in 'Atal Mission for Rejuvenation and Urban Transformation (AMRUT) mission statement and guidelines' (MoUD, 2015). The 'National policy on faecal sludge and septage management FSSM' was

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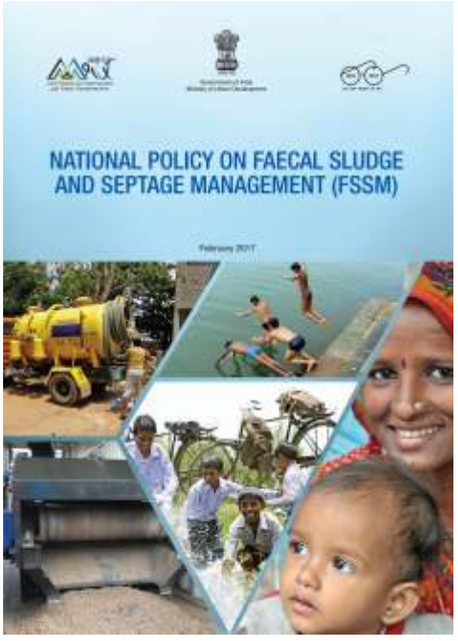
launched in 2017. The key objective of the national FSSM Policy is to set the context, priorities, and direction for, and to facilitate, nationwide implementation of FSSM services in all Urban Local Bodies (ULBs) such that safe and sustainable sanitation becomes a reality for all. Based on the understanding and experience of the gaps and issues in the septage management sector (in India), the FSSM policy attempts to define the roles and responsibilities of various stakeholders (relevant national ministries, state government, ULBs, private sector and households) for effective implementation of the FSSM services through the country. Many state governments (E.g. Tamil Nadu, Maharashtra, Odisha, Rajasthan, Andhra Pradesh, Madhya Pradesh, Punjab, Jharkhand, Gujarat, Uttarakhand and Jammu & Kashmir, etc.) have framed (and taken steps for implementation) guidelines / policies / standard operating procedures on FSSM for meeting their sanitation objectives.



Given the above context and the raising level of importance in the septage management sector among various stakeholders in India, this paper attempts to put together few fundamental points for the discussion with regards to septage management. The idea is to provide a better understanding and overall conceptual clarity (especially to Government officials/decision makers) about septage management[1].

Terminology

For uniform clarity, let us first understand the terminology 'Faecal sludge' and 'Septage'.

Faecal sludge: Faecal sludge includes contents of onsite sanitation systems like pit latrines, septic tanks, aqua privies and dry toilets. It is raw or partially digested, a slurry or semisolid, and results from the collection, storage or treatment of combinations of excreta and blackwater, with or without greywater. Examples of onsite sanitation systems include pit latrines, unsewered public ablution blocks, septic tanks, aqua privies, and dry toilets.

Septage: Commonly refers to the liquid and solid material that is pumped from a septic tank. It is the combination of scum, sludge, and liquid that accumulates in septic tanks.

There appears to be a very thin line between septage and faecal sludge. Septage is limited to septic tank contents where as faecal sludge includes contents from other on-site systems including the septic tank. In other words, faecal sludge from septic tanks is known as septage, but faecal sludge and septage are interchangeably used in India.

Conceptual clarity

It is well understood that sewerage systems are not possible (due to technical, financial & organization reasons) in all towns of India in near future and even it may not meet the complete sanitation needs in all areas within a town. A strategy, therefore, needs to be a combination of onsite and off-site (decentralized and centralized) sanitation solutions co-existing in all cities to achieve the objective of safe and sustainable sanitation for all. Possible sanitation solutions include Conventional underground sewerage systems, faecal sludge and septage management, onsite sanitation

[1] *This paper is based on a thematic online discussion on Faecal Sludge Management, organized by the India Sanitation Coalition on the SuSanA Discussion Forum.*

systems, solid free sewers, simplified sewers, twin drain systems, decentralized systems etc. At this juncture, it becomes very fundamental (especially for decision makers) to have basic conceptual clarity (of all available sanitation solutions/options) before arriving at a decision on the selection of a suitable sanitation system for a town. This paper attempts to provide conceptual clarity on septage management through following relevant key questions.

1. Is Septage Management a complete sanitation solution?

There are basically two streams of wastewater emanating from households viz. blackwater and greywater (also called sullage in India). Blackwater is the mixture of urine, excreta and flush water along with anal cleansing water. The discharge from wash basins, sinks and similar appliances, which does not contain excreta is called greywater.

Sewered systems and septic tanks are the most common sanitation systems in India. Hence, for simplicity only these two cases[2] are discussed.

a. Households connected toa conventional underground sewered system

In this system, both blackwater and greywater are collected and transported through sewers to a wastewater treatment facility for treatment and safe disposal. Hence the entire (100%) wastewater generated at the household level is jointly captured, conveyed through underground sewers and then treated within a treatment facility and safely disposed of in a conventional underground sewered system.

b. Households connected to Septic Tanks

Normally septic tanks are designed for treating only wastewater from toilets. In a septic tank (even if of adequate design and capacity) only a portion of the suspended

solids settles in the tank, the dissolved organic matter and some of the suspended matter are discharged from the outlet of the septic tank in the effluent (overflowing supernatant liquid discharge) and poses a health risk (e.g. by infiltrating groundwater resources used for water supply) if the effluent is not adequately disposed . Therefore, the effluent from a septic tank must not be allowed to drain into an open channel or water body without adequate treatment (IS 2470:1985). In India, generally, the effluent from the septic tanks is discharged into open stormwater drains along the roads. Also, the greywater from households finds its way into the stormwater drains. This situation further complicates the environmental hazard in the rainy season. The effluent from septic tanks and greywater from households is conveyed through the open drains and finally enters untreated into the ecosystem through water bodies and land.

Septage management includes the storage (of septage in septic tanks), collection (emptying of septic tanks filled with septage), transport (of emptied septage), treatment and safe end-use or disposal of septage.

[2] Additionally Pit latrines are also prevalent on-site sanitation system in India. Pit Latrines can be basically classified as single pit latrines & twin pit latrines. As per Guidelines for Swachh Bharat Mission Urban (2014), single pit latrines are considered insanitary and shall be converted to sanitary latrines. The digested sludge from properly designed, constructed & maintained twin pit latrines does not require vacuum trucks for desludging. Hence, it may not be incorrect to say, that it is inappropriate to discuss about Faecal sludge management for pit latrines in urban India.

Hence, septage management includes only the management of septage contained in septic tanks. The effluent from septic tanks and greywater from households is not covered in septage management. It would not be incorrect to say that that in the absence of proper management of effluent from septic tanks & grey water from households, septage management (alone) helps in achieving cleaner environment with out directly contributing to cleaner towns.

Hence, for a complete sanitation solution (treatment of all (100%) wastewater streams emanating from households) in any project area, in addition to a septage management system, an additional system is required for treatment of effluent from septic tanks and greywater.

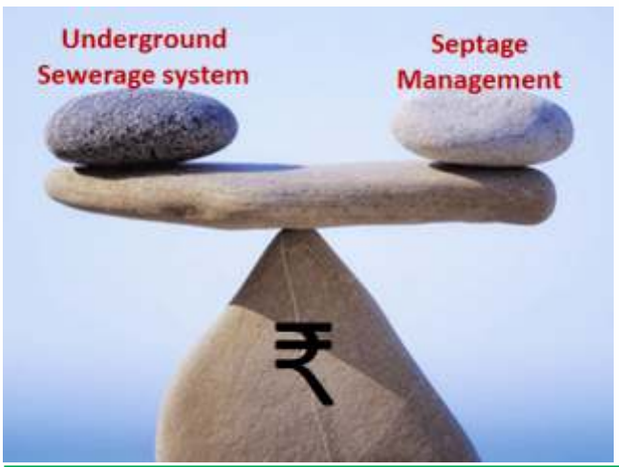
2. What is the real cost of Septage Management?

Generally, people are of the opinion that the cost of septage management is very less compared to the conventional underground sewerage system.

Firstly, it should be clearly understood that septage management alone is not a complete sanitation solution for treating all the wastewater streams emanating from households. Septage management and management (collection, conveyance, treatment and safe disposal) of effluent from septic tanks and greywater from households together make a complete sanitation system. Generally, people tend to compare the construction and operation & maintenance cost of only 'Septage Treatment Plant' with the cost of 'sewerage network and Sewage Treatment Plant' and conclude septage treatment is cheaper.

For an actual understanding of the costs, professionals should consider the cost of the entire system. The major cost heads to be considered under septage management and underground sewerage system are :

Cost heads to be considered under Septage Management	Cost heads to be considered under underground sewerage system
a. Septic tanks b. Septage emptying & transportation vehicles c. Septage treatment plant	a. Connecting household to the sewer network b. Sewer network & pumping stations c. Sewage treatment plant



Even after considering all the above cost heads, it is incorrect to compare the cost of septage management (only) with the cost of the underground sewerage system, because septage management (alone) is not a complete solution and hence, it is inappropriate to compare an incomplete sanitation system with a complete sanitation system. However, if still cost comparison needs to be done between these two systems then the cost for management (collection, conveyance, treatment & safe disposal) of effluent from septic tanks[3] & greywater from households should be added to the cost of septage management.

Hence, before coming to the conclusion on cost, one must seriously check the costs for both the systems for an end-to-end complete sanitation solution (treatment of all i.e. 100% waste water streams emanating from households).

[3] *If the existing septic tanks are improperly designed or constructed / damaged / inaccessible for proper desludging, then the cost of retrofitting / replacement of such tanks should also be added to the cost for septage management for arriving at actual costs.*

3. Are the existing septic tanks (in India) really septic tanks?

Census 2011 states that septic tanks are the most common form of sanitation systems (approx. 38%) in urban India. In simplest terms, a septic tank is a 'watertight settling tank with an inlet & outlet (for supernatant liquid effluent)'. In practice (in India) the septic tanks are not designed as per standards. In many cases, the septic tanks have leaking sides and open bottoms. Septic tanks are also often placed under toilets or are sealed, or cemented over, making it difficult to access them for cleaning/emptying which dis-incentivizes their frequent emptying.

Presently, the improperly designed, constructed and maintained septic tanks and pit latrines along with open defecation are one of the major contributors to groundwater and surface water pollution in many cities in the country (for example the state of Kerala in India has the highest access to toilets in India. Studies have shown that faecal contamination is present in 90% of drinking water wells & about 60% of the population relies on groundwater for drinking….*Source: http://www.kerenvis.nic.in/)*.

It is clearly evident, for effective and efficient septage management the improper septic tanks / pit latrines need to be repaired, retrofitted or replaced. Given the size (approx. 38% of urban households in India) and complexity (social, financial, acceptability etc.) of the problem, it really needs to be seriously discussed, how this retrofitting / replacement of improper septic tanks could be made possible on the ground for existing infrastructure (septic tanks).

4. Is it possible to regularize septage emptying private operators without having functional treatment facilities in towns?

The septage management business (septage emptying & transportation) in India is generally managed by informal small-scale private operators that lead to difficulty in the monitoring

of the process they follow for emptying and disposal. Informal systems also make it harder to institutionalize best practices and regulations, which prevents the establishment of norms around scheduled and safe cleaning.

Hence, it is important to regularize (licensing / permits) the septage emptying & transportation private operators. However, if any town lacks any treatment facility[4], it is important to understand

[4] *As per CPCB 2015, approx. 522 Sewage Treatment Plants in India are operational. There are nearly 7935 towns in India*

where the private operator (after being registered by the Government) will discharge the untreated septage? The Government may be more answerable for allowing the licensed private operators to openly discharge the untreated septage in water bodies / land (until the treatment facility is commissioned).

Hence, should licensing of informal, private septic tank emptying operators be done before commissioning of treatment facilities, or not? This is a sensitive and practically tricky question for the Government.

5. Are the right standards in place for safe reuse of treated septage for agriculture?

The 'Advisory Note - Septage Management in Urban India' (MoUD, 2013) states that 'For dewatered septage/sludge use as fertilizer in agriculture application, it should satisfy the criteria of Class A Bio-solids of US EPA (A fecal coliform density of less than 1000 MPN/g total dry solids). In the absence of any standards, it is recommended that these be adopted until such time standards are notified by the 'Central Pollution Control Board'.

For reusing the dewatered and treated septage (sludge) in agriculture, specific care should be given to pathogen reduction. The 'National Policy on Faecal Sludge and Septage Management' (MoUD, 2017) states 'the Solid Waste Management (SWM), Rules 2016 apply to the final and safe disposal of post-processed residual faecal sludge and septage to prevent contamination of groundwater, surface water, and ambient air. Further, the SWM Rules 2016 will also apply for disposal and treatment of faecal sludge and septage, before or after processing, at landfills and for use as compost'. It should be noted that the SWM Rules 2016 do not include pathogens as one of the parameters for safe application as compost (pathogen reduction cannot be ignored for reuse of septage in agriculture).

One of the neglected aspects in the reuse of treated sludge for agriculture application in India is the 'Land application rate / Cumulative Pollutant Loading Rate'. It is important to determine the appropriate agronomic rate for the land application of treated sludge to maximize benefits, and to especially prevent environmental contamination from excessive application of nutrients. Many countries have set limits for the land application of faecal sludge (e.g. South Africa, China, etc.). However, these are typically the maximum allowed rates (i.e. the volume of faecal sludge allowed per land area). Also clarity is required on what type / species of crops (edible, non-edible) are suitable for the reuse of treated sludge for agriculture application.

Hence, it may be said that further clarity (standards / norms) on reuse of treated septage for agriculture application would be very useful for the much-needed development in the sanitation sector in India.

6. Is co-composting of septage and municipal organic solid waste allowed in India?

Composting is a biological process that involves microorganisms that decompose organic matter under controlled predominantly aerobic conditions. The resulting product is stabilized organic matter that can be used as a soil conditioner. Co-composting of dewatered

septage together with municipal organic solid waste is a well-established technology in the sanitation sector outside India. However, this process needs proper policy guidelines, stringent regulations, standards and above all community awareness.

The principal public health and environmental issue concerning co-composting operations relate to exposure to pathogens and bioaerosols. Exposure to pathogens and/or bioaerosols (especially Aspergillus fumigatus and endotoxin) can occur during the composting process or through the use of the product if the composting process is not executed properly and the resulting product is not disinfected.

It can be said that clear national guidelines (policies, regulations, standards) on co-composting of septage and municipal organic solid waste would bring the much-needed clarity and push in the sanitation sector in India.

7. Are the Government approved environment laboratories prepared for testing septage samples?

The first step in designing a septage treatment technology that will meet defined treatment objectives is to quantify and characterize the septage to be treated. In contrast to sewage characteristics that are already well known, the availability of septage characteristics is very limited. The organic matter, total solids, ammonium, and helminth egg concentrations in septage are typically higher by a factor of ten or a hundred compared to domestic sewage and hence have a direct impact on the efficiency of treatment mechanisms. A thorough septage characterization exercise (representative sampling) within the project area needs to be conducted prior to designing septage treatment plants. Estimations based on literature values are not adequate due to high variations.

The present Government approved environment laboratories in India are well equipped to test and analyze sewage samples. Citing an experience with one environment laboratory, it was experienced that the laboratory personnels were reluctant to test the septage samples due to its highly foul nature. The officials said that the samples were highly concentrated (semi-solid slurry form) compared to sewage samples. They also exclaimed that the samples were similar to 'pathological samples' and were not 'wastewater samples'.

Septage needs to be treated to an adequate hygienic level (pathogen reduction) based on the enduse or disposal option. When analyzing septage, helminths are most commonly used as an indicator of the effectiveness of pathogen reduction due to their prevalence in low- and middle-income countries, and their persistence following treatment. It was experienced that environment laboratories were also not fully equipped to test for helminth eggs (Ascaris lumbricoides).

Based on this experience, it is felt that the Government approved environment laboratories could be better informed and equipped for supporting the requirements of the septage management sector in India.

Conclusions

With the government making its best efforts to achieve the targets of eliminating open defecation, the logical follow-up step is the safe management of the human waste. Septage management is a relatively new concept compared to conventional underground sewerage, the know-how and experience in the subject is limited. Considerable flexibility is granted by the 'Ministry of Housing and Urban Affairs, Government of India' to States to develop their own models to further the cause of FSSM / Septage management for achieving the goal of safe sustainable sanitation for all.

A combination of onsite and off-site (decentralized and centralized) sanitation solutions must co-exist to achieve the objective of safe and sustainable sanitation for all. The 'Manual on Sewerage and Sewage Treatment Systems', (MoUD, 2013) stipulates that the options of underground sewers, septage management, small bore sewers, shallow sewers and twin drains, etc., all have to be relatively evaluated to subregions of the project site instead of blindly going in for total underground sewer flat out.

To arrive at the most suitable sanitation solution for a project area, it is very fundamental to have basic conceptual clarity on the available sanitation solutions. Given the rising interest in septage management in India, it needs to be clearly understood that to achieve the goal of complete sanitation for towns, septage management is one of the available sanitation options (in combination with other sanitation solutions).

As stated earlier to arrive at a most appropriate sanitation solutions for a region /sub-region, it is very essential to have basic conceptual clarity on the available sanitation solutions. This paper has attempted to provide some clarity on septage management in urban India.

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